THE PEOPLE’S WAY: ASSESSING JANMARG BRT FOR INCLUSIVE DESIGN

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SUMMARY

In the last ten years, bus rapid transit (BRT) systems have been widely recognized by planners and transport specialists as a viable mass transport alternative for a rapidly urbanizing India. BRT is a high-quality customer-oriented public transport system that delivers fast, comfortable, and low-cost urban mobility. Currently BRT systems are operational in 3 Indian cities: Delhi, Pune and Ahmedabad. Janmarg, Ahmedabad’s BRT system, is the first in India to have level boarding from median stations and off-board ticketing. Janmarg represents a significant improvement over Ahmedabad Municipal Transport Service (AMTS), the city’s public bus service, in terms of access, passenger comfort, and reliability.

Janmarg has incorporated key facilities such as level boarding, access ramps, and auditory and visual announcements to meet the needs of seniors and transport customers with disabilities, yet our study indicates that the system is not as widely used by these groups. One reason that more seniors and people with disabilities do not use Janmarg is because reaching the stations is extremely difficult. Most streets lack footpaths. Where present, they are narrow, intermittent and often blocked by built obstructions such as electric poles and transformers, as well as temporary obstructions such as parked vehicles and vendors. Many users with disabilities acknowledge that Janmarg is an improvement over AMTS but are not able to take advantage of a superior service because it is not available close to their homes and destinations.

The authors feel that accessibility to BRT can be vastly improved if easy and safe pedestrian connections to surrounding neighbourhoods and destinations such as schools, temples, hospitals, and other civic amenities are made integral to the design and implementation of BRT systems. Expanding the BRT network and operating feeder connections to BRT trunk line will also make the system more accessible to everyone, especially senior and people with disabilities.

KEY WORDS

BRT, Accessibility, Ahmedabad, Pedestrian Infrastructure
PURPOSE OF THE STUDY

People with disabilities have traditionally been excluded from public life and public services, such as transportation. Through the turbulent social movements of the 1960s and 1970s, disability civil rights emerged in the developed countries of the United States and the United Kingdom to challenge the notions of inclusion and human capabilities. Access to public transport was an important demand of those nascent disability movements. While countries were beginning to work on fully recognizing the rights of people with disabilities, improvements in bus systems were being implemented that would shift the paradigm of mass transit.

In developing cities prior to 1972, buses plied shared roadways with mixed traffic. Starting in Curitiba, Brazil, a new manner for buses to traverse the city was envisioned. Curitiba’s architect cum Mayor, Jamie Lerner, implemented an above ground subway system that was run using buses instead of rail. Key aspects of Lerner’s designed system include dedicated right of way for buses so that they were not slowed by other vehicle traffic and bus station entrances that were restricted to passengers who had paid their fare.

This new system moved a much larger number of passengers than traditional bus service and was implemented at a fraction of the cost (and construction schedule) of typical metros. Bus rapid transit (BRT) became so effective in Curitiba’s fight against congestion and sprawl that the city was recognized by the United Nations as one of “the most innovative cities in the world” [http://www.embarq.org/en/city/curitiba-brazil, 2012 ].

BRT systems offer a high-quality, customer-oriented public transport that delivers fast, comfortable, and low-cost urban mobility. The success of BRT is related to the implementation of a comprehensive package of physical infrastructure and operational systems that together provide a high level of customer service. The package includes the following:

- Dedicated lanes for the exclusive use of BRT buses,
- Level boarding to ensure that passengers can get in and out of a bus without having to climb steps,
- Specially designed high quality buses with wide doors,
- Off-board fare collection,
- Enhanced intelligent transportation systems (ITS) including automatic vehicle tracking system, and
- Service level agreements that stipulate penalties for poor performance.

Cities throughout the world, especially in developing countries, have taken to this example of low cost public transportation. Bogota, Columbia; Mexico City, Mexico; Quito, Ecuador; Jakarta, Indonesia; and Johannesburg, South Africa have all developed extensive BRT systems. Bogota’s TransMilenio is one of the most extensive systems, with 84 km of BRT routes, and carrying 1.8 million passengers daily [www.transmilenio.gov.co, 2012]. An important aspect of BRT systems is that they often include significant improvements along the bus corridor for pedestrians and bicyclists. These features are essential to ensure equitable access for citizens who cannot afford public transportation.
The scope and scale of BRT interventions offer planners an important opportunity to make public transport infrastructure easier to use for seniors and people with disabilities. In this section we outline the manner in which various BRT features can be made compliant with building codes and policies related to disability access. BRT interventions can be strategically simplified into three key systems as they relate to the public transport customer: boarding stations, transport vehicles and the pedestrian environment.

