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## **Bike Share: A Sustainable Addition to Urban Transportation**

Creating cities that promote sustainable lifestyles is a complex and far reaching process. One of the most important components of sustainability on an urban scale is the need for an efficient public transportation system, which provides enough convenience that, combined with walking, can be more desirable for residents to use over driving a car. Vehicular traffic congestion is one of the greatest challenges for cities around the world, as city planning departments continually reinvent forms of traffic management. One of the simplest solutions is to reduce the usage of automobiles in general. In the case of cities such as Boston a strong framework for public transportation already exists with buses, a subway system and commuter rails, yet there are still holes in this system, where it is rather difficult to access public transportation and, ironically, it is rather difficult to find parking for a personal vehicle as well. Consequently, establishing an additional transportation system would be extremely useful to the cities overall simplicity for non-drivers. With minimal costs and infrastructural changes, a bike-sharing program could provide a network for those short-distance trips that are just beyond efficient walking distances as well as link up with the existing transportation system. This idea has been successful in many cities, though the advancement of the system has not reached its full potential, as certain computerized technology is continually advancing and becoming more affordable. Bike sharing is not a part of common knowledge among urban dwellers, despite the fact that it provides solutions to many of the hassles of personal bike usage or walking in a city. The bike share network provides an opportunity for the reexamination of transportation and, consequently, the idea of the urban bus shelter. If the bicycle stations become icons within the

fabric of the city, with varying degrees of visual presence through design they will become an integral part of the urban fabric and daily life more quickly than if they appear to be just another bike rack.

Public Use Bicycles, as they have become known as, are extremely valuable components of an urban transportation system. First of all, they provide convenience. With the availability of a free bicycle to use, ready on demand, an immediate convenience is given for short trips, and at times of day with busy traffic, they could actually prove to be quicker modes of transport than a personal car, bus or even taxi. Bicycles are relatively affordable and cheap to maintain, but, nonetheless, theft and vandalism is often a problem even when they are locked resulting in the need for special storage. This situation is exasperated in places like Boston, with the prevalence of small, walk-up apartment units. Public use bicycles can actually reduce theft by providing an alternative for potential thieves<sup>1</sup>. The police department in Copenhagen, Denmark reported that most bike thefts are “convenience” thefts, in that the bike is used as transport and then abandoned at another location. After the implementation of a bike share program in Copenhagen, thefts actually dropped dramatically. Additionally, cycling provides obvious health benefits and benefit the community by reducing pollution and congestion further aiding in sustainable living.

### The Stages of Development of Public Use Bicycles

PUBs have gone through four ‘generations’ in the evolution of their implementation. The first, and most

Top: card reader and lock for Adshel

Below: Ashdel bike at station

Source: [www.communitybike.org/files/adshel](http://www.communitybike.org/files/adshel)

Bottom: First Generation PUBs in Minneapolis

Source: [members.aol.com/humorme81/demaio-paper.pdf](http://members.aol.com/humorme81/demaio-paper.pdf)

simple is simply supplying a city with donated bicycles, similarly marked for easy identification, and used and left on the street in various places, to be picked up by someone else. This was first tried in the 1960's in conjunction with a radical proposal discussing the future of urban lifestyles. The "White Bike Plan" for Amsterdam, which called for the removal of all motorized vehicles from the city center was proposed by Luud Shimmelpennik. He claimed that automobiles were stealing away the city from the pedestrian, removing social interaction from the setting<sup>2</sup>. While cars were not banned from the city, numerous bikes were donated, painted white, spread for public use. Nonetheless, abuse of the bikes and an inconsistency in returning them to the street resulted in a need for further design of the system<sup>3</sup>.

Second Generation PUBs integrate a coin operated locking system, similar to those used on grocery carts. This allowed the bikes' locations to be consistent, and the deposit reduced theft in that they could be locked. While a \$1-\$3 deposit was required to release the bike, it, obviously, did not equate to the cost of the bike<sup>4</sup>. The bikes used for PUBs began to be specially designed with more durability, so that less maintenance was required,



Bike lanes in Amsterdam are well maintained and separated from vehicular traffic.  
source: [www.communitybike.org/files/amsterdam](http://www.communitybike.org/files/amsterdam)

and with use of advertising on the bikes they began to generate revenue for running the system. Additionally, the bicycles have non-standard parts, heavy frames, and unusual design theft is greatly reduced. Adshel, an international advertising company, has created a bike share system that can be implemented in any city using all of the above methods to operate and maintain the system without charging for bike usage<sup>5</sup>.

