



DRAFT

Public Cycle Sharing System for Gandhinagar

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1. Introduction to cycle sharing

Cycle sharing is a public transport system in which people have access to cycles that can be used across a network of closely spaced stations. With a smart card or other form of identification, a user can check out a cycle from a station and return it to any other station.

The Gandhinagar Urban Development Authority (GUDA) is planning a public cycle sharing system with approximately 1,430 cycles and an initial coverage area of 21.8 square kilometres. Gandhinagar is a planned city, characterized by separated land uses with government facilities comprising the central sectors. Since most of the commercial activities and institutional land uses are concentrated in specific areas and given the lack of connectivity to other uses, the city sees a high level of dependence on personal motor vehicles for short trips. Cycle sharing will help address the connectivity gap, serving as an alternate means of mobility that links the residential, commercial and institutional sectors. It will help users get to work and finish daily errands in a quick and cost effective way. Cycle sharing also will complement public transport services, including intercity services provided by the Gujarat State Road Transport Corporation (GSRTC), the local the city bus system VTCOS, and the planned Janmarg bus rapid transit link from Ahmedabad.

In implementing the cycle sharing system, Gandhinagar will join over 500 cities in 49 countries¹ that are enjoying the benefits of cycle sharing. Some of the largest cycles 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 and encourage more people to use this non-polluting and healthy mode of transportation.

Gandhinagar is the capital of Gujarat state and has a population of 2,08,299.² The city's density is approximately 7,900 persons per sq km. Much of the city is organized on a 1.0 km by 0.7 km grid. A typical sector layout consists of convenience shops and community park in the centre surrounded by residences, including both government and private housing. On the whole, major land uses in Gandhinagar are spatially segregated, with separate areas for government offices (Sectors 10 and 11), regional shopping centres (Sectors 16 and 21) and institutions (Sectors 15, 16, and 23) (see Figure 1). The city has high population densities and predominantly residential uses in Sectors 2, 7, 13, 24, and 26. Gh and Ch are the busiest of Gandhinagar's arterial roads. Many public transport routes fall on these roads, which are also heavily used by commuters and residents. The city has a high proportion of green cover—approximately 54% of the city's land area.³

¹ Larsen, Janet. "Bike-Sharing Programs Hit the Streets in Over 500 Cities Worldwide," Plan B Updates, Earth Policy Institute, <http://www.earth-policy.org/plan_b_updates/2013/update112>. 25 Apr 2013. accessed 10 Jan 2013.

² <http://www.census2011.co.in/census/city/316-gandhinagar.html>

³ Kaushik, Himanshu, "With 54% green cover, Gandhinagar India's Tree Capital," Times of India, <http://articles.timesofindia.indiatimes.com/2012-07-22/developmental-issues/32788370_1_lakh-trees-social-forestry-greenest-cities>, 22 Jul 2012, accessed 10 Jan 2013.

