Ministry of Urban Development
Government of India

सत्यमेव जयते

Public cycle sharing systems

A planning toolkit for Indian cities

National Public Bicycle Scheme
December 2012

Contents

Foreword

The Ministry of Urban Development is committed to helping cities develop high quality transport systems that offer sustainable mobility options for their residents. These systems should reflect the spirit of India's National Urban Transport Policy, which emphasises the importance of moving people, not vehicles. Public cycle sharing can play a key role in improving last-mile connectivity as well as modal share of cycling besides raising the image of cycling in Indian cities. Cycling is green and healthy, and it reduces the burden on our strained road networks.

The public bicycling schemes that are popular in western countries are a relatively new concept in India. In the last few years, several Indian cities have shown interest with setting up such systems. The Ministry of Urban Development recognises that non-motorised modes of transport, like cycling, are an important part of making urban transport more sustainable.

To launch the National Public Bicycle Scheme and to build capacity for the implementation and operation of cycle sharing systems, the first consultation meeting held last year received overwhelming support and commendation. After the first consultation meeting, the Ministry organised four sub-groups to research different aspects of cycling sharing:

- Subgroup 1. Improving the national policy environment to facilitate cycling
- Subgroup 2. Toolkit for the cycle sharing planning process
- Subgroup 3. Financing mechanisms for cycle sharing
- Subgroup 4. Product design and technical specifications for the cycles

This toolkit for planning cycle sharing in Indian cities is the outcome of detailed deliberation by not only Subgroups but also the national level consultations held in June 2011 and a national level workshop on 20 November 2012. I would like to thank all the members of Subgroup 2, especially Ms Shreya Gadepalli, Shri Christopher Kost, Shri Bradley Schroeder of the Institute for Transportation and Development Policy (ITDP), who painstakingly put together this toolkit, as well as other individuals and organisations that contributed to this toolkit. I hope that it serves as a useful resource for cities across the country as they develop world-class cycle sharing systems and make cycling a fashion statement in India.

Dr Sudhir Krishna

Secretary,
Ministry of Urban Development
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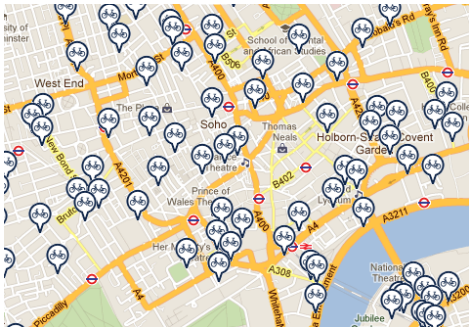
1 December 2012

What is cycle sharing?

Cycle sharing is a flexible form of personal public transport. Cycles are stored in a closely spaced network of stations. With a smart card or other form of identification, a user can check out a cycle from a station, use it for a short ride, and return it to any other station. Cycle sharing stations are often placed near public transport systems to provide last-mile connectivity.



London's Barclays Cycle Hire system: a typical station (left) and a map showing station locations (right)

Modern cycle sharing systems all employ standard best practice features:

Key features of cycle sharing systems

- A dense network of stations across the coverage area, with a spacing of approximately 300 m between stations
- Cycles with specially designed parts and sizes to discourage theft
- A fully automated locking system at stations that allows users to check cycles in or out without the need for staffing at the station
- Electronic tags to track where a cycle is picked up, the identity of the user, and the station where it is returned. The identity of the user is associated with that of the cycle to ensure security
- Redistribution of cycles to ensure availability of cycles and empty docking points
- Real-time monitoring of station occupancy rates through information technology (IT) systems, used to guide the redistribution and provide user information through the web, mobile phones, on-site terminals, and other platforms
- Pricing structures that incentivise short trips, helping to maximize the number of trips per cycle per day

Today there are cycle sharing systems in over 200 cities around the globe, and more programs start every year. Some of the largest cycle sharing systems are in Chinese cities like Hangzhou and Shanghai. Washington, D.C., USA; Paris, France; and London, U.K., have hugely successful systems that have helped re-energize cycling in those cities, providing an ideal transport solution for short trips and a feeder to other public transport options. Cycle sharing is a nonpolluting and healthy mode of transport.

Modern cycle sharing systems have the ability to track the identity of the user as a way of preventing theft of cycles. All users are required to furnish identity proof, either at the time of registration or when signing up for temporary subscriptions. When the user checks out a cycle, the identify of the cycle is recorded along with that of the user. The user's account is cleared when the system detects that the cycle has been returned.

Most systems in Europe and North America rely on credit cards as a security mechanism: if the user fails to return a cycle, a fine can be charged against the user's credit card. The user's account is also blocked to prevent him/her from checking out other cycles. In China, the user is required to keep a deposit in his/her smart card account, and if he/she fails to return the cycle, the deposit is forfeited.

Most cycle sharing systems operate in a public-private partnership structure in which the government carries out planning and oversight activities and the private sector handles day-to-day operations. Successful implementation of a cycle sharing system requires meticulous planning and oversight on the part of the government.

IT components of a third-generation cycle sharing system: station (top); docking unit (above left); and terminal (above right).

A key (below left) or smart card (below right) allows a user access to the system, provided the user is in good standing. It stores information such as which cycle was taken out and the time of check-out. Upon check-in, this information is relayed to operations headquarters and is used to calculate user charges.

As in most public transport systems, cycle sharing systems generally require supplemental revenue sources to cover operating and investment costs. Revenue streams used in major cycle sharing systems around the world include annual and temporary membership fees, advertising, sponsorships, and on-street parking fee proceeds.

Cycle sharing systems are not a replacement for large scale cycle distribution schemes. These programs, generally aimed at rural users, have a strong focus on poverty alleviation. Cycle sharing is an urban transport system designed to appeal to a broad user base.

Project prerequisites

Important initial planning steps include goal setting, identifying a political champion for the project, and taking stock of the city's existing transport system and cycling culture.

Set goals for the system

Before initiating the planning process, it is important to have clarity about the overall goals of the system, as these will serve as the basis for future evaluation of the system's success. The following goals are common to many cycle sharing systems around the world.

Cycle sharing goals

- Extend the reach of the city's public transport system by solving the "last mile" problem
- Enhance the image of cycling to facilitate modal shift
- Reduce congestion and improve air quality by attracting private vehicle users

The system goals should be paired with quantitative indicators that can be used to monitor the overall success of the project. (More detailed service level indicators can be used to evaluate the performance of the system operator. See "Operational systems: designing for the user," later in this toolkit.)

Cycle sharing indicators

- Total registered users
- Trips per cycle per day
- Fraction of customers who previously used private motor vehicles
- Fraction of customers who previously used public transport

Build a base of political support

No cycle sharing system can succeed without political will and policy support. Some of the largest cycle sharing systems in the world, such as those in Paris and London, are the result of active championing by the mayors in those cities.

London's Barclays Cycle Hire scheme is nicknamed "Boris' Bikes" after Mayor Boris Johnson. Mayor Johnson's determination to increase the use of cycling in London by improving infrastructure and setting cycle sharing as a top priority created the context for a successful and innovative system. While the London scheme is overseen by the city's transport department, Transport for London, and operated by SERCO, a private company, on a six-year contract, the support of the mayor's office was the key to success.

In the Indian context, it is essential that both the elected and administrative wings offer their full support. The cycle sharing system should be included as an integral component of the city's Comprehensive Mobility Plan and other transport plans. Support is required both at the municipal and state levels, especially in cities where public transport systems are overseen by the state government.

London Mayor Boris Johnson played a major role in the implementation of the Barclays Cycle Hire system. Political support is an essential ingredient of all successful cycle sharing systems.

Identify cycle sharing user groups

Identification of potential user groups is an important preliminary step in designing a cycle sharing system. Possible user groups include following (Joshi 2010):

- College students. Many student trips take place within a reasonable cycling distance of college campuses. Not all students can afford private motor vehicles, so cycle sharing may serve as a desirable intermediate option.
- Commuters. People who commute by public transport are likely to use cycle sharing as a feeder mode or for local errands.
- Tourists. Tourists comprise a small but growing segment of cycle sharing users. Cycle sharing is a great way for tourists to explore cities at their own pace.

It is important to recognize that cycle sharing is not necessarily for the poorest of the poor, but an alternative for short trips done by paratransit, bus, or walking. Many low-income residents already own and use cycles because they cannot afford to use any other mode, even public transport. A critical aim of cycle sharing is to attract new users who would not otherwise use cycles. By broadening the cycle user base and raising the profile of cycling in a city, cycle sharing can build a constituency for improved cycle infrastructure, which benefits all cyclists, rich and poor alike.

Understand existing travel patterns

Cycle sharing systems are ideal for short trips of 1 to 5 km, which comprise the majority of trips in many Indian cities. They are also integral to solving the "last mile" problem—helping passengers travel from metro, suburban rail, or bus rapid transit stations to their final destinations.

Existing trip patterns should be researched to help plan a cycle sharing system. One method is to conduct origin-destination surveys at major public transport terminals and stations, focusing on passengers who transfer to rickshaws, taxis, or buses to complete their journeys. This can help with determining where the system is most likely to succeed, which in turn plays a role in deciding the coverage area—the zone that is saturated with cycle sharing stations—and the phasing plan.

Identify cycle infrastructure needs

An assessment of the current state cycle infrastructure in the city should be conducted. Cycle sharing can be implemented even if there is little existing cycling infrastructure, but pairing the construction of new cycle tracks with the opening of a cycle sharing system can add to public acceptance and enhance safety for users of the new system. Several cities around the world have combined cycle sharing with street design improvements. For more information on cycle infrastructure, see Appendix 1.