Adshel pushed the second generation PUBs further with the integration of Smart Card technology, which allowed bicycle use by individuals to be tracked and recorded. This Third Generation system has been integrated into many of the bike sharing programs, as the Smart Card technology also allows fees to be charged to the users, whether those are for use, or stolen bicycles. In Adshel's Smart Card system, a GPS tracking device marks the bike in relation to the various stations and sends signals to a roving truck used to redistribute bikes as they become over full or empty<sup>6</sup>.

Finally, Fourth Generation PUBs are beginning to be implemented in cities such as Washington DC and its surrounding areas. The system was advanced to integrate the Smart Card with the Metro card that commuters use to ride buses, the subway and the commuter rails. Consequently, users can coordinate all of their commuting transit with a single card and, due to an optional contract agreement with users, the use patterns are able to be tracked in such a way that the network can be continually adapted to meet the needs of the community<sup>7</sup>. The city also provides many services that encourage personal bicycle use for commuting purposes. For instance, bicycle lockers at commuter stations and showers encourage even suburban residents to avoid automobile use sustainably linking themselves to the commuter rail lines and reducing environmental impacts. The Washington Metropolitan Area Transit Authority website also provides links to various organizations such as groups of riders in various

suburbs and commuter routine planners. A link also creates an itinerary to a destination using public transport, allowing one to prioritize minimal walking, number of interchanges, time and modes of transit<sup>8</sup>. This type of virtual infrastructure is a valuable component in the overall creation of linked communities with residents who choose to travel in a sustainable manner.

### A New Network

A network of a proposed bike share program within the Boston-Cambridge transportation system is currently being implemented on a trial scale at MIT, serving the community for short trips to local amenities such as Newbury Street shopping, Boston Common and Downtown Boston. Additionally it will link the east and west edges of campus, where public transportation is currently limited. The TechBike program, as it has been named, will use card reader technology designed by MIT students to be used by the MIT community<sup>9</sup>. This project is a study that could serve as a potential expansion of the MIT plan, if it were successful, that remains based around the arteries of Massachusetts Ave. and Main Street that run through campus, linking up the eastern and western edges of Cambridge with the rest of public transportation. Larger scale bicycle stations will be located at major bus and subway stations along this network between Central Square and the northern edges of Boston. With a capacity of 10 bicycles at each, they could be integrated with the structures currently needed at these transportation hubs and could expand as a need arises, due to the flexibility of the station components, which will be described later. In addition, neighborhood areas could have smaller scale units with two to four bicycles per station, so they would occupy minimal space on the smaller scale sidewalk spaces; however, distributed every few blocks, travel from residence to bicycle would be low. Consequently, this network, using city space and incorporating a large portion of Cambridge, could be a logical expansion to a

growing system at MIT, and the innovations used in this system, could then be expanded to more of Boston and Somerville.

### The Stations: Icons in Their Context

Much study and development has occurred in relation to the technology involved in the bike share program, and will continue to evolve. However, development of the way in which these systems make their mark in the urban context has not been pursued to its greatest potential. In order to project an image of interconnectedness and sustainable lifestyles it would be beneficial to design the stations for these bicycles in such a way that they are a physical part of the existing infrastructure, with flexibility to adapt to space and need at each site. It is for this reason that I have designed a “kit of parts” for bike station shelters that can also incorporate seating and protective elements, allowing them to serve as shelters as well. Due to limited space along existing urban thoroughfares and the need to integrate the bike network with existing transit elements such as bus stops, subway stops, commuter train stations, and parking garages, this kit will allow the stations to adapt to the requirements of its site, while still retaining an amount of uniformity that will contribute to a recognizability within the city and simplicity of assembly. This proposal begins to look at the system in terms of design establishing an idea base for further exploration in terms of technology and mechanics.

