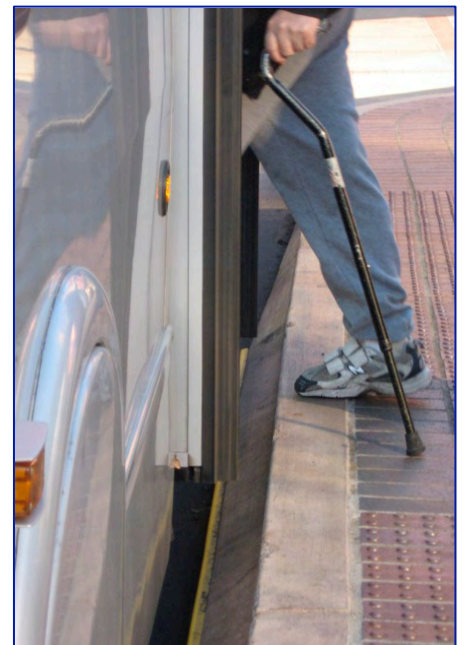


# Technical and operational challenges to inclusive Bus Rapid Transit: A guide for practitioners



This Guide to international experience has been compiled by Tom Rickert for the World Bank thanks to funding provided by the Norwegian and Finnish governments through the TFESSD – Disability Window.

This material may be reproduced without permission for non-commercial purposes only, provided the source is acknowledged.

September 2010

Front cover graphics: The wheelchair logo at upper left is the symbol of the World Bank's Disability and Development Team. Photo at upper right of women and children exiting a BRT station on a grade-level crossing, protected by a traffic light, is from Bogotá, courtesy of Carlos Pardo. Photo at bottom left of a blind person using a tactile guideway in a BRT station is from Mexico City, courtesy of Access Exchange International. Photo at bottom center of a wheelchair user exiting a bus with a bridge for all passengers is courtesy of City of Cape Town – HHO Africa & ARG Design. Photo at bottom right, of a person with a cane easily entering a bus across a narrow gap with platform and bus level at the same height is from Eugene, Oregon, USA, courtesy of Richard Weiner.

Page 1 photos: Photo left, from Bucaramanga, Colombia, courtesy of World Bank. Photo right, from Mexico City, courtesy of Access Exchange International. Both photos show the exteriors of Bus Rapid Transit stations with exclusive bus lanes.



## Technical and operational challenges to inclusive Bus Rapid Transit: a guide for practitioners

By Tom Rickert\*  
Consultant to the World Bank

### Introduction

The purpose of this guide is to bring recent international experience to bear on accessibility issues that challenge the ability of Bus Rapid Transit systems in less-wealthy countries to serve persons with disabilities, seniors, and others who especially benefit from inclusive design.

The rapid spread of Bus Rapid Transit (BRT) systems presents an historic opportunity to create models of accessible transport for passengers with disabilities and for older passengers, often in cities with little previous experience in this field. BRT trunk line corridors and their feeder lines can enable new categories of passengers, including more women and children, to benefit from an improved level of safe, accessible, and reliable public transport. Such systems can also serve as models of good practice to encourage transit and pedestrian improvements far from BRT lines. Bus Rapid Transit systems, as well as rail, metro, and other forms of public transit, can thus help incorporate new groups of passengers into the larger movement toward sustainable and livable cities.

The spread of Bus Rapid Transit may be the most important single opportunity in the history of public transportation to enhance the mobility of persons with disabilities in less-wealthy countries.

However, emerging international guidelines for inclusive design are not being consistently followed. On the one hand, many Bus Rapid Transit systems, for example in Latin America where BRT concepts were first invented and implemented, are rapidly learning from regional experience and from their customers with disabilities. But some BRT systems in every region have fallen short, often due to a failure to incorporate feedback from older persons and passengers with disabilities into the learning process. Even though in theory their systems lend themselves to accessible design, they can be inaccessible to a wide range of

passengers who cannot reach the stations or, once there, are unable to board the buses due to a variety of technical and operational issues. This concern takes on special relevance as most people in the world live in countries that have already ratified the United Nations Convention on the Rights of Persons with Disabilities with its policy guidance on accessibility issues. For such countries, the Convention provides a framework for national and more local policies to address inclusive design to assure that all citizens can exercise their right to mobility.