Cycling infrastructure implemented alongside cycle sharing schemes

Guangzhou	46 kilometres of segregated cycleways and 5,000 on-street cycle parking spaces
Paris	Expanded from 371 km of cycle paths to 439 km today (C40 undated). 700 km planned for 2014 (Freemark 2010)
London	4 "cycle superhighways" constructed; 11 more planned
Barcelona	150 km of cycle paths
Boston	80 km of cycle lanes (Kaiser 2012)

Institutional roles and responsibilities

Cycle sharing is a public transport system and requires a similar management structure. It also needs an operational approach that emphasizes good customer service. The implementing agency needs to be tech-savvy, business-minded, and disciplined.

In general, it is recommended that cycle sharing systems be implemented by a special purpose vehicle (SPV) for public transport if one exists in the city. Setting up an SPV can confer several benefits with regard to revenue management and flexibility in hiring. Day-to-day operations are handled by a private entity that enters an agreement with the SPV. The system requires active and ongoing support from the municipal and state governments. The division of responsibilities is indicated in the diagram below.

Urban local body, state government, and/or central government	▪ Technical guidance ▪ Space for stations and revenue rights ▪ Political and policy support ▪ Viability gap funding, if required
Implementing agency (e.g. public transport SPV)	▪ System planning ▪ Contracting for operations ▪ Monitoring of operator and system performance ▪ Recipient of all revenue. Pays the operator for services provided, with incentives and penalties as outlined in the service level agreement
Private operator for cycle sharing	▪ Day-to-day operations, including redistribution, maintenance, and customer service activities

The SPV should hire a dedicated team of staff who can focus on implementing the cycle sharing system. This team is responsible for evaluating of the local environment, planning the system, contracting private operators, and overseeing the phased roll-out of the system. The task force requires appropriately qualified staff and access to adequate office space, computers, and internet connections.

Integration with public transport

As a cycle sharing system is one part of the city's larger transport system, integration with existing public transport modes is essential. Components of integration include:

- Cycle sharing stations located at major public transport terminals and stations to facilitate convenient transfers
- Uniform electronic identification and payment systems for public transport and cycle sharing
- Sharing of data networks and other infrastructure

Operating the cycle sharing system through an existing public transport SPV can facilitate many of these integration activities. If the city chooses to create a new entity to manage cycle sharing, this agency will need to pursue partnerships with the major public transport providers in the city to ensure that the systems work together.

An integrated cycle sharing and bus rapid transit station in Guangzhou (China). The public transport operator in Guangzhou also operates the cycle sharing system.

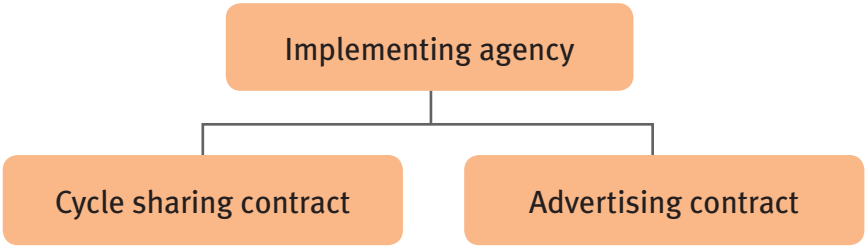
Contracting structure

Private sector participation can bring several advantages, including access to capital and technical expertise. However, constant oversight by the implementing agency is key to ensure that the system meets high service quality standards. The contracting structure should create the right incentives by rewarding good work and penalising poor performance. In order to evaluate the operator's performance, the implementing agency needs access to real-time system data (see "Operational systems: designing for the user," later in this toolkit).

Most cycle sharing contracts combine the installation of infrastructure with the operations once the system is launched. Such an arrangement creates an incentive for the contractor to supply high quality infrastructure so as to minimize maintenance costs over the life of the contract. A suggested term for a cycle sharing contract is 5 years. This term length is designed to coincide with the point at which most of the cycle fleet must be recapitalised. The contract is long enough to create an incentive for the operator to procure high quality cycles but short enough to give the implementing agency the flexibility to find a new operator in the event of lackluster performance. Since the station and IT infrastructure is expected to last beyond the first 5–year contract, the implementing agency should ensure that the software systems are non-proprietary, so as to allow for a change in operator at the end of the contract.

Advertising is a common source of revenue for cycle sharing systems. Many cycle sharing systems, especially in Europe, originally used advertising as the main revenue stream. While this in itself is not a bad idea, many systems partnered with advertising agencies—whose primary competency is advertising, not cycle sharing—to manage both the advertising and the operations of the cycle sharing system. This created inefficiencies and led to poor service levels for the cycle sharing systems.

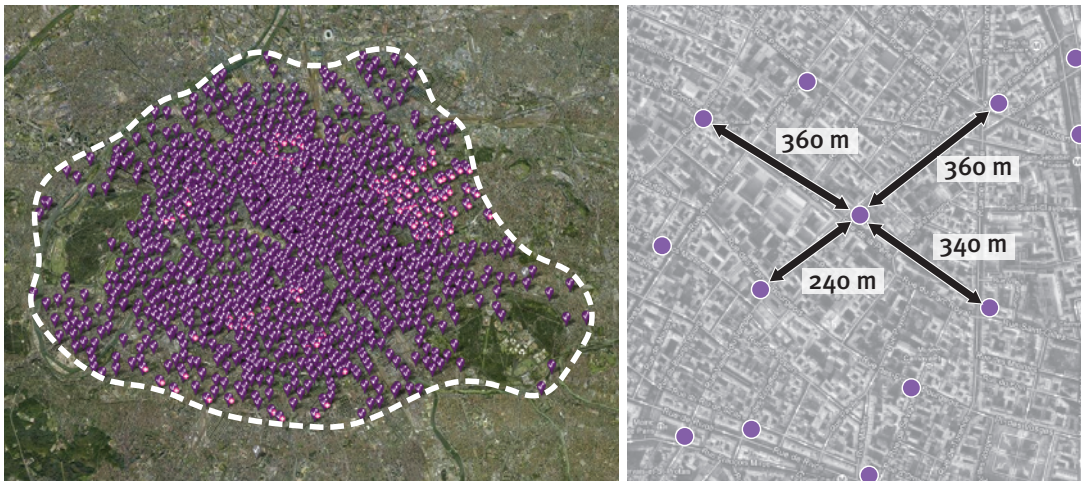
It is therefore advisable that the implementing agency maintain control of the cycle sharing system by signing different contracts with operators and advertisers. This allows the government to cancel or penalize either contract without affecting the other. It also reduces revenue risk for the cycle sharing operator. If the government does award a single contract for advertising and cycle sharing, the contract should specify that all revenues be deposited in an escrow account. In the event that the operator fails to meet service levels, some of the escrow account funds can be withheld. One example of the separation of operations and advertising provisions is the Bicing system in Barcelona, Spain. Bicing is operated by the advertising firm ClearChannel, but the city separated the advertising and cycle sharing components in its agreement with the company.



For systems financed in part by advertising, separating the advertising contract from operations can help ensure that the operator focuses on the core task of running the cycle sharing system.

Coverage area

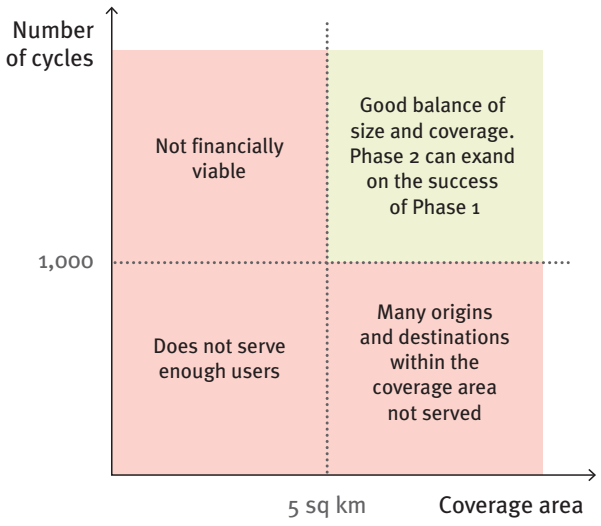
The single most important aspect in defining the scale of a cycle sharing system is to select a coverage area that includes a meaningful set of origins and destinations. Dense, mixed-use areas are likely to generate the most demand for cycle sharing.



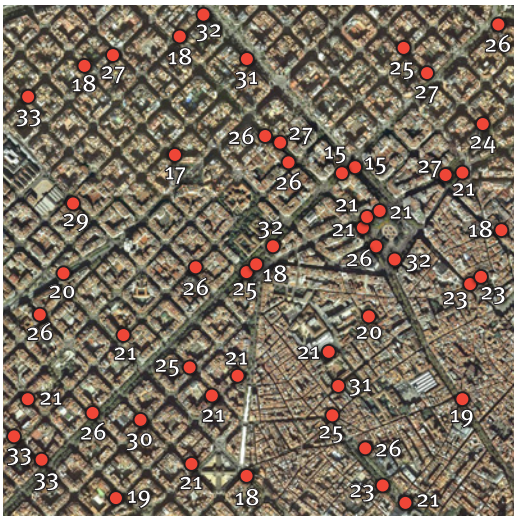
The Vélib cycle sharing system in Paris, France, features a dense network within the coverage area (left). The close placement of stations ensures that a station is always a short walk away (right).

The coverage area and system size must be selected jointly to ensure that the system is large and dense enough to serve a coherent set of origins and destinations. Stations are required every 300 m to ensure that cycles are available within a convenient walking distance from any point in the coverage area. Reaching a cycle sharing station should be at least as convenient as finding an autorickshaw. The identification of the coverage area is best carried out by qualified planning institutions through surveying and statistical data analysis.

A phased implementation plan can facilitate for the systematic expansion of a cycle sharing system. Initial phases should focus on dense, mixed-use areas where there is high potential demand.



A viable first phase cycle sharing system consists of at least 1,000 cycles placed at stations spanning a coverage area of approximately 5 sq km.