**Boarding Stations:** BRT systems strive to make boarding and alighting as easy as possible by coordinating platform and vehicle floor heights. The access route to the platform also must be free of obstacles, including curbs, bollards, turnstiles or other abrupt changes in level. All vertical height transitions must be ramped in a manner compliant to disability access standards. The fare booth and fare gate should be designed in a compliant manner that allows wheelchair users (or people who are short in stature) to communicate with station agents and enter the station easily.

Within the station itself, it is important that signage for vehicle arrival and transport system information is appropriately large type size and high contrast so that it is easily legible. Auditory announcements for vehicle arrival times and other essential public transport information may also be provided for customers who are unable to see or read visual signage. Tactile hazard indicators must be utilized to indicate the location of vehicle boarding locations within the station.

**Transport Vehicles:** The ability to physically enter BRT vehicles is key for people with disabilities. To facilitate customer boarding, the degree to which platform and vehicles are coordinated (vertically and horizontally) is especially important. Reducing the horizontal and vertical gaps between the transport vehicle and the platform assists boarding for able-bodied customers and improves overall system performance [Kantor et al, 2006]. It also allows boarding for transport customers who are unable to climb stairs (such as wheelchair users, or seniors with limited mobility).

In the BRT systems in Delhi and Pune as well as other large cities in Asia and the Americas, horizontal gaps create larger challenges to boarding [Rickert, 2010]. To address this issue, vehicles can be equipped with bridge plates to eliminate gaps or the stations can be designed to assist drivers in docking vehicles closer to the platform thus reducing the horizontal gap. More advanced technology can also be utilized to provide electromechanical or optical guidance in pursuit of precision docking. Regardless of which of these techniques a system employs, the role of a skilled and experienced operator is paramount. Training, skill certification (and recertification) as well as disciplinary penalties for poor performance should be utilized to ensure proper BRT docking and vehicle accessibility.

The interior layout of BRT vehicles is equally important to facilitate access for seniors and people with disabilities. The close quarters of transport vehicles highlight the complexity and contradictory needs of disabled customers. For example, people with mobility disabilities, such as seniors who are unable to stand for long periods of time, require seating; however, those who must utilize mobility devices and assistive technologies such as canes, crutches, walkers or wheelchairs may require additional interior space for positioning and navigating their devices. The minimum clear space requirements for positioning mobility devices should be determined by following local...
disability access standards. The vehicle should also have provisions to strap and secure the mobility device.

For transport customers who experience sensory disabilities such as low vision, blindness or hearing impairment, etc. it is important to provide vehicle location and system information (i.e., next stop announcements, updates on system delays/detours, or emergency egress instructions) in alternative formats. Thus, auditory announcements as well as dynamic visual text systems are recommended.

**Pedestrian environment:** BRT systems are far more than dedicated bus lanes and special buses. Typically, implementing a BRT system involves significant improvements to the pedestrian environment along the right of way. These external corridor improvements offer the greatest benefits for people with disabilities. While an accessible and thoughtfully aligned BRT system offers increased connections and mobility, public transport users with disabilities often face great challenges getting to stops and stations. Accessible pedestrian improvements along BRT corridors offer disabled users greater local connectivity as well as make the system easier for them to reach. An essential benefit of BRT corridor improvements is that seniors and people with disabilities who often experience lower wages and earning potential and thus are less able to afford premium public transport services are able to benefit from public space for mobility or social reasons without having to pay transport fares. The pedestrian environment should thus be compliant with local accessibility design guidelines including consistent pavement surfaces, appropriately sloped ramps, and an unobstructed path of travel. Tactile indicator tiles should be positioned at level changes such as curb ramps, stairs or any other locations where the pedestrian path of travel intersects with a potential hazard (i.e., moving vehicle or bicycle traffic).

