

Public Bicycle Sharing System: A Modern Need to the City

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ABSTRACT

The main objective of this paper is to study the improving the accessibility of Bus rapid transit system and Metro train by providing public bicycle sharing system as a feeder system.

Rapid urbanization all over the globe has left the engineers with enormous challenges and opportunities in almost all areas of civil engineering. With urban population increased in India, though the level of urbanization is in the vicinity of 31.8%, due to the high population, the urban areas are becoming denser with population and issues like urban transportation are demanding more and more. This project identifies the issue of ease of access of mass transportation and the effort has been made to propose a solution. In order to solve the increasing frequencies of traffic jams in urban areas, it is desired that more and more people use public transportation modes like metro, local train like in Mumbai, buses and BRTS etc. BRTS is one of the new concepts in this area and in Gujarat a few cities have adopted the same. In order to encourage the citizens to use such facilities, it is required to increase accessibility of stations of the same. The study will help to improve accessibility of BRT System & Metro System... Public Bicycle Sharing system responds to the challenges of urban mobility as a healthy, efficient, and relatively inexpensive mean of transportation.

Keywords - Bicycle Sharing System, Feeder System, Accessibility, Public Transportation Modes

1. Introduction

Public Bicycle Share, also called 'Public-Use Bicycle' (PUBs), 'Bicycle Transit', 'Bike sharing' or 'Smart Bikes'. Bicycle-sharing schemes comprise of short-term urban bicycle rental schemes that enable bicycle to be picked up at any self-serve bicycle station and returned to any other bicycle station. This makes bicycle-sharing ideal for point-to-point trips. The principle of bicycle sharing is simple: individuals use bicycle on an 'as-needed' basis without the costs and responsibilities of bicycle ownership. There is distinction between bicycle sharing programs and bicycle rentals which is like that between car sharing programs and car rentals. Shared bicycles are intended for shorter periods of use and a larger number of daily users per bicycle than rentals. Moreover, fees for use are generally very low or use is free. But beyond these basic features, bicycle sharing schemes vary widely in nature. 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 1100 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.



Figure 1 Illustration on how to use a PBS system
Source: Center for green mobility

1.1. Users of Public Bicycle Sharing System

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 km), 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.

1.2. 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:

Table 1 Bicycle sharing vs bicycle renting

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, direct subsidies	Subscription Fee, User Fee

Source: "Consultancy services for developing guidance documents for transit oriented development (TOD), non-motorised transport (NMT) and public bicycle sharing (PBS)," may. 2016.

1.3. 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.

2. Bicycle

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.

3. Expanding sustainable transport through public bicycle sharing

As cities consider reframing their transportation network as a service that maximizes ease and efficiency for users, opportunities emerge for bikeshare to be seamlessly integrated into the larger transit system. While this may or may not translate into increased ridership, integration between transit and bikeshare would contribute to a better, more seamless transportation network. An April 2016 study conducted by the United States Bureau of Transportation Statistics found that 77% of all bikeshare stations in the US were located within one block of another public transit mode, thereby meaningfully extending the network. Bikeshare stations near bus stops were the most common transit connection; additional connectivity could be gained through on-board stop announcements that alert riders of nearby bikeshare connections, as has been implemented in Milwaukee's buses with connections to the city's BublR bikeshare.

Several cities, including Los Angeles, Mexico City, and Montreal, have had success implementing 'lite' transit integration, linking per trip and annual bikeshare membership payments with their existing transit cards through RFID. On the 'back end,' however, the user maintains two separate accounts—one for bikeshare and one for transit—each with its own payment system.

"Robust" transit integration, however, is characterized by the use of a single payment platform that enables users to access bikeshare and transit seamlessly. Bikeshare operators' concerns about liability complicate the issue, since the transit card would need to be linked to a credit card or bank account that would be charged if a bike is damaged or stolen. Robust transit integration would enable discounted transfers to and from bikeshare, as are commonly offered between bus and rail lines, offering an alternate transportation option to help mitigate the first-last-kilometre problem. While few systems offer robust transit integration, some are moving in that direction. For example, Pittsburgh launched a transit integration pilot program in October 2017 between its Healthy Ride bikeshare and the city's Port Authority, enabling ConnectCard users to access an unlimited number of free 15-minute bikeshare rides without setting up a separate Healthy Ride account. Transit card users are able to link their account to bikeshare by tapping their card at a Healthy Ride kiosk, and can then immediately rent a bike for free.