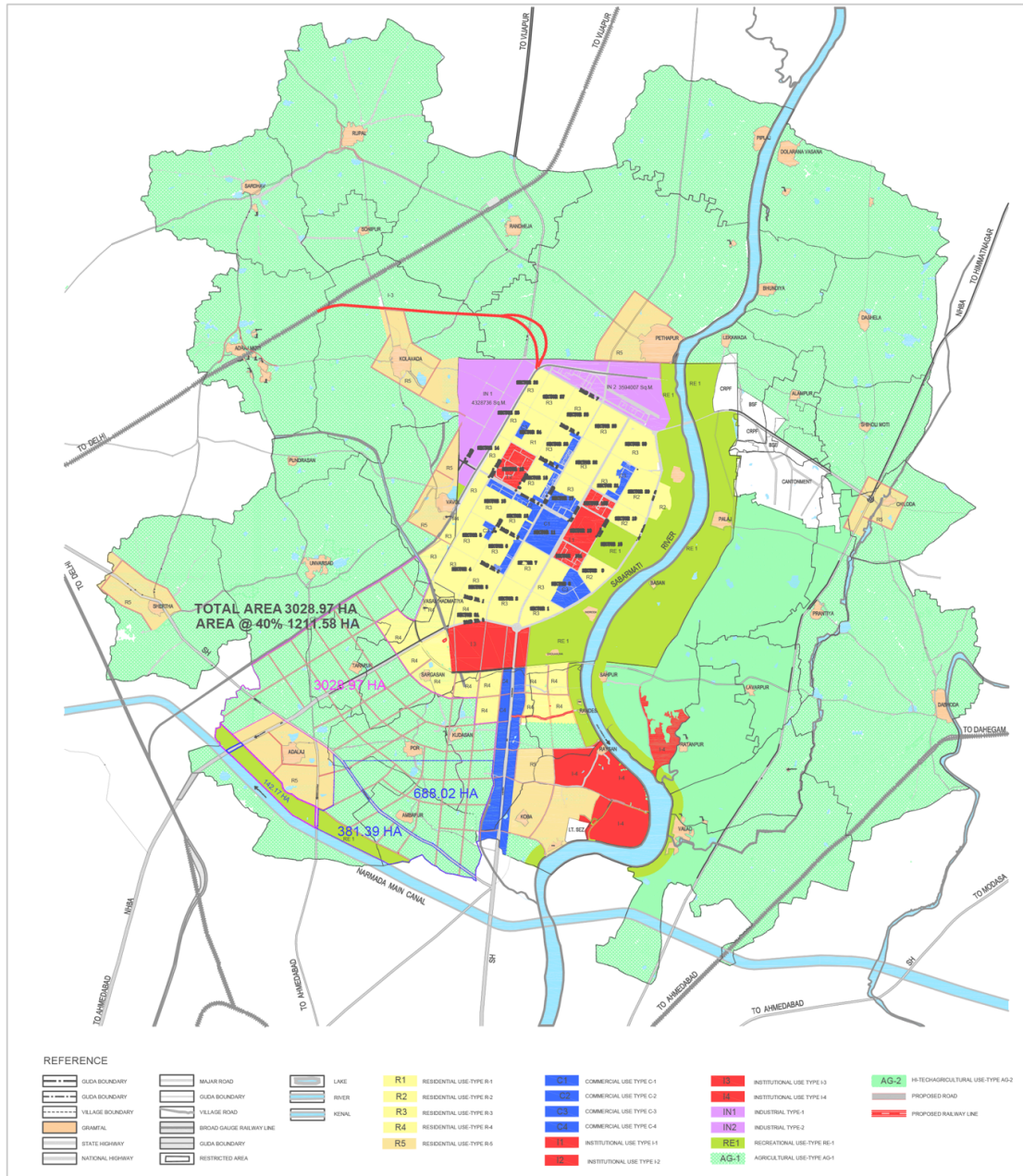


Figure 1. Some sectors in Gandhinagar are dominated by government (Sectors 10 and 11), institutional (Sectors 15, 16, and 23), or commercial uses (Sectors 16 and 21), while other sectors are primarily residential. (Source: GUDA)

2. Cycle sharing features at a glance

The Gandhinagar cycle sharing system will employ the following best practice features:

- A dense network of stations across the coverage area, with approximately 200 to 300 m between offices and residences and the nearest cycle sharing station.
- A fully automated locking system at stations that allows users to check cycles in or out without the need for staffing at the station.

- Radio frequency identification devices (RFIDs) to track where a cycle is picked up, where it is returned, and the identity of the user.
- Real-time monitoring of station occupancy rates through General Packet Radio Service (GPRS), used to guide the redistribution of cycles.
- Cycles with specially designed parts and sizes to discourage theft and sale as whole or for parts.
- Real-time user information provided through various platforms, including the web, mobile phones, and/or on-site terminals.
- Advertising space on cycles and at stations (provides revenue generation options for system operator or city).
- Pricing structures that incentivise short trips, helping to maximize the number of trips per cycle per day.

These characteristics are described in more detail in the sections below.



Figure 2. Modern cycle sharing systems feature a dense network of stations. A user checks out a cycle using an RFID-enabled smart card and can return it to any other station.

3. Project goals

The cycle sharing system in Gandhinagar will help the city achieve the following goals:

- Facilitate the use of the city's public transport system by expanding the reach of popular bus routes.

- Reduce congestion, improve air quality, and alleviate parking problems by attracting users from personal motor vehicles.
- Increase the mode share of cycling in Gandhinagar.
- Transform the image of cycling, making it a popular means of travel for the middle and upper classes.
- Promote the use of active transport, helping to improve public health.

The cycle sharing system will help improve access within and among sectors, providing seamless connectivity between homes, shops, workplaces, and other destinations. The system also will increase the catchment area of major GSRTC bus stops and terminals, easing the commutes of students and government employees who travel to Gandhinagar on a daily basis. Cycle sharing stations will be strategically placed to ensure physical connectivity and fill in the gaps where public transport is missing. Cycle sharing will be faster, cheaper, and more flexible than existing feeder modes, particularly auto rickshaws. Cycles will be available on demand, so users will not need to wait for a bus or rickshaw to appear. Cycle sharing will be less expensive: most feeder trips will be accomplished within a 30-minute time span for which there is no user fee.

4. Target user groups

The cycle sharing system will target a different user group from those who currently own cycles or rent them on a daily basis. The target user will be the commuter who uses public transport, auto rickshaws, or walks long distances to complete some portion of his or her trip. The user will tend to have a higher income than typical cyclists in Gandhinagar, and she/he will place a premium on the quality of the system: the ease of use, the level of upkeep of the cycles and stations, and seamless integration with other modes. Key user groups include:

- College students who do not own vehicles and for whom cycle sharing provides connectivity from campuses such as the National Institute of Fashion Technology (NIFT), the Bhaskaracharya Institute for Space Applications and Geo-Informatics (BISAG), the National Institute for Cooperative Management (NICM) and the National Institute Of Design (NID) to nearby shopping areas and residential areas such as Sectors 2 and 3.
- Commuters who travel from Ahmedabad to the Udyog Bhavan, Sachivalaya, and other offices using GSRTC buses and jeeps. The cycle sharing system will serve as a feeder service to GSRTC bus stops and terminals.
- Local residents who commute to government offices and institutions in Sectors 11 and 10.
- Young employees who travel to work at the Infocity campus and other institutions.
- Daily commuters and home makers who use cycling for midday errands to Sectors 7, 21, and 24 and the Infocity commercial complex.