13 stations per sq km
318 docks per sq km

13 stations per sq km
302 docks per sq km

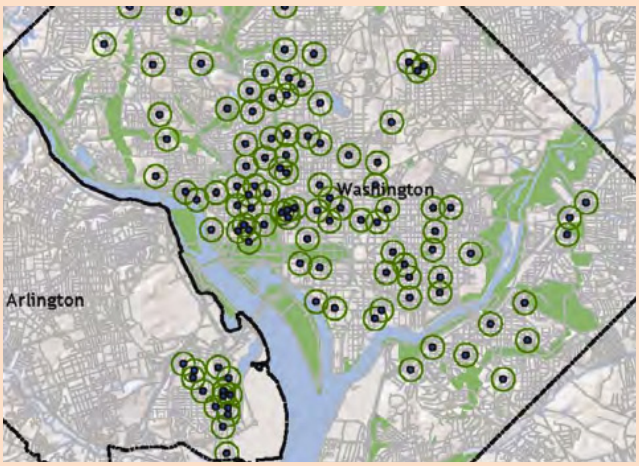
The coverage area should be saturated with stations. Station maps for cycle sharing systems in Barcelona, Spain, (left) and London, U.K., (right) show the close spacing between stations in city centre locations. The number adjacent to each station indicates the station's capacity (i.e. number of docks).

Washington, D. C.'s cautionary tale on the drawbacks of small pilot projects

"Pilot projects" in cycle sharing may not be viable if they do not cover sufficient origins and destinations to serve as a useful complement to existing the existing public transport systems. Washington, D.C. (USA) attempted to implement a pilot project in the form of Smartbike DC, which had only 10 stations and 120 cycles. With so few stations, the system served a very limited number of origin-destination pairs and saw around only one trip per cycle per day (DePhillis 2010).

After over a year of just skirting failure status, Smartbike was closed and replaced by a new system known as Capital Bikeshare, which began with 1,100 cycles and 100 stations in Washington, D.C., and another 14 stations in nearby Arlington. Capital Bikeshare is now considered a huge success, with six to seven rides per day per cycle during summer months (C. Holben, personal communication, 10 October 2012). This case study illustrates that scale and saturation of a coverage area are paramount factors in success of cycle sharing systems.

Washington D.C.'s Smartbike system began with a mere 10 stations.



The newer Capital Bikeshare system began with 1,100 cycles at 100 stations spread over a meaningful coverage area.

Stations

Station design is a function of the level of demand, the amount of space available, and the nature of the roadside environment. For a full-sized municipal system, all stations should accommodate automated check-in and check-out with smart cards or other electronic payment mechanisms. Automated systems reduce operating expenses, improve efficiency, and provide a better user experience.

Station typologies

There are two basic kinds of station design that accommodate automated check-in and check-out: stations with docking points and enclosed parking areas.

Stations with docking points

This type of station consists of a series of docking points and a user terminal. The docks hold the cycles in a fixed upright position.

Cycles are checked out by tapping a smart card or inserting a key at the docking point or by using a smart card or credit card at the terminal. Thus, this type of station can serve both regular users and short-term subscribers. While it might be prudent to have personnel on hand in the initial period after the launch, the station should be fully capable of operating without attendants.

The number of docks can be calibrated to the expected level of demand. Most docking systems have a modular design, allowing the operator to easily expand the station as demand increases. A station with docking points has a narrow profile that fits in a single parallel parking lane, and there is a great deal of flexibility in adjusting the layout to fit the available space.

DATURI VIA FLICKR

Cycle sharing stations in Barcelona, Spain, (top) Paris, France (bottom).

Cycle parking areas

Parking areas are ideal for larger stations (i.e. over 50 cycles) where there is room in the urban landscape for a secure area for storing the cycles. Parking areas stations are often placed near metro stations and other locations that experience very heavy demand.

Cycles are checked in and out through a metro-style turnstile that reads smart cards.

Cycle parking areas can hold more cycles per unit area than stations with individual docking points. The disadvantage is that the parking area needs to be secured by a fence or a wall, which can be visually intrusive. In addition, the station must be attended at all times. The check-out process itself is automated but attendants ensure that no one lifts a cycle over the turnstiles.

A parking area cycle sharing station in Shanghai, China: the staging area (top) and the turnstiles used to check out cycles (bottom).

A system can incorporate both station typologies, depending on demand levels, desired street views, and availability of space. While the docking terminals are popular for roadside stations, cycle parking areas serve unusually high demand stations such as metro stops and train stations. Stations should have sufficient docking positions or storage space to accommodate peak demand. For the system as a whole, the combined storage capacity of the docks and parking areas should exceed the number of cycles. For example, in European systems that rely exclusively on stations with docking points, the average system has 1.7 docks per bicycle (OBIS 2011).

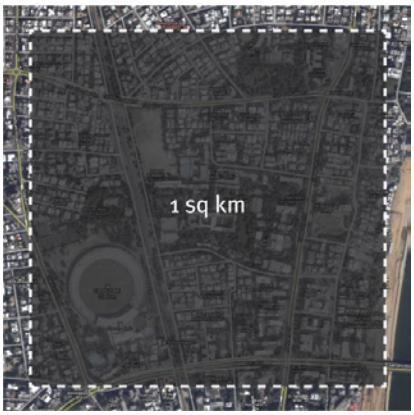
A cycle sharing station with docking points in Bangalore.

Station locations

Stations should be placed near important origins and destinations, including public transport hubs, points of interest, libraries, colleges, markets, shopping malls, and at strategic positions in residential areas. In the absence of a single important building, stations should be placed near intersections to serve origins and destinations in multiple directions.

The detailed planning and design of the coverage area and station locations should also be done by the implementing agency with input from private sector consultants. Besides using data from field surveys to identify possible station locations, the planning team can solicit recommendations from the community.

Survey methods for determining station locations and the coverage area.



The maps here cover a 1 square kilometre portion of the proposed cycle sharing coverage area.

Informal autorickshaw ranks: indicator of key origins and destinations.

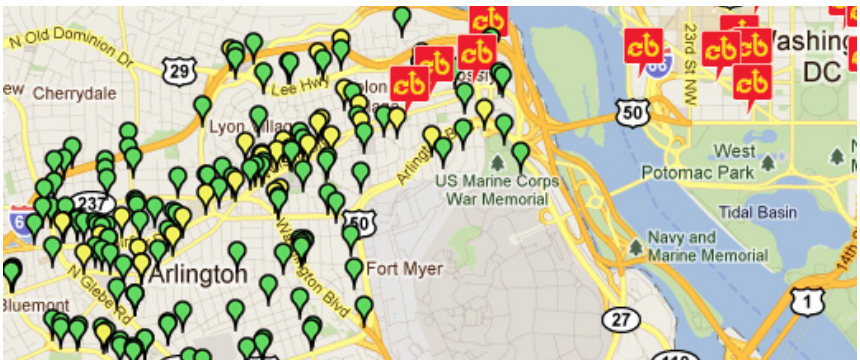
Streets with dense on-street parking activity: a proxy for the presence of commercial uses.

Local and intercity bus stops that should be integrated with the cycle sharing system.

Government offices, educational institutions, and other important local landmarks.

Final cycle sharing station locations (the larger circles represent large stations).

Arlington, USA, used crowdsourcing technology to solicit suggestions for station locations. Existing cycle locations are indicated with red icons. Suggestions from the implementing authority are shown in yellow; community suggestions are in green.



A cycle sharing station in a pedestrian plaza in Paris, France. Note the proximity to the bus stop.

A cycle sharing station in an on-street parking lane in Brussels, Belgium. The station located next to a metro station entrance (near the "M" logo).

A cycle sharing station in the parking lane on a busy commercial street in Barcelona, Spain.

Cycle sharing station under a pedestrian overbridge in Guangzhou, China.

Station placement

Positioning stations in the street environment is an urban design art form. Stations should be visible to passers-by but at the same time should make use of underutilised and vacant spaces to minimize interference with other activities and the overall urban landscape. Typical options for station location include the following:

- On-street parking spaces
- Vacant space in roadside landscaping strips
- Areas beneath flyovers and foot overbridges
- Private property near large commercial and housing developments

The parking lane is an ideal location for cycle parking stations. In Paris, France, over 1,450 on-street parking spaces were removed to create space for 4,000 cycles in the Velib system (ITDP 2011). Similarly, Barcelona, Spain, converted nearly 1,200 parking spaces to for use by the city's Bicing cycle sharing system. While a parking space typically serves only one commuter, the space used by the car can serve multiple commuters over the course of the day if converted to a cycle sharing station.

Stations should not be placed on footpaths unless there is sufficient clear space for walking beside the station. As suggested by the Indian Roads Congress (IRC), a width of 2.3 m of clear space for walking is required in all locations, and more space should be provided where larger pedestrian volumes are present (IRC 2012). At intersections, space is often more readily available on the minor street than on the main thoroughfare.

The cycle

The cycle should be attractive and durable. The overall appearance of the cycle is a key element in the overall branding of a cycle sharing system and should project a sleek, modern image. The design can differentiate the cycle sharing fleet from regular cycles in the city through distinctive design, colours, and graphics.

Front basket

The cycle should be designed with a porous front basket for carrying personal items. Rear racks are not advisable as they can be overloaded, causing damage to the cycle. Front baskets are ideal for carrying purses and valuables, which would be subject to theft if carried in a rear rack. The design should prevent the use of the basket for carrying a second passenger.