A key aspect of elevating bikeshare to a consistently-used transportation mode is encouraging regular bikeshare use among commuters. Several systems in the US and Canada, such as in Philadelphia, Phoenix, and Vancouver, offer discounted corporate rates for employers to offer bikeshare as a commuter benefit to employees. If offering a discounted corporate rate, the bikeshare implementing agency should encourage employers to provide indoor bike storage and showers and/or changing areas to further lower barriers to cycling to work.

Major challenges to integrating bikeshare with transit arise from a lack of funding and staff time to overhaul existing or implement new technology. Bilateral coordination between bikeshare operators and city and regional transit authorities, as well as other relevant agencies is recommended to help incorporate bikeshare operations into transportation decisionmaking in a more holistic, effective way. Further, cities should take advantage of

projected updates to their transit system's payment technology as an opportunity to create links with bikeshare payment options.

3.1. Bike share strengthens a long-term vision for cycling

Bikeshare can be a key component of transportation plans that include a long-term vision for cycling. Because bike share reduces some barriers to cycling, it can help quickly boost the number of cyclists on the road. This, in turn, can generate a political constituency that supports comprehensive infrastructure and other investments that ingrain bicycling into the transportation system. For example, in California, Santa Monica adopted a Bike Action Plan in 2011, which designated bike share as a high priority project toward the city's goal to reduce vehicle trips.¹²

San Diego, California citing a goal from its legally-binding climate action plan to increase the share of bike commuters from 2% to 6% by 2020 and to 18% by 2035, is reworking its bike share system to better serve commuters.¹³ The city relocated 15 stations, which had previously served mostly tourists along the beach, to neighbourhoods more connected to public transit and biking infrastructure. At the same time, the transportation department committed to build more bike lanes and pedestrian greenways in downtown San Diego.

Rosario, Argentina passed municipal ordinance 9030 in 2012, which established the city's public bike share system. Article 6 of the ordinance calls for "segregated cycle facilities" to connect bike share stations to one another and for these facilities to be built out as the system expands.¹⁴ While these lanes benefit bike share users, they can be used by all cyclists and contribute to a safer, more comfortable riding experience. As of 2017, Rosario has 120 km of protected bike paths compared to Washington, DC, which has roughly the same area and 138 km of protected lanes (only 14.5 km of which are on-street).

4. Conclusion

As a healthy and environment-friendly trip mode, public bicycle-sharing systems, which have so far been built in hundreds of cities around the world, have been developing rapidly recently. The public bicycle-sharing systems, which are usually spatially embedded where original urban bus transport networks are located, comprise the new urban public transport system together with the bus transport networks. Therefore, studying the impact of the public bicycle-sharing systems on the original urban public transport networks is an important research subject. The public bicycle-sharing systems can decrease the average trip time of passengers and increase the efficiency of an urban public transport network, as well as effectively improve the uneven level of traffic flow spatial distribution of an urban public transport network and will be helpful to smoothing the traffic flow and alleviating traffic congestion.

5 References

- i. Ahmadreza Faghih-Imani, N. e.-G. (2014). How land-use and urban form impact bicycle flows: evidence from the bicycle sharing system in Montreal . *Journal of Transport Geography*.
- ii. Ana Barberan, A. M. (2016). How did bicycle share increase in Vitoria-Gasteiz? . *Procedia CIRP Journal*, 312-319.
- iii. *Bicycle Share Plan for Pune City*. Pune: Parsanna Desai Architects. Retrieved September 4, 2018