For people who are blind or experience low vision, tactile wayfinding paths are often recommended to guide users through pedestrian environments to key destinations such as transport station entrances. We find that the typical installation of these features is often problematic. Thus we recommend tactile wayfinding paths only in situations where a.) Pavements are consistently maintained. b.) Key destinations are few, and c.) Resources exist to effectively communicate to user groups about the location and effective use of these features. We have observed that the above conditions are seldom present in transport systems in developed as well as developing regions.

Janmarg, Ahmedabad’s BRT system, opened in 2009 and now covers a length of 45 km. The phase two of the system is expected to be operational in 2014. When these extensions are completed, the network will span 88 km [Janmarg Bus Rapid Transit system plan phase II DPR, 2008], covering a significant area of the city. The system carries an average of 140,000 passengers per day. Janmarg is the first BRT system in India to have level boarding from median stations and off-board ticketing. Janmarg represents a significant improvement over Ahmedabad Municipal Transport Service (AMTS), the city’s public bus service, in terms of access, passenger comfort, and reliability. Janmarg has incorporated many facilities and interventions described in the above section to meet the needs of transport customers with disabilities. Through qualitative user interviews and quantitative technical audits, this study assesses the Janmarg for inclusive design and also examines the utility of the system for seniors and people with disabilities.
METHODOLOGY

Four distinct user groups were identified for this study: (1) seniors, (2) persons with impaired mobility, (3) persons with impaired vision, and (4) persons with impaired hearing. Three types of surveys were carried out to assess the effectiveness of Janmarg in providing easy accessibility to these users groups.

A questionnaire survey (English and Gujarati) was developed with questions pertaining to commute patterns, origins and destinations, preferred mode, and obstacles encountered in AMTS and BRT in Ahmedabad. The questionnaire was distributed to more than 50 people in the above mentioned categories to seek insights on barriers to public transport usage and specific needs of the focus groups.

A user count and qualitative survey was conducted at five heavily used Janmarg stations (Shinranjini, Anjali, Narol, RTO and Andhjan Mandal) on a weekday. This survey helped determine the percentage of Janmarg passengers with visible disabilities. This field survey also enabled first-hand observations of individual users’ transportation experiences and the types of problems they encounter.

An access audit of Janmarg buses and stations was conducted by Institute for Transportation and Development Policy (ITDP) staff and volunteers. The authors strongly feel that traditional access audits are too technical and rely largely on international standards and not much on immediate context, user behavior and local challenges and innovations. “In overly focusing on physical and technical access, auditors miss the importance of programmatic and policy interventions as well as the need for a more collective contentious politics.” [Friedner, Osborne, 2011] For the purpose of this study, an audit format was developed that was simple, intuitive and operational in nature. The audit was carried out by volunteers and the audit process was also used to sensitize them about problems people with disability face while navigating the built environment.

Audits were carried out at 20 stations in different parts of the city. The station types included normal trunk line stations, a terminal station, special multi-level stations and one-way stations. Two types of buses currently plying on the corridors were also surveyed. The technical audit of stations examined all three aspects of BRT systems discussed in the previous section: boarding stations, transport vehicles and pedestrian environment (100 m in all directions from the station). Performance indicators for the design features were established based on the Bus Rapid Transit Accessibility Guidelines [Rickert, 2007].

RESULTS

1. Results from ridership/ user count survey at five Janmarg stations:

The 5 stations were selected based on passenger volumes and diversity in locations. Andhjan Mandal station was also included because of its vicinity to Blind Peoples Association, a vocational centre frequently accessed by people with disability. The ridership data for the given survey date was provided by Ahmedabad Janmarg Limited (AJL). The following table and pie diagrams illustrate the survey findings:
Andhjan Mandal Anjali Narol RTO Shivranjini

Total Users 2,430 5,129 5,041 7,418 5,549
Total users with disability 306 504 233 417 698
% of users with disability 12.59% 9.83% 4.62% 5.62% 12.58%