5. Cycle sharing components

5.1 Cycles

The cycles in a cycle sharing system see heavy use—upwards of five rides per cycle per day in a successful system. Therefore, it is essential to procure a durable cycle that requires minimal

maintenance despite frequent use. In addition, the cycle should be attractive and easy to use. The following design standards should be followed:

- Universal design: usable by all, regardless of gender or clothing.
- Convenience: a front basket for carrying a small bag or briefcase and mudguards to protect clothing.
- Protection against theft and vandalism: unique parts, enclosed wiring, RFID tags that allow the system to connect the cycle to the user.
- Safety: reflectors, automatic LED lights for night riding.
- Distinctive styling: should project a modern image.
- Longevity: solid frame and puncture resistant tyres.



Figure 3. A unique, robust cycle design is critical the branding and reliability of the system. The cycle should be a unisex model with an adjustable seat.



Figure 4. Special parts help deter theft and vandalism.

5.2 Stations

The station design is a function of the level of demand, the amount of space available, and the nature of the roadside environment. Decisions regarding station design also need to take into account the impact on the city's image. All stations need to accommodate a fully automated smart card check-in and check-out. IT-based management of cycles and users is critical to the delivery of modern cycle sharing systems. It also allows a user to check out a cycle without interacting with an attendant, thus decreasing the time required to take out or return a cycle and limiting the possibility of a station being off-line because an attendant is not present. While fully automated stations may represent higher capital costs, they will reduce operating costs because they do not need to be manned at all times.

There are two general station typologies that will be employed in the system:

- Stand-alone docking terminals: these stations are comprised of separate docks for each cycle. The size of stations with docking terminals will depend on the level of demand, ranging from small stations with 15 docks to large stations with 60 docks. Moreover, the station sizes are adjusted depending on the demand once the system is operational. Overall, the system provides 50 per cent more docks than bicycles in order to prevent stations from becoming fully saturated with bicycles. A user checks out a cycle by tapping his/her smart card on the dock, which automatically releases the cycle.
- Bicycle parking areas: for larger stations or special events, bicycles can be stored inside secured parking areas. Passengers take bicycles through a smart-card enabled turnstile or are check out by attendants with handheld devices.



Figure 5. Station typologies: docking terminals (left) and parking area (right).



Figure 6. A typical cycle sharing station includes docking positions, a user terminal, and space for advertising.

Stations will be placed at frequent intervals, with a distance of 200-300 m between stations. Close station spacing will help make cycle sharing competitive with other modes and will reduce the distance that a user has to walk to the next station, should s/he find a station either completely full or completely empty.

Stations will be placed near important origins and destinations, including:

- Public transport hubs
- Government offices
- Libraries
- Markets (e.g. Sectors 7, 21, and 24)
- Sector and district shopping areas (Sectors 7, 12, 16, 17, and 24)
- Major commercial complexes
- Colleges
- Strategic positions in residential areas

In the absence of a single important building, stations will be placed at existing nodal points, important public spaces, and near intersections to serve origins and destinations in multiple directions.



Figure 7. Station locations: GSRTC Central Bus Stand (left) and government offices (right).



Figure 8. Station locations: cultural landmarks (left) and community gardens (right).



Figure 9. Station locations: shopping areas (left) and educational institutions (right).