Docking mechanism with RFID tag

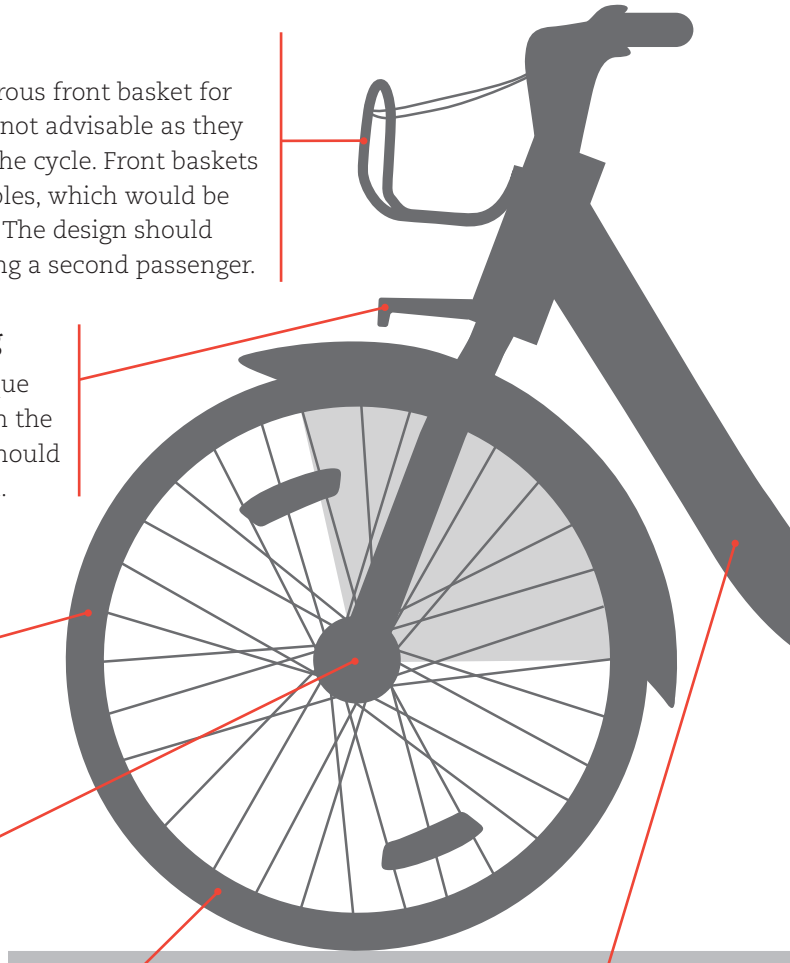
The RFID device carries the cycle's unique identification number and is read when the cycle is docked at a station. The cycle should be held in a fixed position when docked.

Sturdy tyres

Solid or puncture resistant tyres with a wide profile are recommended to reduce the frequency of punctures and increase life expectancy.

Drum brakes

Front and rear drum brakes with internal wires are preferred. Disk, cantilever, and V-brakes should be avoided because they are difficult to maintain.



Protection against theft & vandalism

The cycle should be made from unique parts and sizes to deter theft. Nuts and screws should be designed so that they can only be opened with proprietary tools. Similarly, the standard 26-inch tyre size should be avoided. (The tyre diameter should not be too small because small tyres are prone to getting stuck in potholes.)

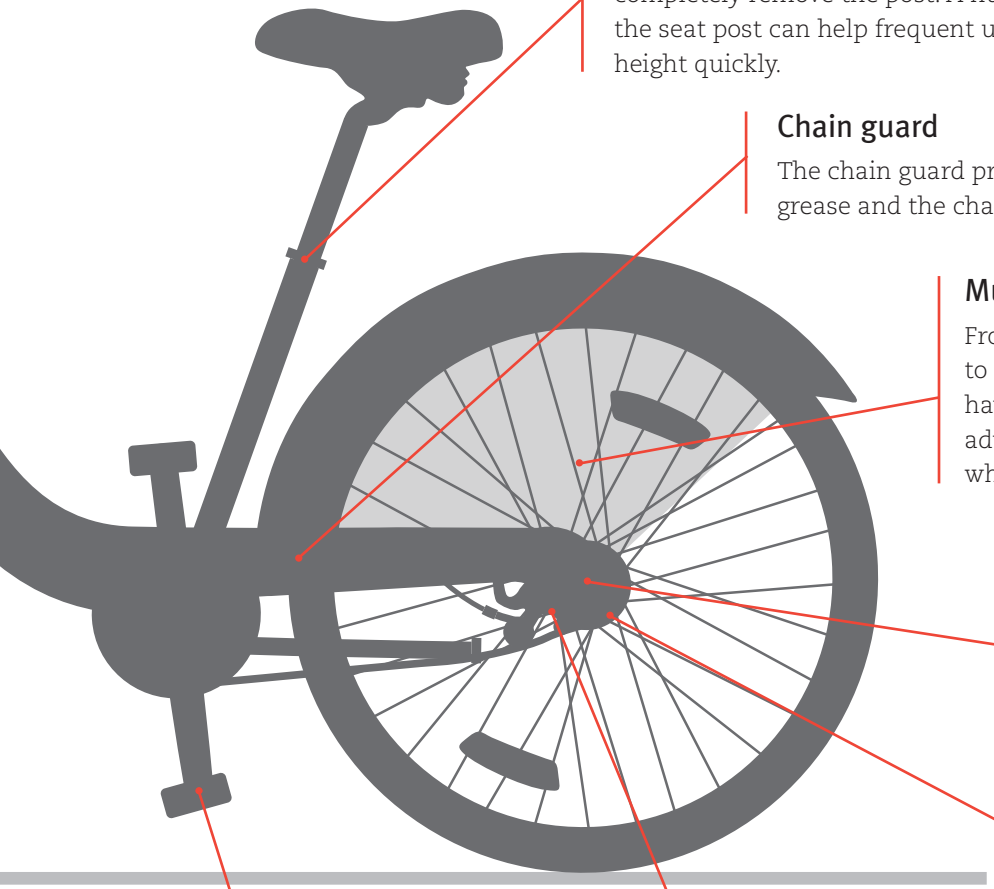
Step-through frame

A step-through frame design is required to ensure that the cycle is compatible with all types of clothing. The frame should allow for a comfortable upright riding position.

How long do cycles last?

Cycle manufacturers often overestimate the depreciation period, or life span, of cycles in a cycle sharing system. This is done because most companies do not take several key factors into consideration when estimating the life span:

- The outward appearance of the cycles is important to the image of the system. If a cycle looks old but is still functional, the manufacturer will consider it useful while the cycle sharing system operator will feel that it should be replaced.
- The optimal usage rate in cycle sharing systems is 6 to 7 rides per day. This is much higher than typical usage rates, and rates of wear and tear are correspondingly higher.
- The cycles are stored outside where they are subject to environmental elements such as sunlight and rain. As a result, they suffer more damage than cycles that are personally owned.



Adjustable seat post

'Quick release' seat posts can be designed to allow easy height adjustments without making it possible to completely remove the post. A numbering system on the seat post can help frequent users adjust the seat height quickly.

Chain guard

The chain guard protects the user from grease and the chain from damage

Mudguards and advertisement space

Front and rear mudguards are needed to protect clothing. The cycle should have a provision for the installation of advertisements over the front and rear wheels and in the frame.

Gears

If the city has hilly terrain, a three- or six-speed internal hub can be provided.

Automatic lights

Front and rear LED lights powered by a hub dynamo are needed for visibility at night. In addition, reflectors should be provided on wheels, pedals, and both ends of the cycle. The frame colour and branding elements on the cycle should be bright and reflective. A yellow, orange, red, or reflective chrome colour is preferable.

Safe pedals

Large, flat pedals can help inexperienced riders keep their feet securely on the pedals. Avoid selecting a pedal with sharp barbs, as they can injure the foot and leg of an inexperienced rider.

Protected components

If the cycle has multiple speeds, these must be provided through an internal hub. External derailleurs are to be avoided, as they are fragile and difficult to maintain. Wiring for brakes and gears should be hidden.

Operational systems: designing for the user

A successful cycle sharing system is designed to provide a positive user experience in order to build long-term customer loyalty and maximize the value of the city's investment in the system. A positive user experience encompasses everything from the registration, the location, usability, and appearance of the stations, through to the riding of the cycle (Alta 2011). To accomplish this the user must be put first in the operational design of the system. Planners and the operator constantly need to ask themselves, "What would the user prefer?"

The successful delivery of cycle sharing depends on active oversight from the implementing agency. All of the activities outlined below need to be monitored constantly by the implementing agency to ensure service levels are met. The operator contract needs to include a service level agreement that stipulates rewards and penalties. This section discusses the various tasks carried out by the private operator. After each section, sample service levels and monitoring methods are presented.

Customer service

Customer service platforms collect and disseminate information from and to the user through various mediums. They introduce potential users to the system, allow customers to set up accounts, receive payments, and provide information about user account status.

The web is an ideal platform as it has the advantage of being available 24/7 and offers seamless interaction without the hassle of waiting in long queues. It also reduces operational costs and gives the system a modern, high-tech image. E-mail and mobile phone applications are an expanding realm of user interaction. Many of the internationally renowned cycle sharing schemes have applications for smart phones and interact with users via e-newsletters and e-mail service alerts.