**This publication is not a general guide but rather is aimed directly at those concerns that have *especially* caused many BRT systems to fall short of their potential to serve all categories of passengers. In 2007, the World Bank commissioned the *Bus Rapid Transit Accessibility Guidelines*, a compilation of international resources available at <http://go.worldbank.org/MQUMJCL1W1>. Sections of this guide are referenced to this publication, as is the Check List from those guidelines that appears as Appendix A. Along with the additional resources found in Appendix B, these sources provide technical guidance for the features discussed in this current publication.**

<u>Contents</u>	
	Page
Section 1 Forecasting demand for inclusive BRT design . . . . .	3
Section 2 Problems with pedestrian bridges . . . . .	6
Section 3 Mitigating the bus-to-platform gap . . . . .	9
Section 4 High-floor and low-floor buses: Accessibility issues .	17
Section 5 Pedestrian infrastructure issues . . . . .	21
Section 6 Feeder bus, taxi, and service route issues . . . . .	26
Section 7 Working with the community . . . . .	34
Appendix A Check list for task managers . . . . .	38
Appendix B Resources . . . . .	41

\* Tom Rickert developed accessible transport for San Francisco, California's, public transport agency from 1980 to 1990. For the past twenty years, he has served as Executive Director of Access Exchange International, an NGO promoting inclusive transport around the world. He has provided workshops on accessible transport in 25 countries. His work preparing this guide was as a consultant to the World Bank's Integrated Mass Transit Systems Project for the Republic of Colombia.

## Section 1

# Forecasting demand for inclusive BRT design

Wheelchair users are the tip of the iceberg and represent a small fraction of the total beneficiaries of inclusive design of BRT systems. Transit systems unable to meet the needs of other beneficiaries of universal design run the risk of denying service to multiple categories of potential riders.

Consider, for example, that existing Bus Rapid Transit systems must incorporate an average of more than 40% more older persons into their service areas during the next twenty years.<sup>1</sup> Right now, for every wheelchair user there are up to four persons using canes or crutches or other mobility aids<sup>2</sup> who also benefit from level boarding and easy access to BRT buses and stations, not to mention the needs of persons with sensory or cognitive impairments.<sup>3</sup> And three-quarters of all BRT inclusive design features provide at least some benefit to all passengers, while only 11% of such features exclusively serve passengers with mobility, sensory, and/or cognitive disabilities.<sup>4</sup>

In order to forecast demand for BRT service by persons with disabilities it is important to be able to count passengers with hidden disabilities, including those who are frail or have a vision impairment or have arthritis, a heart condition, or are deaf, deafened, or hard-of-hearing. However, when transit planners turn to national or municipal statistics on disability, they may be confronted with confusing or inaccurate data because of different criteria for disability and the different interests of agencies collecting the data.<sup>5</sup>

It is easier to count persons using wheelchairs because they are easily identified. This leads to wheelchair users becoming a surrogate for everyone else with a disability and contributes to the almost universal practice of saying a bus “is accessible” or “is not accessible” solely based on the ability of passengers using wheelchairs to ride. This is unfortunate because it ignores such features as audible and text signage and many other features that help those with sensory and cognitive disabilities as well as all other passengers. It also grossly underestimates the number of passengers who benefit from level boarding.

Clearly, data on potential trip demand by passengers using wheelchairs will be helpful to BRT planners, provided that this data is understood as a surrogate for the far higher need for level boarding by other passengers with less visible mobility impairments, and the even higher

---

<sup>1</sup> “The proportion of older persons was . . . 10 percent in 2000, and is projected to reach 21 percent in 2050,” according to United Nations world data, and the 40% figure is a conservative extrapolation of growth expected over the next 20 years in developing countries.

<sup>2</sup> From USA data from the University of California, San Francisco, Disability Statistics Center. The ratio is probably greater in developing countries. Downloaded 7/20/10 from dsc.ucsf.edu.

<sup>3</sup> The percentage of persons with disabilities with sensory and cognitive disabilities is greater than the percentage with mobility impairments, as reported, for example, in TRL 2004, page 8 (see Resources at rear).

<sup>4</sup> “Universal Design Features within the Context of the Costs and Benefits of Bus Rapid Transit Systems,” World Bank, 2006. Design features range from curb ramps to station assistants to good lighting to text and audible signage, narrow bus-to-platform gaps, etc.

<sup>5</sup> See *Transport for All: What Should We Measure? Comments on the use of indicators and performance measures for inclusive public transport in developing regions*, AEI 2005

demand by other categories of beneficiaries of accessible design such as passengers carrying children or packages. What data there is suggests the following conclusions.

1) The origins and destinations of trips by wheelchair users tend over time to parallel the travel patterns of all other passengers. The assumption that wheelchair users are



concentrated in some areas far more than others may not be correct in regions where transit systems are accessible and where a culture of independent living is replacing a culture of institutionalization of persons with disabilities. A similar trend may be experienced in less wealthy countries that have ratified the UN Convention on the Rights of Persons with Disabilities with its support for independent living. The map at left illustrates the experience of San Francisco, California, a city with a matured accessible transport system developed over the past thirty years. The map exhibits GPS data collected electronically from a sample of wheelchair lift and ramp deployment by buses and trolley coaches, showing that the favorite routes and destinations of wheelchair users are much

the same as for all other passengers. Anyone familiar with San Francisco would see that the wheelchair trip activity shown on the map is largely to the same set of business areas, tourist destinations, universities, and other major trip generators used by everyone else. (Destinations by rail modes or by door-to-door van or taxi services are not shown.)