<table>
<thead>
<tr>
<th>Seniors</th>
<th>9.63%</th>
<th>8.72%</th>
<th>2.36%</th>
<th>2.26%</th>
<th>9.97%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually impaired</td>
<td>1.65%</td>
<td>0.51%</td>
<td>0.83%</td>
<td>1.11%</td>
<td>1.77%</td>
</tr>
<tr>
<td>Mobility impaired on crutches/ cane</td>
<td>0.86%</td>
<td>0.35%</td>
<td>1.19%</td>
<td>0.70%</td>
<td>0.59%</td>
</tr>
<tr>
<td>Mobility impaired on wheelchair</td>
<td>0.08%</td>
<td>0.14%</td>
<td>0.06%</td>
<td>0.69%</td>
<td>0.16%</td>
</tr>
<tr>
<td>Hearing impaired</td>
<td>0.37%</td>
<td>0.12%</td>
<td>0.18%</td>
<td>0.75%</td>
<td>0.09%</td>
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Table 1: Percentage of users with disability at five heavily used Janmarg stations

- The average percentage of seniors and users with visible disabilities at these stations was observed to be 8%
- Of the 8%, majority comprised of seniors (6.59%) followed by users who are visually impaired (1.17%)
- People using a wheelchair or other mobility device formed a very small fraction of the identified users group (0.02%)

2. Results from questionnaire survey

The purpose of this qualitative survey was to gauge user perceptions regarding the new BRT system and the AMTS bus system and help identify problems that people with disability face while using public transport. Of the 50 questionnaires distributed among the user groups, we received 27 responses (54%).

- Out of the 27 respondents, 14 (51%) had used public transport (AMTS or Janmarg) in the past six months. All of the 11 users who had used both AMTS and Janmarg and prefer Janmarg over AMTS
- Eight respondents use public transport frequently (several times a week). The most commonly noted barriers to using public transport were “route to the bus stop/station is unsafe,” “the buses are too full,” “no space to sit or rest,” and “buses do not stop at bus stops.”
- The biggest challenges with AMTS were “crowded/unsafe conditions” and “boarding the vehicle.”
• The biggest challenge with BRTS was “service not available where I live.”

• Most important issues that need to be addressed to improve accessibility to public transport:
  o Auditory and visual announcements
  o Frequency of buses/reliability
  o Climbing steps should be made easy
  o Drivers should stop at bus stops and should be sensitive to the needs of users with disabilities.
  o Available/comfortable seating in buses
  o Citywide disabled friendly infrastructure

3. Results from access audit of BRT stations, buses and pedestrian environment

Station Design: The most important feature in Janmarg trunk line stations that allows easy access for all passengers is the coordinated bus and station design. The boarding platforms are raised to meet the height of the BRT buses (900 mm) allowing level boarding. Platform extensions allow the bus to dock closer to the platform gap without damaging the vehicle. Doors open automatically once the bus is parked. Janmarg also has radio frequency identification (RFID) system that does not allow the platform doors to open if the bus is not docked properly. A horizontal gap of 10 cm is considered to be the absolute maximum. The observed gap in Janmarg was in the range of 12 cm.

While the inclusive design features incorporated in Janmarg contribute considerably to easy access, several design limitations were observed that hamper easy access and egress to and from the stations for users with disability:

• Bollards placed at mid block crossings (to prevent 2-wheelers from passing through) do not allow wheelchair users to pass through and access the platform, severely limiting their access to the system. They are also an irritant, if not an absolute barrier, for passengers using other assistive technologies such as canes and crutches.

• Location of street lights, traffic signals and other utilities are not coordinated with the station design. It was observed that at two locations, poles have been installed right in the middle of the tactile paving endangering the safety of visually impaired users. These poles also reduce the clear width of the access path.

<table>
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<tr>
<th>Janmarg Features that encourage access for all</th>
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<tbody>
<tr>
<td>At grade crossings at all trunk line stations</td>
</tr>
<tr>
<td>Enclosed, well lit stations with seating</td>
</tr>
<tr>
<td>Access Ramps (1:12 gradient)</td>
</tr>
<tr>
<td>Map and route information in English and Gujarati</td>
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<tr>
<td>Auditory and visual announcements in stations and buses</td>
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<tr>
<td>Level Boarding</td>
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<tr>
<td>Drivers trained to dock bus closer to platform</td>
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<tr>
<td>Tactile warnings at boarding gates</td>
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Table 2: Inclusive Design features in Janmarg
**Vehicle Design**: Two types of buses are currently plying on the Janmarg system—Euro III diesel buses with Tata chassis and assembled locally and CNG Tata Marco Polo buses. Both bus types have doors on either side and can provide services both on and off the trunk line. Both buses have dedicated space for wheelchairs, but with better location of doors and provision of secure strapping, the Marco Polo Bus is more conducive to users with disability, especially wheelchair users.