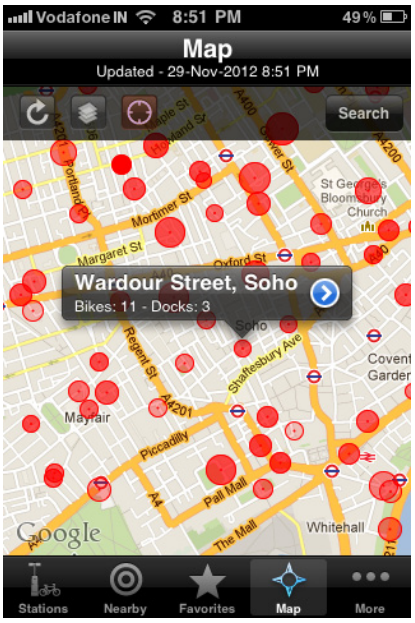
Cycle sharing website contents

- How to register
- Online registration form
- The process of checking out a cycle
- A map of station locations with real-time station data
- User data (e.g. account balance)
- Hours of operation
- Customer service phone numbers and e-mail addresses
- A blog with system news and updates

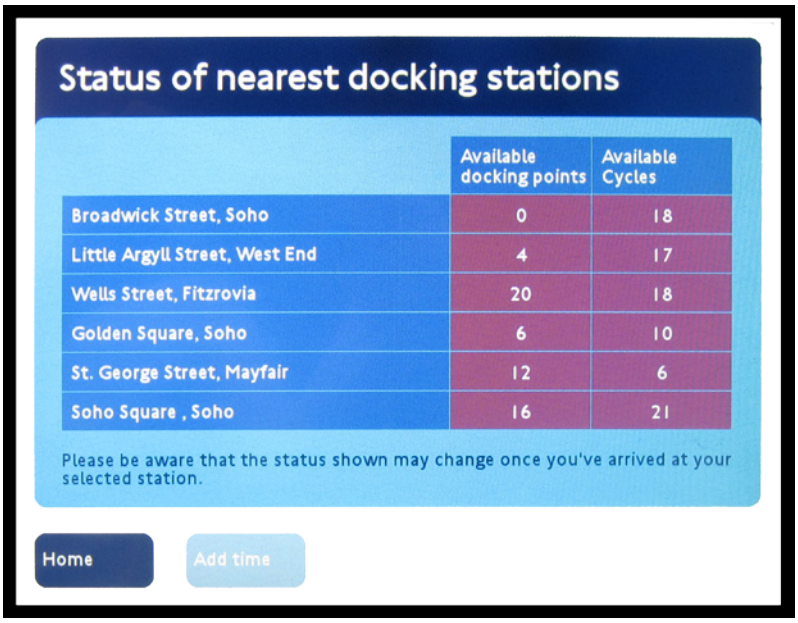
While many users may access the system through the website or station terminals, it is important to have a face-to-face platform at the operational headquarters and/or at large stations. Manned kiosks offer the same benefits of the online system to users who do not have access to technology.

Sample service level indicators for customer service (TfL 2010)

Indicator	Sample benchmark	Data source
Registration applications processed	99.5% within 3 days; 90% within 1 day	Operator records
Customer complaints processed	For post, 99.9% within 10 days; for e-mail/web, 99.9% within 5 days; For all complaints, 95% within 3 days	Operator records
Number of valid customer complaints	Fewer than 11 per month	Operator records
Call centre abandon rate	97% of calls not abandoned	Call centre IT system
Call centre queuing time	99.9% of calls answered within 180 seconds; 90% of calls answered within 20 seconds	Call centre IT system; spot checks
Per cent of the time that the call centre is available	99.9%	Call centre IT system
Maximum time on a single day that the website is not available	20 minutes	Real-time IT feed
Percent of time that the website is available per month	99%	Real-time IT feed
Overall customer satisfaction	Industry benchmark	Customer interviews



Mobile phone applications can help users determine the locations of nearby cycle sharing stations and the availability of cycles and docks.



A Barclays Cycle Hire terminal display showing the availability of cycles and docking points at nearby stations.

User verification and payment options

The authority should specify the verification methods and payment mediums that will be accepted by the system in the service level agreement. Upon registration, the system must require users to furnish some form of identification proof or monetary deposit:

- **Credit cards**. The cycle sharing system places a hold on the user's credit card account. When the subscription period ends (and the user has returned in any cycles that s/he checked out), the hold is removed.
- **Mobile phone account**. The cycle sharing subscription is tied to the user's phone number. If the user fails to return the cycle, the mobile phone company imposes a fine or suspends the user's account. This option would require the authority or operator to enter into agreements with mobile phone companies.
- **Smart cards**. Public transport smart cards, such as the Common Mobility Card (also known as "More"), can allow access to the system provided that the user maintains a sufficient deposit in his/her account. In Chinese cycle sharing systems, the deposit is often set at or near the value of the cycle. In India, this might prevent many potential users from joining the system. A preferred approach is to set deposit level somewhat below the actual value of the cycle, using risk analysis to weigh the benefit of greater membership against the higher probability of theft. If the cycle is not returned, the deposit is deducted from the user's account.

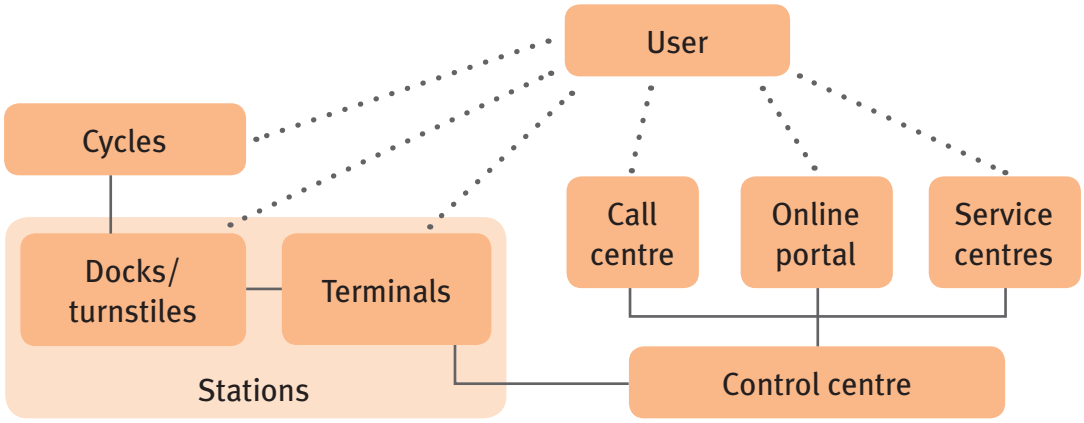
The Common Mobility Card is a possible payment mechanism for cycle sharing systems.

Note that in smaller, closed systems, such as university campus cycle sharing systems, student and staff ID cards can substitute for these identification mechanisms.

Upon registration, the user pays the deposit fee. Once a user has registered, the system can deduct money from the user's credit card, mobile account, or smart card to cover the hourly usage fee. Smart card users can recharge at designate customer service kiosks or at station terminals. (For more on pricing structures, see "Financial analysis.")

IT system

Information technology (IT) systems manage the interaction between the user and the operational headquarters and are the critical factor behind the success of third-generation cycle sharing systems. They allow for real-time data exchange and the tracking of the user's



Communication systems and user interface.

identity to reduce the likelihood of theft and to increase efficiency. It was the application of IT systems to cycle sharing that made it a viable option for cities worldwide. The implementing authority needs to ensure that the operator employs a robust IT backbone to provide good customer service.

Real-time tracking of cycles and users is made possible by RFID (radio frequency identification device) chips on the user's smart card and on the cycle. The terminal and docking units read both RFID tags, linking the identify of the user to that of the cycle that s/he is using. The IT system feeds the information to a control centre via hard wires or GPRS—the technology used by mobile phones to transmit data. The control centre is the hub of information gathering, analysis, and dissemination.

The control centre in turn disseminates system information to customer service platforms such as terminals at stations, mobile phone applications, and the system's website. The IT system allows the operational headquarters to view real-time information about the status of cycles and stations. The implementing agency also needs to have real-time access to the IT system because the system data are used to evaluate whether the private operator has met the service level standards outlined throughout this chapter. The system should also generate a real-time public data feed with the number of occupied and empty docks at each station for use by third-party software developers.

Sample service level indicators for the IT system (TfL 2010)

Indicator	Sample benchmark	Data source
Time required to check out a cycle	95% of transactions below 15 seconds	Spot surveys
Data protection breaches	0	Operator records
Terminal performance	99% of transactions executed in under 10 sec	Real-time IT feed
Smart card performance at the terminal	99.5% of transactions in under 4 sec	Real-time IT feed
Smart card performance at the dock	99.5% of transactions in under 1 sec	Real-time IT feed
Payment processing	98.5% of payments processed on the same day	Real-time IT feed

Redistribution

A key responsibility of the cycle sharing operator is redistribution, broadly defined as the rebalancing of cycles from stations that are near or at capacity to stations that are close to empty. Redistribution is one of the greatest challenges to operating a cycle sharing system, accounting for as much as 30 percent of operating costs (OBIS 2011).

Successful redistribution is critical to the viability of the system from the customer's perspective. If an operator has an adequate IT system, redistribution becomes predictive, and is better thought of as the rebalancing of cycles to stations where users will need them and away from stations where users will be dropping them off. While a cycle system may operate 24 hours a day, many systems only need to redistribute between 7 a.m. and 9 p.m., when the majority of trips are made.

PUG FREAK VIA FLICKR

Redistribution vehicles should hold the cycles in a position that prevents scratching and allows the attendant to easily insert or take out cycles without much effort or time.

Sample service level indicators for redistribution (TfL 2010)

Indicator	Sample benchmark	Data source
Percent of the time that high-priority stations are empty during peak hours (7-10 a.m. and 4-7 p.m.)	6%	Real-time IT feed
Percent of the time that high-priority stations are empty during off-peak hours	3%	Real-time IT feed
Percent of the time that low-priority stations are empty during peak hours (7-10 a.m. and 4-7 p.m.)	23%	Real-time IT feed
Percent of the time that low-priority stations are empty during off-peak hours	8%	Real-time IT feed
Minimum per cent of total cycle fleet available at 6 a.m.	100%	Real-time IT feed

Maintenance

Regular preventative maintenance is necessary to keep the cycles in good working condition. The following schedules are suggested (Alta 2011).

Preventative maintenance schedule

- Every two days: inflation of tyres; removal of dust and grease from cycles, docks, and terminals.
- Every two weeks: drive chain lubrication, handlebar cantering and tightening, check for proper functioning of brakes, inspection for saddle wear and tear, verification that lights and reflectors are intact and function properly, and general observation of all other cycle components.
- Once per year: remove and clean entire drive train, adjust tension and true wheels, inspect and replace tires that are worn, and inspect and service hubs and the bottom bracket.