Let us begin this project’s presentation with the bicycle itself. The Adshel system and others have already incorporated design innovations that seem to be extremely beneficial to the system including GPS sensing in the bikes, electronic chips recording the duration the bikes are in use, Smart Cards for reserving bikes, advertising panels, leak-proof tires, durable and heavy frames, handlebars that are incorporated with a bag container for holding belongings and solid wheel frames. Assuming all of these



Above, behind: map of proposed Boston transportation network  
Below: section through bike station with all components

will be used in the system, I propose a new idea for bike security. If an immobilization mechanism was incorporated into the wheel frames, similar to tire boots on cars, the bike could be made stationary no matter where it was located. The basic idea consists of a pegged circular disk attached to the bike frame that interlocks with a slotted wheel frame. This system could be electronically activated by the overall Smart Card system. Due to the bike's weight, and its non-standard parts an immobile bike would be rather useless to steal.

The components of the bike station kit consist of bike stalls, bike covers, a bench, a canopy for shade and rain protection for people, and a wall that may further enclose the shelter, keeping out blowing snow or rain. The bike stalls themselves are simple spaces bound by low walls, which have sensor technology and a small computer incorporated in them. The Smart Card system is in each of the taller posts, with a small map of the various bike stations around the city, so that a user may reserve a spot at another station if he/she chooses. The immobilized bike sits between the sensor posts, which use similar technology as that of store security sensors. When the Card triggers the release of a reserved bike the sensors release the immobilizer discs on the bike, and allow the bike to be removed from the stall. If a bike is lifted from between the stalls without the triggering of the system, an alarm will sound and the wheel will not be unlocked. The stalls could come in groups of two, allowing for smaller stations in residential areas where the sidewalks are not as wide.

The posts of the bike stalls are formed in such a way that they can act as supports for a bench seat. The bench will be slotted, in order to allow some overlap in bicycle storage and seating, conserving space. Many bus stops do not contain a bench, so the bike station could bring an additional convenience to some of the smaller bus stops through this simple addition.

The next component is a bike locker device, which allows the bicycles to be sheltered from the weather and have additional security from vandalism and theft. These covers would be molded to curve over the bicycles, their form relating to the arc of the canopy structure. They would consist of a series of covers, which would lock into place when lowered. The locking device could use similar methods to those used in roller coaster shoulder guards, as they also hinge and lock into place without a connection to another surface. They would be unlocked using the SmartCard system as well.

In areas where bus shelters presently exist, a greater quantity of bikes could be stored if the existing shelter were removed to make room for a hybrid bike station and waiting shelter. The third component, a canopy, provides shelter from rain, snow and sun using a light system in a curved form that requires minimal vertical supports freeing more sidewalk space. Altering the orientation of the canopy and the bench in relation to the stalls, it can shelter bikes and people if there is no available space for the bike covers

Lastly, there is a wall component, which would be made of a prefabricated panel system similar to those used in existing bus stops. Folding around the bench, it can enclose the space below the canopy. This will shelter the waiting space in thunderstorms, wind, or blowing snow. The wall panels would have spaces for advertising, which could provide additional funds for maintaining the bike-sharing network.

The total of these components provides much variation and flexibility in the nature of the bicycle stations, while still providing a consistency that makes them easily locatable for use by the community. The stations, as with many iconic bus stops in cities, could be altered in terms of color and materiality in various sites, adding to their highly visible presence in the urban environment.

However, more practical infrastructural alterations must be made within the city in order to further encourage this as a viable mode of transport for the city. This includes the creation of a more continuous, integrated system of bike lanes and reduction of potholes and uneven sidewalks. One of the reasons cycling is such a viable option in cities such as Amsterdam is that the streets are zoned to accommodate various modes of traffic in a safe manner. Additionally, a virtual information infrastructure creating links between modes of transportation, a metro card that can be used for all modes, and a web-based format for managing transportation are valuable ways of encouraging bicycle transportation.