**Pedestrian Environment**: Poor quality of pedestrian infrastructure around BRT stations severely hampers accessibility to the system. Of the 20 stations surveyed, no station area had a footpath with continuous clear width of -1.5M. At 18 stations there was at least 1 location where the footpath was absent. Where present the footpaths were too narrow or obstructed by temporary or permanent encroachments such as parking, vendors, trees and poles. No access complaint curb ramps were observed at any of the 20 station locations.

The following diagram illustrates an area of 100 m around one BRT station. The grey box in the centre of road represents the BRT station. The footpaths are shaded yellow, cycle tracks are shaded orange and the black and white stripes show the pedestrian crossing locations. The white arrows represent the 4 locations from which one can access the station from the footpath.

![Diagram of BRT station access](image)

**Figure 1**: Challenges to accessibility to Janmarg station

- Obstructions to accessibility that are part of BRT station design and implementation
- Obstructions on footpaths

**DISCUSSION**

Janmarg has proven to be a major advance over AMTS in terms of reliability, access, safety, and comfort for all users and specially the elderly and the disabled. With multiple steps at the door, getting on an AMTS bus is a huge challenge. Moreover, the buses do not come to a complete halt at the stops, forcing passengers...
to literally “run” and board the bus, leaving many vulnerable users baffled and frustrated. The Janmarg system is accessed through enclosed, weather protected, and well lit stations with adequate seating and rest areas. Level boarding with a small gap makes it easy for all users, including seniors, people with mobility impairments, and pregnant women, to board. Universal access features such as access ramps with hand rails and auditory and visual announcements incorporated in design were noted to be especially beneficial to the identified user groups.

While Janmarg has incorporated many facilities to meet the needs of transport customers with disabilities in its station and bus design, our survey results indicate only 8% seniors and people with disability using the system. The main reason why more seniors and people with disabilities do not use Janmarg is because reaching the stations is extremely difficult owing to a poor pedestrian environment. Most streets lack footpaths. Where present they are narrow, intermittent and often blocked by parked vehicles, vendors or other permanent obstructions such as electric poles and transformers. Most pedestrians prefer to walk on the road, but seniors and people with disability find it unsafe to navigate the traffic on the busy streets.

CONCLUSION

The Janmarg BRT presents a successful case study in terms of improved accessibility to public transport in Indian cities. It has made commuting easier and dignified for not only seniors and people with disabilities but also other sensitive groups such as women, children and people with heart conditions and other ailments. However, as the survey results indicate it falls short of being a truly inclusive system in several aspects. The authors feel that incorporating following reforms in planning and operations in upcoming phases of Janmarg will allow many more users to benefit from the system.

- While designing and implementing the BRT system, improved accessibility to surrounding neighbourhoods and destinations such as schools, temples, hospitals, and markets should also be taken into account. Safe and unobstructed footpaths with proper curb ramps and cycle tracks on both sides of the corridor and on perpendicular connections to the trunk line should be provided.

- A long-term implementation plan should be in place that includes connections with feeder routes and other public and para transit modes. A route rationalization exercise is currently underway to integrate the AMTS and Janmarg services. Operating some AMTS routes as feeder routes to Janmarg will make the system accessible to new users.

- While planning future phases, participation should be actively sought from all users, including people with different types of disabilities. An information and outreach plan should be put in place to educate and inform all users about BRT

- Active testing of pedestrian facilities by BRT system designers by walking on footpaths and rolling along them in wheelchairs can help identify whether the designs are accessible. Problems identified during these audits can be resolved before construction is finalized and can inform the design of future corridors.
• Good Design is the key to a successful BRT system. However poor accessibility also is often a result of bad construction quality and lack of maintenance especially in Indian cities. High quality of construction should be ensured while construction. Maintenance contracts should be in place to ensure that an accessible system remains accessible even in the long run.

• Better coordination between the BRT planners, AJL, AMTS, paratransit providers, and other relevant city and state departments involved in street design and enforcement (planning and engineering, public works department, traffic police) will ensure easy access from footpaths and other modes on to the BRT.

REFERENCES