In the case of damaged cycles, the operator is responsible for fixing minor repairs on-site and notifying redistribution teams to collect major repairs that need to be completed at a depot. Many cycle sharing schemes allow the user to report a fault. One method is to allow for notification through the docking station terminal. Once a user reports a faulty cycle,

Constant oversight on the part of the implementing authority is required to ensure that the operator maintains the cycles in a state of good repair.

In Paris, France, (left), users report a fault by pointing the seat backward. The docks in Washington, D.C., USA, (right) have a button that users press to alert the control centre that a cycle needs a repair.

that cycle is taken offline (it cannot be checked out again), and the operations headquarters is notified. A more primitive solution, used in the Velib system in Paris (France), is to point the adjustable seat backwards to alert the cycle maintenance team that a cycle needs to be repaired. The damage or replacement cost of bicycles due to misuse or vandalism should be shared between the operator and the government because vandalism is a function of social order, a responsibility of the government.

Sample service level indicators for maintenance (TfL 2010)

Indicator	Sample benchmark	Data source
Minimum per cent of total cycle fleet available at 6 a.m.	100%	Real-time IT feed
Minimum per cent of total fleet availability during the day	95%	Real-time IT feed
Per cent of cycles repaired within 4 hours of being flagged for repair by a customer	95%	Real-time IT feed, spot checks
Percent of cycles without major dust accumulation or grease stains	95%	Spot checks
Terminal availability per day	99%	Real-time IT feed

Outreach & marketing

Cycle sharing is a new transport solution for Indian cities, and a well thought-out public participation, education, and marketing campaign is essential for gaining acceptance of the system. A broader marketing campaign can follow, making use of print media, the Internet, and other media.

System identity

A cycle sharing system needs a clear identity that presents a professional, modern image and distinguishes the system from other urban transport options. There are several elements of the identity, including the name, logo, and tag line. Choosing an effective name is critical to the identity, and the following criteria can guide the naming process (Wright 2011):

Criteria for selecting a system name

- Brevity
- Phonetics
- Lexicon
- Local content
- Personal affinity
- Professionalism

Similarly, the system should have a logo that is meaningful in the local context. The logo can help create a vibrant, progressive image for the system. Making consistent use of the core identity elements can improve customer identification and pride in the system.

Cycle sharing system logos.

Consistent use of the Bicing system logo in Barcelona, Spain.

Internal marketing

All implementing agency staff and officials need to be informed about the service the system will provide, its costs, and its benefits. Similarly, public transport operators need to be briefed about the benefits of integration between the cycle sharing system and the city's overall transport framework. The internal campaign is best executed through presentations to each body.

Typical cycle sharing marketing messages

- Checking out a cycle is quick and convenient—you don't have to worry about looking for parking or spend time waiting for a bus
- Cycle sharing saves money
- For short trips, cycle sharing is a faster than walking or taking the bus
- Cycling is good for health
- Rates are pre-set—no haggling with rickshaw drivers over rates

External marketing

The goal of the external campaign is to inform the public about the merits of cycle sharing, how the system works, and the benefits to the individual citizen and the city as a whole. The marketing campaign should make use of new media, such as blogs and social media sites to reach different audiences. The marketing campaign must work proactively with media houses to define the public narrative about the system, rather than simply responding to external queries after the fact. Important marketing messages include the following:

The external marketing strategy can include the following components:

- **Public participation.** A public planning process gives community members a stake in the process of setting up a cycle sharing system. It provides an opportunity to disseminate information about cycle sharing to persons living in neighbourhoods where the system will be introduced. Community input is valuable in choosing where to place docking stations. Before holding public meetings, the government should establish criteria for approving or denying station requests.
- **Soft launch.** Demonstrations of station and cycle technology can give people a hands-on idea of how the system will work. Potential sources of opposition to cycle sharing can be flagged early in the process, and the concerns can be addressed in the design process.
- **Launch event.** A high-profile launch event with celebrities and important city officials can help generate media coverage when the system begins official operations. Showcasing the system with prominent figures helps reinforce the idea that the system is for the masses and helps to counter the image that cycling is just for the poor.

Financial analysis

An initial financial analysis of a cycle sharing system is a major concern for all stakeholders involved. The financial analysis can reveal the viability of the system. The capital and operating costs are a function of system technology and are straightforward to determine, but the revenue can be difficult to determine because it depends on usage levels and political decisions on funding mechanisms.

While modern cycle sharing systems have high capital costs, these are offset by the lower operating costs made possible through IT systems and greater revenue potential. These long-term financial savings, coupled with third generation systems' improved user friendliness and reliability make it the optimal choice.

Capital costs

The cost including terminals, docking points, cycles, and construction costs can be calculated once station technology, station size, and IT system requirements are stipulated. Appendix 2 explains the calculations behind these representative capital costs.

Representative capital costs

Note that these costs include stations, IT equipment, the control centre, cycles, and other capital components:

- Hangzhou: Rs 64,000 per cycle
- Guangzhou: Rs 58,000 per cycle
- Pune (estimated [Cycle Chalao 2012]): Rs 54,000 per cycle
- Ahmedabad (estimated [ITDP 2012]): Rs 77,000 per cycle

Operating costs

Operating costs include administrative, maintenance, and redistribution costs. As discussed earlier, redistribution costs represent the largest portion of operating expenses.

Representative operating costs

- Hangzhou: Rs 9,900 per cycle per year
- Guangzhou: Rs 13,600 per cycle per year
- Pune (estimated [Cycle Chalao 2012]): Rs 24,000 per cycle

Note that the operating costs for Pune are higher than the other examples because the assumed operational system is not fully automated and the staffing costs add to the financial burden.

Pricing models

There are two types of fees for cycle sharing systems:

- Time-based usage fees
- Membership fees (e.g. annual, monthly, daily)

Usage fees for cycle sharing systems encourage short trips to maximize the number of times each cycle is used per day. In European and North American systems, the first half hour of usage is usually free, whereas in China that free time period is extended to one hour. Time after that is charged at an increasing rate. This type of pricing model encourages users to turn in the cycles promptly for others to use.

Representative usage fee structure

- Fewer than 30 minutes: free
- 30 minutes–1 hour: Rs 5
- 1 hour–2 hours: Rs 10
- More than 2 hours: Rs 15 / hour

While most systems earn little revenue from usage fees (see below), the annual membership fee does constitute a meaningful revenue stream. By charging an membership fee, the system can deter theft and track active users by requiring them to update their user profile and payment details on a regular basis. The annual subscription fee should be carefully calculated so as not to not create a barrier to entry for targeted user groups.