The network of the MIT Techbikes, due to its convenience and affordability promoted through simple, yet important infrastructural alterations will very likely expand to the scale of this proposal, and hopefully beyond. This will link much of Greater Boston, resulting in a bike share program that is a component as easily used as the subway, commuter rails or buses. The stations and their design dynamics will be valuable for making this system a well-known, usable system for the masses, highly functional and integral with the present infrastructure, yet playful in design, creating a recognizable image and attractive aesthetic quality within the city.

<sup>1</sup> DeMaio, Paul J. "Smart Bikes: Public Transportation for the 21<sup>st</sup> Century." Download at: [members.aol.com/humorme81/demaio-paper.pdf](http://members.aol.com/humorme81/demaio-paper.pdf)

<sup>2</sup> Simmelpennik, Luud. "The White Bike Plan." [http://www.communitybike.org/files/new\\_urbanism/](http://www.communitybike.org/files/new_urbanism/)

<sup>3</sup> Benedict, Jared. "Amsterdam White Bike Program and Bicycle Culture." [www.communitybike.org/files/amsterdam](http://www.communitybike.org/files/amsterdam). updated 06/07/2002.

<sup>4</sup> DeMaio, Paul J. "Smart Bikes: Public Transportation for the 21<sup>st</sup> Century." Download at: [members.aol.com/humorme81/demaio-paper.pdf](http://members.aol.com/humorme81/demaio-paper.pdf)

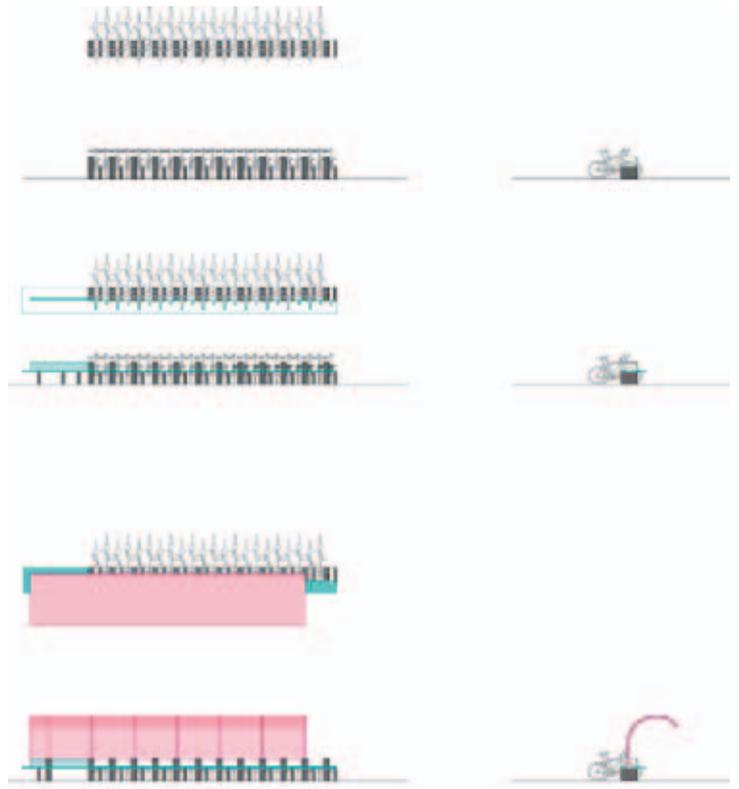
<sup>5</sup> Benedict, Jared. "Clear Channel Adshel SmartBike Program Overview." [www.communitybike.org/files/adshel](http://www.communitybike.org/files/adshel) updated 04/09/2002.

<sup>6</sup> Benedict, Jared. "Clear Channel Adshel SmartBike Program Overview." [www.communitybike.org/files/adshel](http://www.communitybike.org/files/adshel) updated 04/09/2002.

<sup>7</sup> DeMaio, Paul J. "Smart Bikes: Public Transportation for the 21<sup>st</sup> Century." Download at: [members.aol.com/humorme81/demaio-paper.pdf](http://members.aol.com/humorme81/demaio-paper.pdf)

<sup>8</sup> [www.MetroOpensDoors.com](http://www.MetroOpensDoors.com)

<sup>9</sup> Information about the program outline for Techbikes can be found at <http://web.mit.edu/dzshen/www/>



Right: bike station components  
Below: proposed station in context