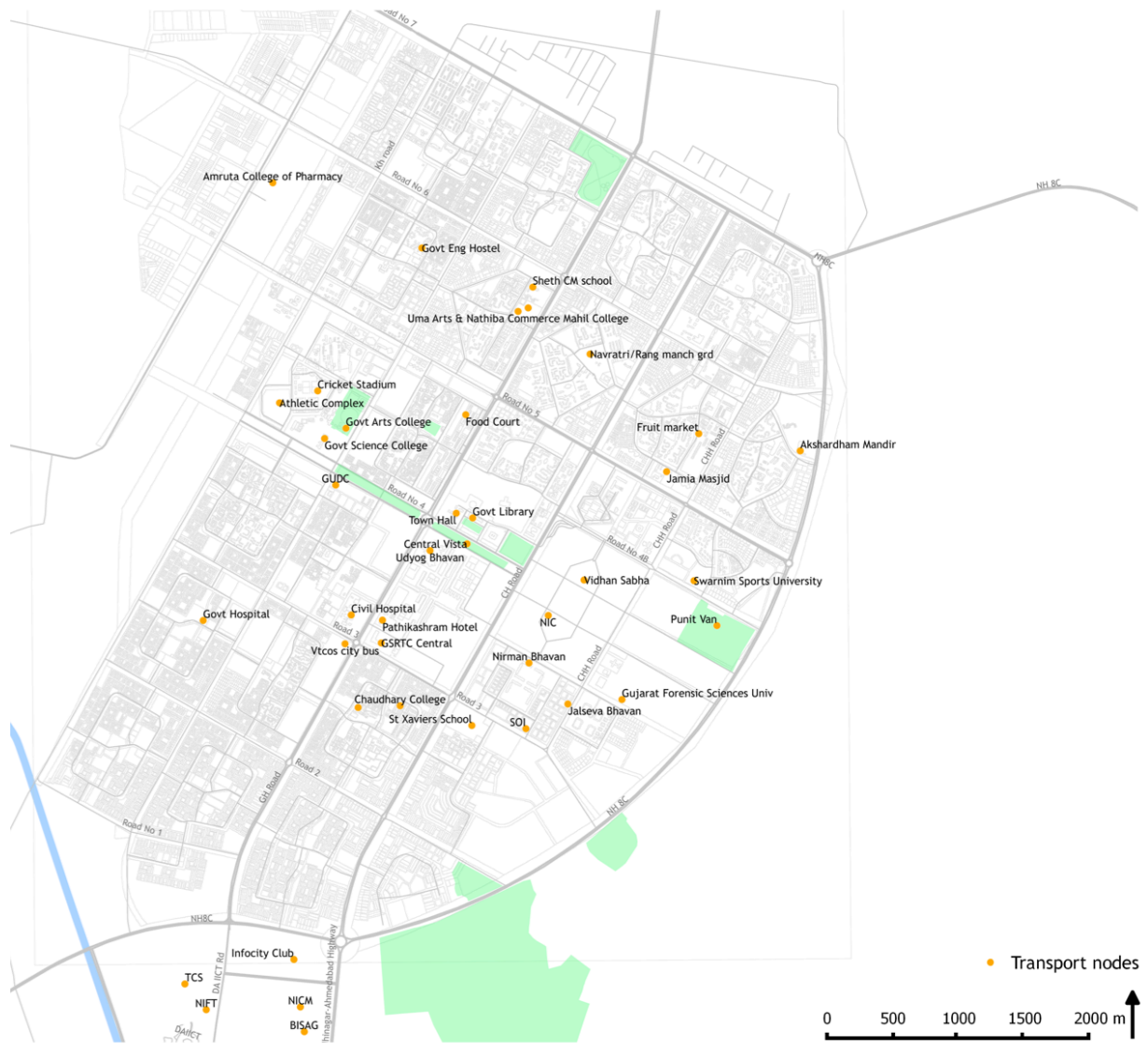


Figure 10. Key destinations and transport nodes in Gandhinagar that will be connected through the cycle sharing system.

The specific siting of stations will be determined on a case-by-case basis. Typical placement options include the following:

- On-street parking spaces
- Vacant space in roadside landscaping strips
- Land adjacent to bus terminals
- Areas around public spaces, commercial areas
- Cultural landmarks such as temples and mosques
- Recreational spaces such as community garden, regional parks, athletic complexes, and Rangmanch
- Within the premises of private properties such as info city

- Inside government campuses, such the Udyog Bhavan, the Old Secretariat, and the Vidhan Sabha

In most cases, stations will be located on streets, plazas, parking areas, and other public land owned by the Roads and Buildings Department, Government of Gujarat. However, some stations are planned for private premises such as the Infocity Supermall commercial complex to ensure that the stations are easily accessible to the users of these facilities. In these cases, GUDA will need to negotiate with the respective landowners to obtain permission for the placement of these stations.



Figure 11. A cycle sharing station can fit in a 2 m wide parking lane.

5.3 User interface

Customer service platforms will collect and disseminate information from and to the user through various media, including the web, mobile phones, terminals, and face-to-face interaction. They allow customers to set up accounts and receive information about the system and their account. 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, hi-tech image. While the majority of 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. “Brick and mortar” kiosks offer the same benefits of the online system to users who do not have access to technology. An optimal location for the customer service centre is the GSRTC Central Bus Stand.

Users who want to access the cycle sharing system will be required to complete the registration online or fill out a membership form at the customer service kiosk. Along with a registration form, the prospective user will be required to submit identification proof and pay a registration fee. Besides the registration fee, around Rs 50 shall be paid towards the user’s opening balance to cover initial user fees. Once the registration is completed, the cycle sharing operator will carry out a background check to verify the information submitted. The operator will mail a smart card within 24 hours to the address listed on the identification document submitted by the user. Upon receipt of the card, the user may begin using the system.

6. Operations

6.1 Security mechanisms

Cycle sharing systems ensure security by tracking the identity of both users and cycles. On the user side, the system obtains identification details during the registration process (see Section 5.3) and the user is issued a smart card with an RFID chip linked to the user's account. RFID chips are also present on the cycles. When a user checks out a cycle using a smart card, the identity of the user is linked that of the cycle that s/he checks out. If the cycle is not returned within a specified time period, say 24 hours, the user's balance is forfeited and his/her smart card is deactivated. In addition, the user will be barred from registering for the system again.

The system can also accommodate daily or weekly subscriptions by walk-up users who pay by credit or debit card. In this case, the system places a hold on the user's credit card account for the duration of the subscription. If the user is in good standing, the hold is removed at the end of the subscription. However, if a cycle is not returned then the hold remains on the user's account.

6.2 Redistribution and maintenance

Redistribution is broadly defined as the rebalancing of bicycles from stations that are near or at capacity to stations that are nearly empty. The operator will be responsible for redistributing bicycles during peak periods to ensure that bicycles remain available at all stations and that some docking positions remain open at each station. Redistribution is one of the greatest challenges to operating the cycle sharing system, and accounts for a large portion of operating costs. Redistribution is expected to be particularly critical in Gandhinagar given the city's separated land uses and unbalanced directional flows during peak hours.