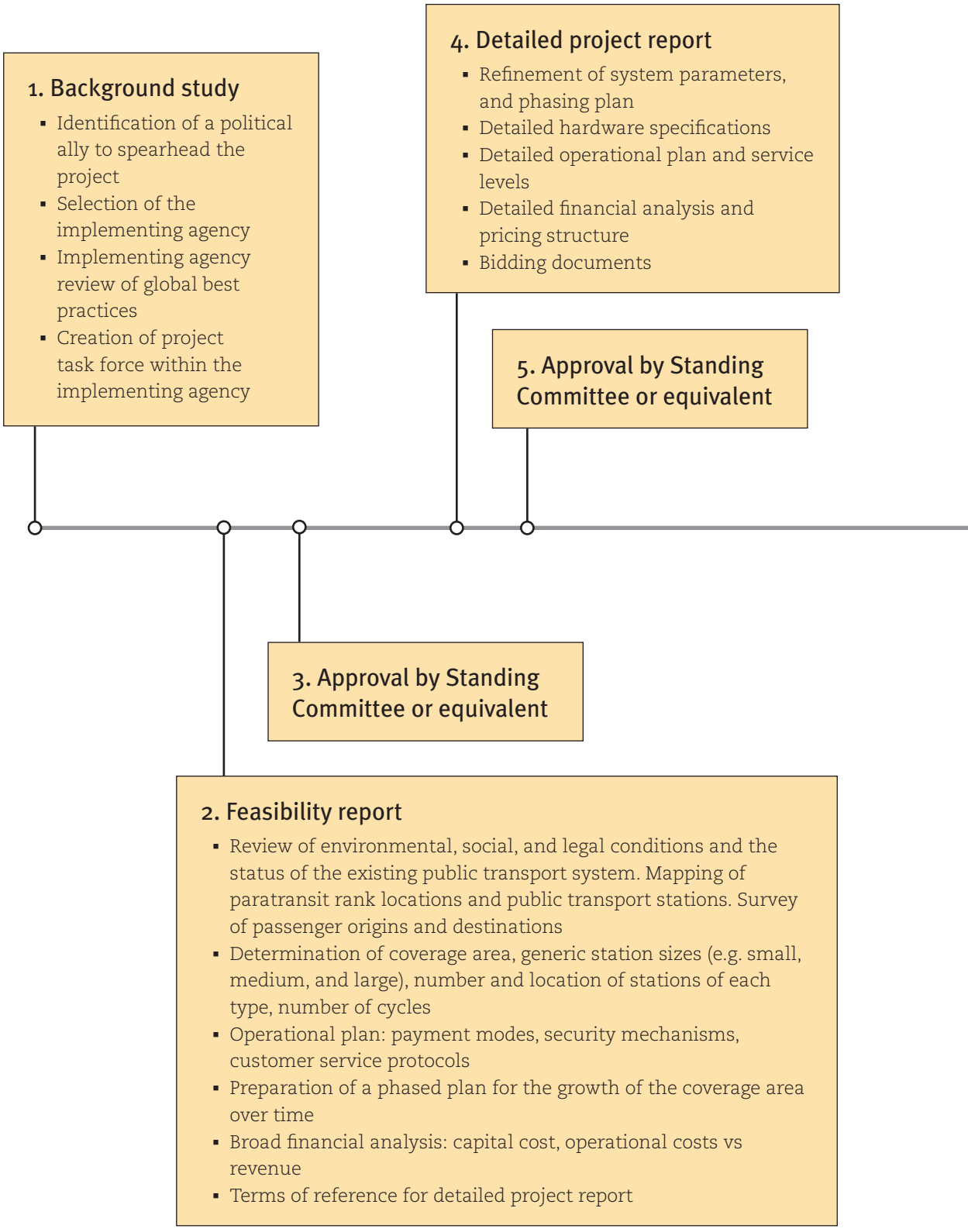
Operating revenue

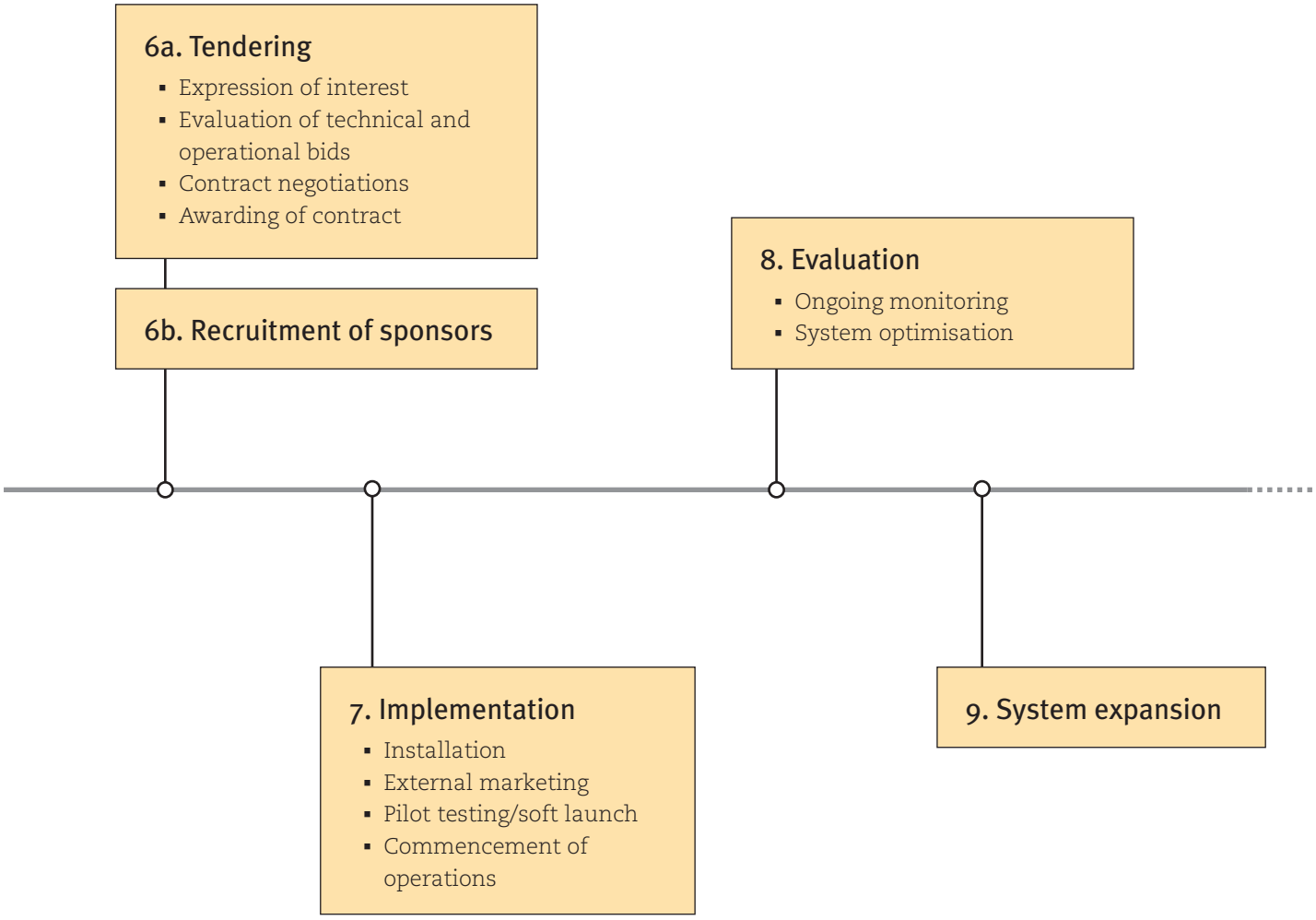
Almost all high quality sharing system systems around the world require some combination of advertising, sponsorship, or parking fee revenue to cover their operating costs and ensure that the private operator receives a fair return on investment. Cycle sharing systems that try to cover their costs through user fees run the risk of pricing the service out of the reach of key user groups. As is the case in public transport systems, providing supplemental revenue can ensure that a cycle sharing system is available to a broad spectrum of the population.

Potential revenue sources

- **Annual subscriptions**. Aimed at regular users.
- **Temporary subscriptions**. Daily or weekly subscriptions for occasional users.
- **Time-based user charges**. User charges usually equate to very little revenue as the pricing model should encourage short trips. In Hangzhou, more than 95 percent of rides are under 1 hour and are thus free (Tang 2010). In Guangzhou, 99 percent of trips are free (ITDP 2011).
- **Advertising**. The sale of advertising space on the stations and, to a lesser extent, on the cycles is a potentially significant source of revenue.
- **System sponsorship**. A private entity sponsors a system in exchange for branding rights. London earned £25 million over five years by selling the naming rights for the city's cycle sharing system to Barclays.
- **Parking fees**. Charges for on-street motor vehicle parking in the cycle sharing coverage area can provide a sizable revenue stream. Barcelona pioneered an innovative policy of devoting 100 percent of revenues from on-street parking fees to the city's Bicing cycle sharing system (ITDP 2011).
- **Retail at stations**. Larger stations may need kiosks to help customers and to assist with the redistribution of cycles. These kiosks can sell drinks, snacks, and newspapers.

Cycle sharing planning process




6a. Tendering
▪ Expression of interest
▪ Evaluation of technical and operational bids
▪ Contract negotiations
▪ Awarding of contract
6b. Recruitment of sponsors
8. Evaluation
▪ Ongoing monitoring
▪ System optimisation
7. Implementation
▪ Installation
▪ External marketing
▪ Pilot testing/soft launch
▪ Commencement of operations
9. System expansion

Frequently asked questions

Is cycle sharing worth the money?

A high quality cycle sharing system with 5,000 cycles can be implemented for Rs 40 crore. Many cities are ready to spend more than this on a single flyover. A cycle sharing system of this size can serve tens of thousands of commuters per day, helping to reduce pollution, congestion, and overcrowding on public transport.

Will cycle sharing succeed if our city doesn't have a cycling culture?

While an existing cycling culture can confer some benefits on a cycle sharing system, it is by no means a prerequisite for success. In fact, some of the most popular cycle sharing systems are found in France, Italy, and Spain—countries where there was minimal prior use of cycles (OBIS 2011).

Only poor people cycle. Why would middle class commuters use the system?

Cycle sharing systems that provide an reliable, affordable mobility can attract new cyclists, even people from the middle and upper classes. It is key to achieve an attractive system image by maintaining high performance and quality standards.

Is cycle sharing the same as a cycle rental system?

Cycle sharing is often confused with a cycle rental systems. Cycle sharing is a technology-based self-service system that differs in significant ways from the traditional commuting or tourism-oriented rental services that are present in many parts of India.

Cycle Rental	Cycle Sharing
A private cycle rental company	A public transportation service
Pricing model encourages longer trips or usage	Pricing model encourages short trips rather than revenue
Cycles are rented and returned from a single location	Origin/destination: a user can collect the cycle at one location and drop it off at another
Security guaranteed through personal rapport or the deposit of identification documents	Security provided through RFID-based tracking of cycles and users
Monthly rentals to commuters or short-term rentals for recreation and tourism	Integrated into the public transport system to provide last-mile connectivity

Shouldn't the city build cycle tracks before launching a cycle sharing system?

Better cycling infrastructure is a good complement to a cycle sharing system. But it's important not to wait until the city meets the elusive goal of having a complete cycle

network of dedicated cycle facilities. Cycle sharing systems help raise the profile of cycling, making it easier to invest in cycle infrastructure.

Many Indian cities already have a large cycling mode share. This existing user base is significant because of the "safety in numbers" resulting from the large number of cyclists on the road. In cities where cycling is common, motor vehicle users are likely to be more alert to the presence of cyclists on the road and to have experience negotiating road space with non-motorised vehicles.

Will users cycle in the summer heat?

Cycling for transport is not like cycling for fitness. Most users will cycle at a very relaxed pace and most trips will be less than 30 minutes. To take a cycle will be cooler than walking or taking a bus, the other options for many commuters.

Why do we need advanced IT components? Can't we use a system with manual check-in and check-out?

While capital costs of modern cycle sharing systems may seem high at first glance, the larger up-front investment pays long-term dividends. The IT-based systems for tracking users and cycles ensure efficient operations and lower rates of vandalism and theft.

With manual check-out systems, the check-out time may add up to around 30 seconds per passenger. In the even that several customers arrive at the same time, the last passenger may end up waiting 5 minutes just to get a cycle. Given that the riding time for many cycle sharing trips may be in the range of 10–15 minutes, the 5 minutes of waiting add considerably to the total trip time, creating a severe disincentive to use of the system.

A low-tech cycle sharing system in Wuhan, China, results in long customer queues and poor customer service. Given that most cycle sharing trips are under 30 minutes, the time spent waiting to check out a cycle becomes a large portion of the total trip time.

Does the IT system need to track the cycle, or is it sufficient to record the user's identity?