- iv. Bimal Patel, S. B. (2017, April 12). Building regulations are a barrier to affordable housing in Indian cities: the case of Ahmedabad. *Policy and Practice*, pp. 12-16.
- v. Do people value bicycle sharing? A multilevel longitudinal analysis capturing the impact of bicycle sharing on residential sales in Montreal, Canada. (2016). *Transport Policy*.
- vi. Egils Ginters, Y. M. (2016). Intelligence Enhancing of Dual Use Bicycle Routes Designing and Planning System Simulator. *Procedia Computer Science Journal*, 525-529.
- vii. Eva Heinen, M. K. (2018). The public bicycle-sharing scheme in Brisbane, Australia: Evaluating the influence of its introduction on changes in time spent cycling amongst a middle- and older-age population. *Procedia CIRP Journal*.
- viii. Goel, R. (2018). Distance-decay functions of travel to work trips in India. *Data in Brief*, 50-58.
- ix. Hiroki Nakamura, N. A. (2014). Evaluation of the hybrid model of public bicycle-sharing operation and private bicycle parking management. *Transport Policy*, 31-41.
- x. India, M. o. (2012). *Public cycle sharing systems A planning toolkit for Indian cities*.
- xi. India, M. o. (2016). *CONSULTANCY SERVICES FOR DEVELOPING GUIDANCE DOCUMENTS FOR TRANSIT ORIENTED DEVELOPMENT (TOD), NON-MOTORISED TRANSPORT (NMT) AND PUBLIC BICYCLE SHARING (PBS)*. Guidance Document.
- xii. Inês Frade, A. R. (2014). Bicycle sharing systems demand . *Procedia Social and Behavioral Science Journal*, 518-527.
- xiii. iTrans, Prasanna Desai Architects, & Centre for Environment Education. (2017). *Bicycle Share Plan for Pune City*. Pune.
- xiv. Jose I. Castillo-Manzano, L. L.-V.-B. (2016). Going a long way on your bike comparing the distance for which public bicycle sharing system and private bicycles are used. *International Journal of Sustainable Transportation*, 95-105.
- xv. Markus Straub, C. R. (2018). Semi-Automated Location Planning for Urban Bike-Sharing Systems. *Transport Research Arena*.
- xvi. Megha Kumar, S. S. (2016). Informal public transport modes in India: A case study of five city regions. *IATSS Research*, 102-109.
- xvii. Megha Verma, T. R. (2016). The factors influencing bicycling in the Bangalore city. *Transportation Research Part A*, 29-40.
- xviii. Municipal Corporation, B. (2012). *Public Bike Sharing Scheme for Bhopal City*. Final Detailed Project Report, Bhopal.
- xix. Suzana R. Moro, A. C.-M. (2018). Barriers to bicycle sharing systems implementation: analysis of two unsuccessful PSS . *Procedia CIRP Journal*, 191-196.
- xx. Till Koglin, T. R. (2014). The marginalisation of bicycling in Modernist urban transport planning. *Journal of Transportation and Health*, 214-222.

- xxi. Usher, E. M. (2014). The Role of Bicycle-sharing in the City: Analysis of the Irish Experience. *International Journal of Sustainable Transportation* , 116-125.
- xxii. *Velib Metropole*. (2017). Retrieved November 10, 2018, from <https://www.velib-metropole.fr/en/service>
- xxiii. Xu-Hua Yang, Z. C.-Y.-J. (2018). The impact of a public bicycle-sharing system on urban public transport networks. *Transport Research*, 246-256.
- xxiv. Yanjie Ji, Y. F. (2016). Public bicycle as a feeder mode to rail transit in China: The role of gender, age, income, trip purpose, and bicycle theft experience. *International Journal of Sustainable Transportation*, 308-317.
- xxv. Yasuo Tomita, A. N. (2017). Demand and cost structure analyses on Japanese successful bicycle sharing system called “Ekirin-kun” to install cycle ports at railway stations . *Transportation Research Procedia*, 3412-3420.
- xxvi. Yi Wu, D. Z. (2017). Bicycle Sharing Based on PSS-EPR Coupling Model: Exemplified by Bicycle sharing in China. *Procedia CIRP Journal*, 423-428.
- xxvii. Zhili Liu, X. J. (2012). Solving the Last Mile Problem: Ensure the Success of Public Bicycle System in Beijing. *Procedia Social and Behavioral Science Journal*, 73-78.