The cycle sharing system will be operated on a day-to-day basis by a private sector contractor appointed by GUDA (see Institutional Structure, below). The private operator will have several responsibilities, including redistribution, maintenance, and customer service. For an experienced operator, redistribution becomes predictive, and is better thought of as the rebalancing of cycles to stations where the operator expects a shortage to occur. The RFID devices on the cycles allow the operator to record all of the trips that are made with the system. After a short period of operation, the IT system generates a full record of the trip patterns and station occupancies. This information can be used to guide the redistribution process. Many operators use logistics software to assign routes and schedules to redistribution crews.

Regular preventative maintenance is necessary to keep the cycles in good working condition. Cycle redistribution vehicle maintenance teams will be responsible for carrying out minor repairs onsite and notifying redistribution teams to collect major repairs that need to be completed at the depot. In addition to cycle maintenance, maintenance teams need to have basic knowledge of fixing minor problems at docking stations and terminals. Station and cycle cleanliness is an important aspect of the image of the system. Cycle maintenance teams should wipe down all cycles at least once a week. They should also clean the station area. GUDA will set service level standards to ensure that redistribution and maintenance activities are carried out diligently (see Section 7, below).

7. Institutional structure and business model

The Gandhinagar cycle sharing system will be structured as a public-private partnership in which GUDA carries out planning and oversight activities and the private sector handles day-to-day operations. The following table indicates the respective roles of the government and the private sector.

Table 1. Respective responsibilities of the government and the private operator

Government	Private operator
<ul style="list-style-type: none"> • System planning and implementation • Cover system costs • Provide space for stations and control centre • Set service level benchmarks • Monitor the operator’s performance • Collect fares and revenues • Market and conduct outreach 	<ul style="list-style-type: none"> • Install and operate the hardware and IT systems • Maintenance of cycles and stations • Redistribute cycles among stations to maintain optimum numbers of cycles and empty docks • Provide customer service • Operate the control centre • Provide system information on a real-time basis

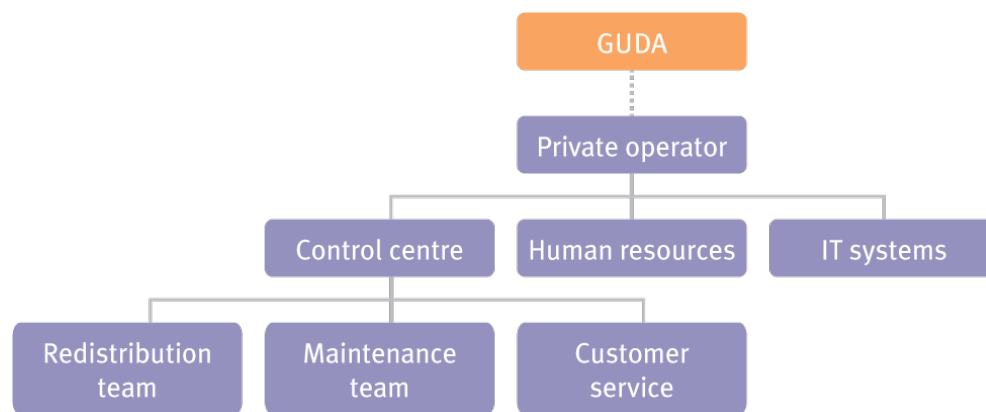


Figure 12. Management structure for the Gandhinagar cycle sharing system

Under the proposed structure, the private operator will build and operate the cycle sharing system. All revenues to the system will accrue to GUDA, which will in turn pay the operator for the services provided.

Costs to the operator will include the upfront capital investment to buy and install the hardware and IT systems as well as on-going costs once the system is operational. The cycle sharing operator will be paid a monthly fee based on the number of cycles in operation. Beyond a base payment, the operator will receive an incentive payment that will increase with system usage (i.e., the number of rides per cycle per day). At the same time, penalties will be applied if system performance falls below service levels stipulated in the operator’s contract. Categories of service level standards include the following:

- How many hours per day a station can remain completely full or empty
- How long a damaged cycle can stay in the system before being fixed or taken to a depot
- The fraction of the total fleet that can remain in repair facilities at any particular time
- How often cleaning of cycles and stations should be performed

- How often a terminal can remain out of service

These standards need to be measurable and will be spelled out in detail in the operator contract. The contract will require the operator to deliver the service level statistics to GUDA on a real-time basis to enable GUDA to monitor the operator's performance. Compensation will be calculated based on these operational data.

8. Outreach

Marketing of the Gandhinagar cycle sharing system will begin well before the system is operational and carry on through the life of the system. Initial marketing efforts include promoting the system name, 'tag line,' and logo. A user doesn't take a cycle—s/he takes "Velib" (Paris) or "Bicing" (Barcelona). A trendy name and logo will be established for the system. Due to cultural barriers, women are mostly prevented from taking cycles, thus it is important to actively encourage them to use the system and generate awareness through media / social campaigns at schools, colleges/universities covering on what works best in cycle sharing system, the healthy lifestyle and safety of women.