If the system does not track the identity of the cycle, then attendants are required at every station to verify that each user returns a cycle when s/he checks in. This manual procedure will slow the process of check-out and check-in. For stations with heavy demand, there is a risk of confusion when multiple users arrive at the same time to check in their cycles. These factors are likely to result in poor customer service and a negative system image.

Appendix 1. Supporting infrastructure

Cycle sharing systems can achieve greater success when paired with measures to create dedicated infrastructure for cycling. These facilities can improve safety and convenience for all cyclists, including users of the cycle sharing system.

Network planning

A cycling network plan should be created to help prioritise cycle infrastructure improvements. Priority areas can include streets with high-speed traffic, streets with large cycle volumes, and streets near destinations that generate cycle traffic, such as schools and industrial units. On smaller streets, traffic calming measures can help reduce motor vehicle speeds to levels that facilitate safe intermingling with cyclists.

Cycle track design criteria

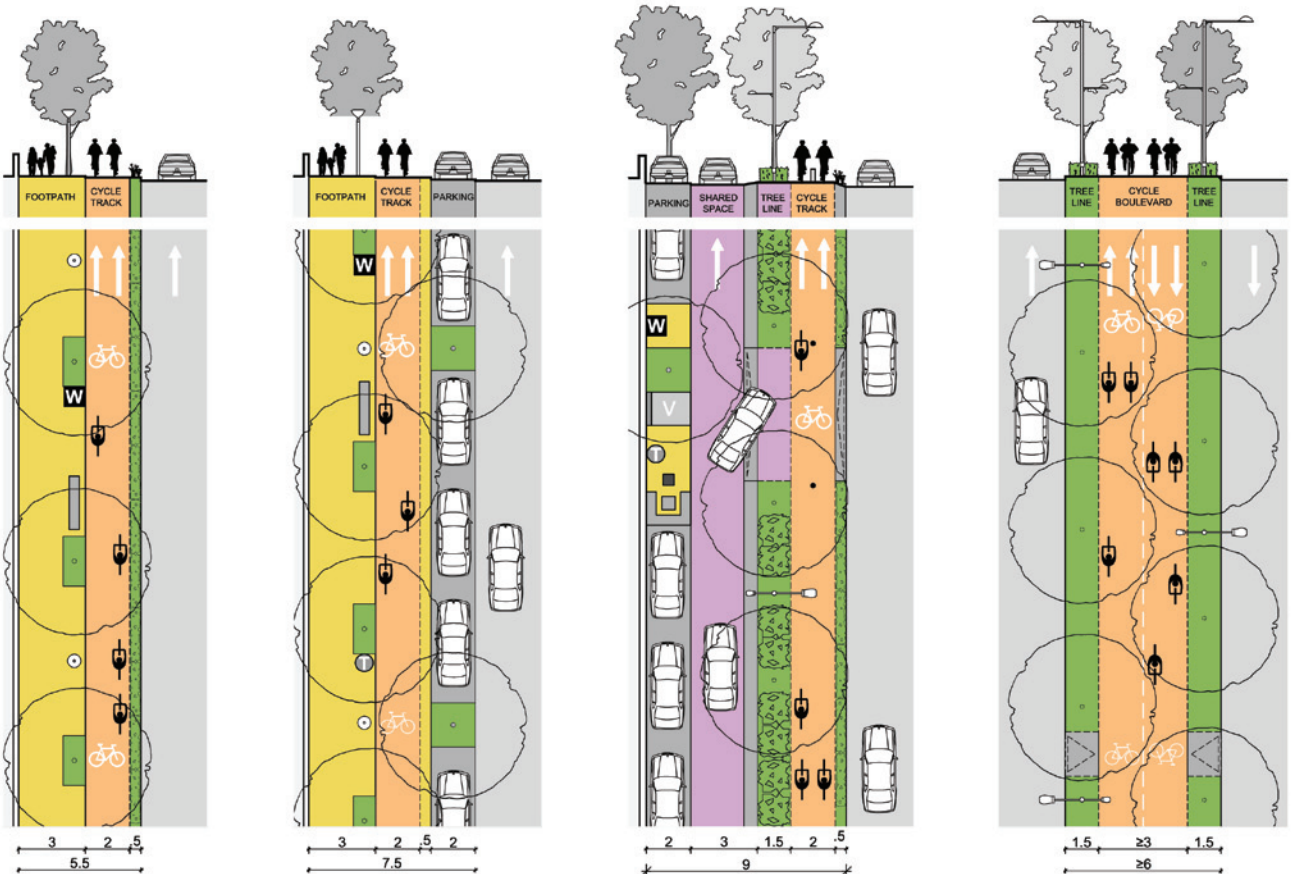
Good cycle tracks are continuous and provide for uninterrupted movement. They are physically separated from the main carriageway to ensure both comfort and safety, and are protected from encroachment by parked vehicles, pedestrians, and street vendors.

Cycle tracks can be placed in the median or at the outer edges of the carriageway. Cycle tracks in the median reduce conflicts with parking and street-side activities. However, street-side cycle tracks may be provided where encroachments due to parking or commercial activity are minimal, as may be the case if a service lane is available.

Cycle tracks should incorporate the following:

- A minimum width of 2 m for one-way movement and 3 m for two-way movement
- Continuity to allow for reasonable speeds
- A smooth surface material—asphalt or concrete. Paver blocks are to be avoided

Barcelona, Spain, offers an integrated network of cycle sharing stations and dedicated cycle tracks, helping to improve safety for cycle sharing users and other cyclists alike.



A clear width of 2 m is needed for one-way movement of cycles. To accommodate cycle rickshaws a minimum 2.5 m width is recommended, and to accommodate two-way movement, 3 m is recommended. A 0.5 m buffer is needed between a cycle track and motor vehicle or parking lanes. The buffer can accommodate ramps and storm water catch pits. The buffer should be paved if it is adjacent to a parking lane.

Median cycle tracks (far right) reduce conflicts with parking and property access. Frequent access points with ramps are essential. Turning movement conflicts at intersections can be mitigated through bicycle boxes and proper signal phasing.

- Manhole covers should be avoided and, if unavoidable, should be level with the surrounding surface
- Continuous shade through tree cover
- Elevation above the carriageway (e.g. +150 mm) that allows for storm water runoff
- A buffer of 0.5 m between the cycle track and parking areas or the carriageway
- At property access points, the cycle track remains at the same level and vehicle access is provided by a ramp in the buffer

Management

Cycle tracks are easily taken over for activities such as parking and street vending or as a travel lane for motorised two-wheelers. Any cycle track that is easily accessible to cyclists is also accessible to motorised two-wheelers. An effective street management strategy and vigilance on the part of the traffic police are need to ensure that cycle tracks remain free of encroachments.

Well-designed cycle tracks are continuous and shaded. Curb heights are appropriate, and storm water drains into catch pits located in the landscaped buffer. The cycle track is differentiated from the pedestrian path through a slight elevation difference with a beveled edge.

Appendix 2. Capital cost components

The following tables present the capital cost breakdowns for representative cycle sharing systems.

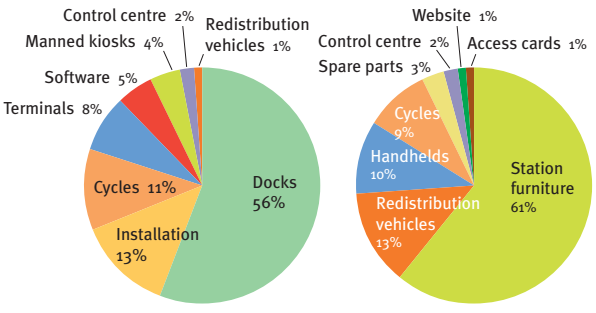
With fully automated cycle sharing systems yet to be implemented in India, cost projections must be estimated or derived from comparable settings. The first example, the estimated costing for a 2,450 cycle system in Ahmedabad, is based on cycle sharing systems in China, which offer a reasonable proxy for the costs likely to be seen in India. The second example is an estimate for Pune's cycle sharing system. The Pune system is semi-automated, so it has lower capital costs and higher operating costs than those estimated for Ahmedabad.

Estimated capital costs of a 2,450-cycle system in Ahmedabad

Item	Unit cost (INR)	Quantity	Total cost (INR)	Fraction of total cost (%)
Docks	31,000	3,430	10,57,81,000	56
Installation	1,68,000	145	2,44,12,000	13
Cycles	9,000	2,450	2,11,44,000	11
Terminals	1,14,000	130	1,48,57,000	8
Software	86,13,000	1	86,13,000	5
Stations (manned kiosks)	5,62,000	15	84,33,000	4
Control centre	32,26,000	1	32,26,000	2
Redistribution vehicles	8,00,000	2	16,00,000	1
Total			18,80,65,000	

Estimated capital costs of a 300-cycle system in Pune (Cycle Chalao 2012)

Infrastructure component	Total cost (INR)	Cost share (%)
Station furniture	10,000,000	61
Redistribution vehicles	2,100,000	13
User verification devices	1,562,500	10
Cycles	1,500,000	9
Spare parts	540,000	3
Control centre	300,000	2
Website	200,000	1
Access cards	125,000	1
Total	16,327,500	



Estimated cost components for a typical cycle sharing system in Ahmedabad (left) and Pune (right).

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To launch the National Public Bicycle Scheme (NPBS) and to build capacity for the implementation and operation of cycle sharing systems across the country, the first consultation meeting held last year. It received overwhelming support and commendation. The second consultation workshop was held in November 2012. After the first consultation meeting, the Ministry of Urban Development (MOUD) organised four subgroups to research different aspects of cycling sharing. As part of the NPBS, this toolkit was prepared for MOUD by a team from the Institute for Transportation and Development Policy (ITDP), an organisation that works with cities worldwide to bring about transport solutions that cut greenhouse gas emissions, reduce poverty, and improve the quality of urban life. The authors wish to thank the Chairperson and all the members of Subgroup 2 of the NPBS for their meaningful input and support.

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