The early marketing efforts will focus on information:

- What is cycle sharing?
- The process of checking out a bicycle
- How to register for the system
- Station locations
- Hours of operation
- The pricing system
- Phone numbers and websites for obtaining more information

The marketing campaign needs to put forth that a cycle sharing system is a trendy, health and environmentally friendly, more efficient alternative to their crowded buses, uncooperative auto rickshaw drivers, or long walks. GUDA will bring in celebrities and prominent citizens to project a positive image. The system will be promoted through give-aways and promotional events prior to the launch. GUDA will retain a professional public relations firm to handle these events. Even after the launch, an on-going campaign will communicate with existing and potential customers and public at large through newspapers, a website, blogs, and smart phone apps, advertisements on cycle sharing stations and bus stops, and other collateral.

Moreover, GUDA and the cycle sharing operator can pursue other initiatives such as involving the health and recreational clubs to actively promote the use of the system by their members. In addition, GUDA can tie up with major hotels in Gandhinagar to facilitate cycle sharing services for visitors.

9. Project Planning and Phasing

The delineation of a coherent coverage area and the saturation of the coverage area with stations at frequent intervals are critical to the success of the Gandhinagar cycle sharing system. From the day operations begin, the coverage area needs to be sufficiently large to cover a robust set of origins and destinations. It also needs to enhance the city's public transport system in a meaningful way.

9.1 System phasing

The cycle sharing system in Gandhinagar has been categorized into two phases where GUDA has selected a Phase 1 coverage area of 21.8 km. This initial coverage area links residential sectors with the central government complex and city centre. In Phase 2, the system can be extended to further south covering GIFT City, and important institutions such as Petroleum University, National Law University and Institute of Seismological Research, and residential areas along the Gandhinagar-Ahmedabad Road.

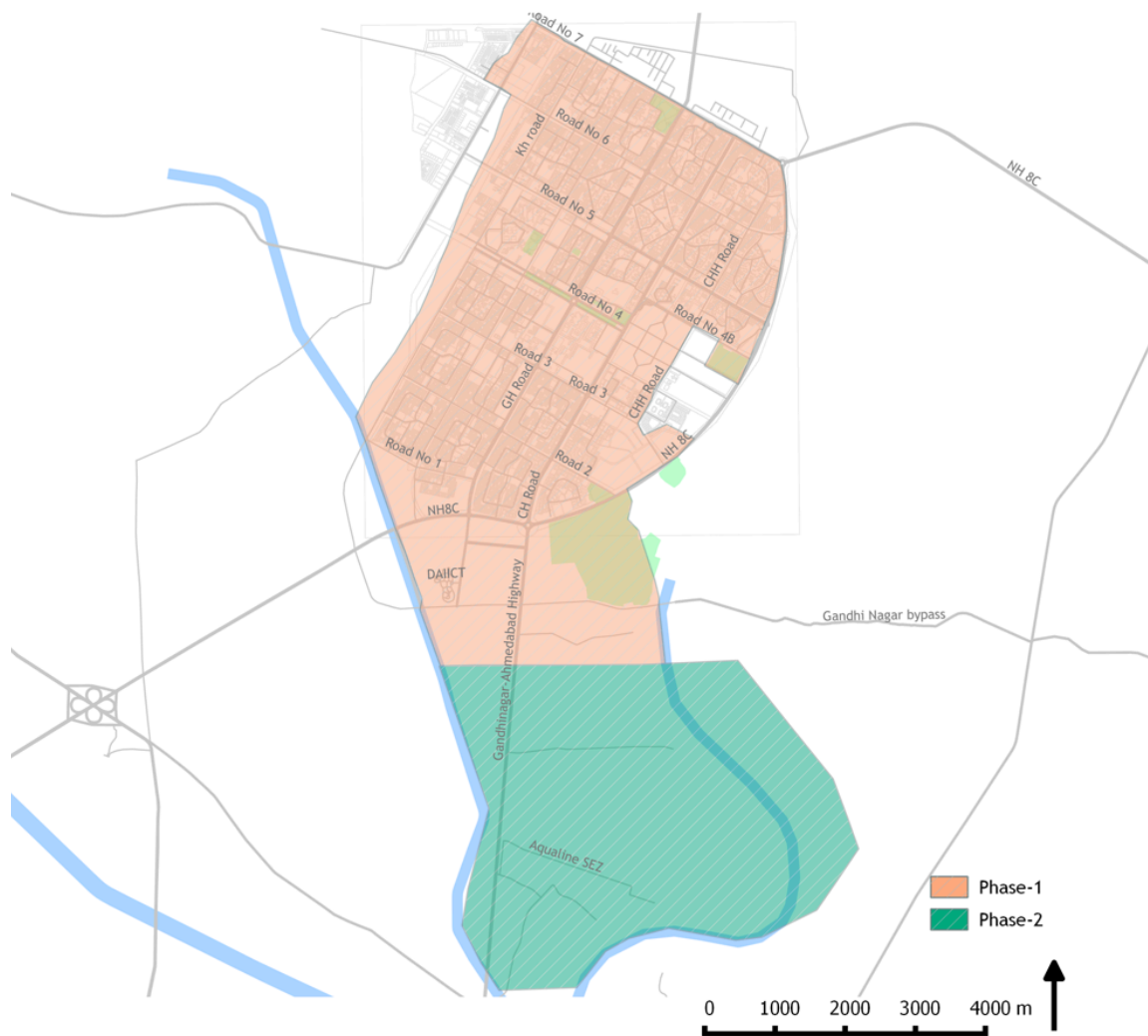


Figure 13. Phasing of the Gandhinagar cycle sharing system. Phase 1 will be implemented in the main built-up areas of Gandhinagar. In Phase 2, the system can be expanded to the emerging residential and institutional areas to the south as well as GIFT city.

9.2 Station identification

The planning team visited the proposed coverage area and identified optimum station locations near the following landmarks:

- Central government complex

- Public spaces
- Community gardens
- Colleges and universities
- Markets and commercial/shopping areas

Stations were located so as to cover all major residential, commercial, and institutional areas in central Gandhinagar. Some sectors have a large quantity of abandoned residential buildings, open space that is not in active use, or lower density residential areas that are unlikely to generate meaningful demand for the cycle sharing system. Such locations were excluded from the coverage area (see Figure 14).

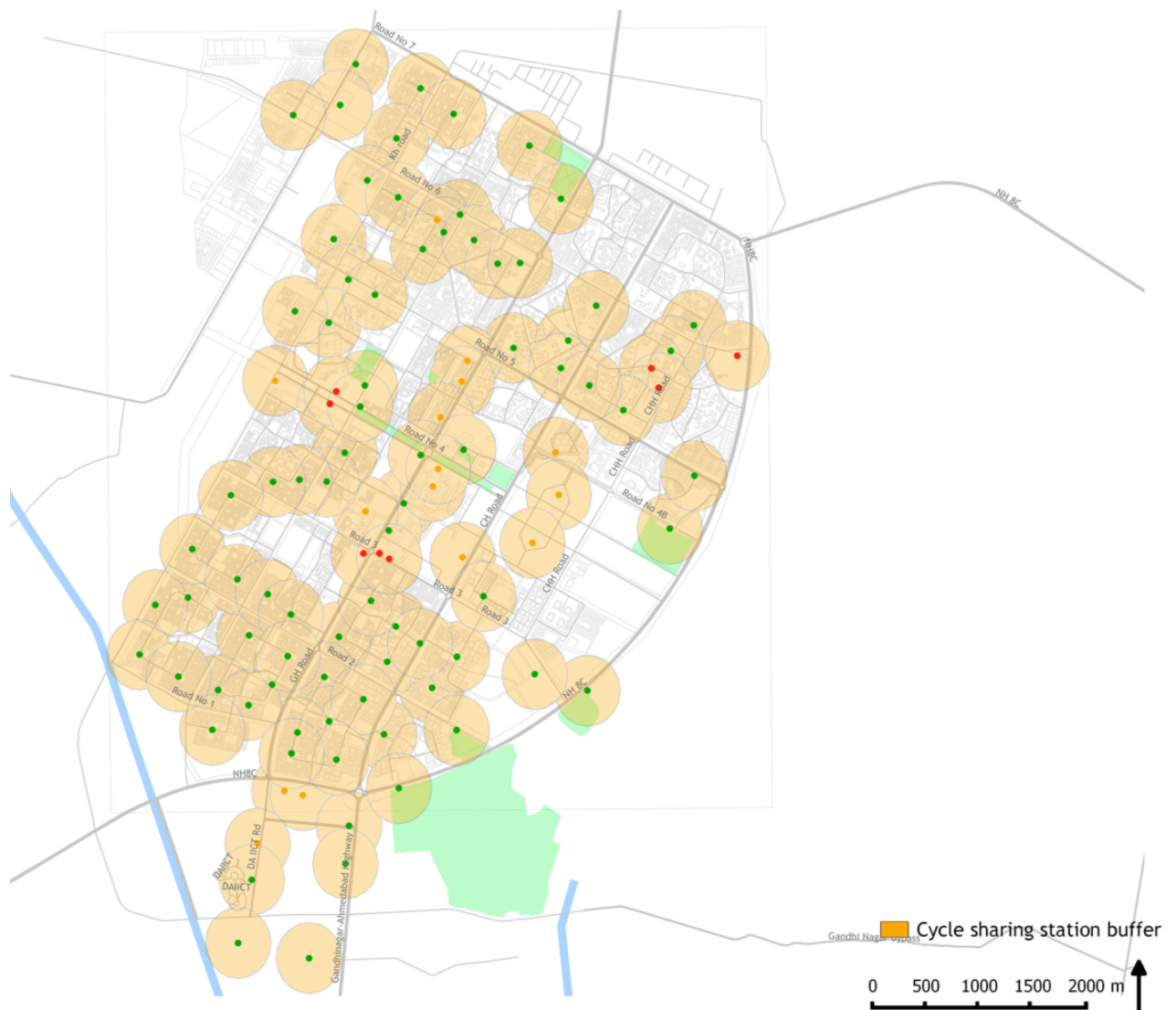


Figure 14. The cycle sharing coverage area, shown as a 300 m radius around each station.



Figure 15. Phase 1 station locations of Gandhinagar cycle sharing system (small = 15 docks, medium = 30 docks, large = 60 docks).

9.2.1 Phase 1 system parameters

Parameters for the Phase 1 system are presented in Table 2.

Table 2. Phase 1 system parameters

Coverage area (sq km)		21.8
Number of stations	Small (15 docks)	79
	Medium (30 docks)	16
	Large (60 docks or parking area)	8
	Total	103
Number of cycles		1,430

9.2.2 Pricing structure

This section presents a possible pricing structure for the Gandhinagar cycle sharing system. The annual subscription rate should be set at a rate that is high enough to discourage theft of cycles but low enough to encourage broad uptake within the study area. The daily subscription rate would be offered at a lower price for the first month of operations in order to encourage new users to try out the system. The usage rates should be calibrated so that the cycle sharing system remains competitive with other modes in Gandhinagar.

Table 3. Proposed subscription rates

Subscription type	Rate (Rs)
Daily subscription	30
Monthly subscription	300
Annual subscription	800

The objective of the user fee structure is to incentivise short trips. This increases the number of times that each cycle in the system can be used. Trips with duration less than 30 minutes are not charged.

Table 4. Proposed usage fees

Time period	Usage fee (Rs)
First 30 minutes	free
30-59 minutes	5
60-119 minutes	10
each additional hour	15

9.3 Ridership scenarios

Some initial estimates of the number of potential subscribers and daily users were prepared using the following demographic data:

- Population density in Gandhinagar: 7,939 persons per sq km⁴
- Study area size: 21.8 sq km
- Trip generation rate: 0.92 motorised trips per day⁵

Table 5 indicates the subscriber base as a fraction of the population residing in the study area (21.8 sq km study area * 7,939 persons / sq km = 173,000 persons). It also estimates the number of trips per day assuming that each subscriber makes 0.92 trips on the cycle sharing system. These trips include users of personal motor vehicles who switch to cycle sharing as well as public transport customers who begin using cycle sharing as a feeder mode.

Table 5. Subscription and ridership scenarios

Uptake rate (% of population residing in the coverage area)	Number of subscribers	Number of trips	Number of trips per cycle per day
2% of 173,100	3,500	3,200	2.2
4% of 173,100	6,900	6,400	4.5
6% of 173,100	13,800	12,700	8.9

9.4 Financial analysis

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 advertising, sponsorships, and on-street parking fees. Capital cost, operating cost, and revenue components are summarised in Table 6.

Table 6. Cycle sharing cost components

Capital costs	Operating costs	Revenue streams
<ul style="list-style-type: none"> • Stations • Bicycles • IT equipment • Software • Redistribution vehicles • Control centre • Website 	<ul style="list-style-type: none"> • Maintenance • Stations • Bicycles: cleaning + repair • IT: software + web • Docks • Administration: supervisors, managers, call centre, 	<ul style="list-style-type: none"> • Subscriptions (annual and temporary) • Advertising • System sponsorship

⁴ GUDA.

⁵ Ahmedabad Municipal Corporation, Comprehensive Mobility Plan and Bus Rapid Transit System Plan, Phase 2, March 2008. The trip rate from Ahmedabad is used as a proxy because local data were not available for Gandhinagar.

- membership process
- Redistribution of Bicycles:
diesel + vehicle repair

The following cost estimates have been prepared taking into account costs observed in high quality cycle sharing systems in Asian peer cities as well as costs that have been quoted by prospective operators in the context of Indian cycle sharing project proposals.

Table 7. Capital cost

Capital costs (crore Rs)	
Aggregate capital cost @ Rs 100,000 per cycle	14.30

Table 8. Annual operating cost

Operating cost (crore Rs)	
Aggregate operating costs @ Rs 10,000 per cycle per year	1.43

Table 9. Annual earnings

Source	Earnings (crore Rs)
Annual subscriptions: 6,900 @ Rs 800 per subscription per year	0.55
Advertising: 24 stations @ Rs 60,000 per station per year - (medium, large)	0.14
Total	0.69

As per the proposed contracting structure (see Section 7, above), GUDA will receive all system revenues, including subscription fees, usage fees, and advertising revenue. GUDA in turn will compensate the cycle sharing operator on a monthly basis for the services performed, subject to penalties associated with the stipulated service levels. Taking into account the capital costs plus five years of operations, total payment to the operator will amount to around Rs 4.5 crore per year from years 2 to 6 (after a mobilisation period during the first year).

Subscriptions are estimated to account for the bulk of system revenues. User fees are not expected to be a significant revenue source because most trips will be under 30 minutes—the period for which there is no charge. Another potential source of revenue is advertising on large and medium sized stations, which are likely to be in highly visible locations. In addition to the revenue sources outlined above, GUDA can allocate an annual reserved fund in the budget to cover the operating shortfall. This supplementary funding can be generated through other sources, such as fees for on-street parking.

9.5 Implementation timeline

The proposed timeline for the rollout of Phase 1 is presented below. The total timeframe required for the implementation of the system is about 9 months.

Table 10. Implementation timeline for Phase-1

Month	1	2	3	4	5	6	7	8	9
Demarcation of station locations	Active								
Supply of cycles, stations, terminals, and software		Active	Active	Active	Active	Active	Active	Active	
Installation of stations			Active	Active	Active	Active	Active	Active	
Start-up, testing, and roll-out				Active	Active	Active	Active	Active	Active
Marketing and outreach				Active	Active	Active	Active	Active	Active