2) Trip demand tends to grow year by year as accessible transport serves more destinations with more frequent service, provided that the service is safe and reliable, using well-trained drivers with well-maintained accessibility features. If the service is not reliable, the trend will be exactly the opposite and ridership per vehicle will decrease year by year.

Data collected from several transit systems tend to support this assumption, showing how trip making has grown as more service is phased in. Some examples follow:

- San Francisco, California, USA, is a city with hilly terrain and a population of approx. 800,000. GPS data for lift use on weekday bus service in 2009, extrapolated by the author to also include rail modes, indicates a total of 180,000-200,000 trips per year system-wide or approx. 200 trips/year/vehicle in peak hour service. This is supplemented by city-sponsored door-to-door taxi and van services for wheelchair users totaling 212,000 trips/year, to give a total of roughly 400,000 trips per year on publicly sponsored transportation on all modes.<sup>6</sup>
- Sacramento, California, USA, a metropolitan area on level terrain and a population in excess of one million, reports 214,000 lift-assisted bus trips and 76,000 accessible light rail trips for wheelchair users from 2006 data. Depending on mode, between .5% and somewhat in excess of 1% of all boardings are by wheelchair users, who clearly have made this reliable system a primary means of travel. This no doubt relates strongly to a low trip denial rate (e.g., due to overcrowded vehicle, mechanical failure of lift) of only some .4% to 1%

<sup>6</sup> Data and graphic provided by Accessible Service Office, San Francisco MTA, dated 5/28/10

depending on mode. Also, 196,000 door-to-door trips for wheelchair users were provided, for a total of approx. half a million trips per year by all modes.<sup>7</sup>

- Austin, Texas, USA<sup>8</sup> An average of approx. 100,000 yearly trips (averaging 2004-9 data) are reported on the 340 buses in peak service of the Austin Metro, representing approx. 300 trips/bus/year or slightly under 1 trip/day. The service area is approx. 900,000 persons.
- France: "... earlier enquiries in the automated metro of Lille (1983) and the tramway of Grenoble (1987) evaluated that 3% and 6% travelers respectively wouldn't have been able to ride (an inaccessible) bus. These travelers were ambulant impaired mostly." More recent data, from 2007 in Grenoble, is from 3 tramway lines supplemented by some bus lines and reports 363 daily weekday trips by wheelchair users or approx. 110,000 trips per year.<sup>9</sup>
- Hong Kong reports 63,000 trips by wheelchair users per year in 2008 on its 1,900 accessible buses, or only 33/trips/bus/year. Hong Kong lacks accessible sidewalks in some areas and also has a large door-to-door system that provided 562,000 trips for all persons with disabilities in 2005.<sup>10</sup> When given a free choice, most public transit riders will choose such service over bus or rail alternatives. Having said this, trips/bus/year in Hong Kong have nevertheless risen from 19.5 in 2000 to 28.6 in 2005 to 33.1 in 2008.
- Suggestive data from the Catalan Railways Company in Barcelona notes that the inclusion of access features appears to be associated with a more rapid increase in ridership (23%) over the five year period of 2001-2006 than occurred with a comparable system that initiated access improvements at a later date and increased ridership by only 16%.<sup>11</sup>
- From a country with an emerging economy, we have data from Curitiba, Brazil, whose well-known Integrated Transport Network provides 21,000 daily trips for disabled persons registered with the system to travel free of charge (slightly under 1% of all trips). Of this number, some one thousand individual wheelchair users ride the system daily according to a survey in 2008, implying in excess of 500,000 one-way trips per year, a number which forms part of some 8 million annual trips by all registered disabled persons and their attendants. Unregistered persons with disabilities are not counted, nor trips by some 2,400 special education students served by dedicated buses on 51 pickup routes.<sup>12</sup>

It is of course difficult to interpret varied data from different cities. Nevertheless, the growing importance of access features in both BRT trunk and feeder lines is clear when reported use by wheelchair riders is multiplied by use by others who benefit from level boarding, and clearer still when multiplied by all those who need other access features. These multipliers will vary from city to city and over time, and will depend on trends in an aging population as well as poverty rates, both of which tend to correlate with disability rates. Lack of access to sidewalks will depress use of both trunk line and feeder line buses, and the reader is referred to Section 5 for a discussion of this issue.

---

<sup>7</sup> Richard Weiner, Nelson Nygaard, provided the fixed route data in message dated 8/24/09 and Paratransit, Inc. provided the door-to-door data in message dated 7/22/10

<sup>8</sup> Jennifer Govea, Austin Metro, messages dated 8/11/10 and 8/13/10

<sup>9</sup> Maryvonne Dejeammes, CERTU, message dated 12/10/09

<sup>10</sup> Engineer Kane Shum of KNB in message dated 6/23/10, also Hong Society for Rehabilitation

<sup>11</sup> Francesc Aragall in message dated 7/14/10

<sup>12</sup> Data from the City of Curitiba and its transit network, courtesy of Juan Pineda of Plural Arquitectura Incluyente of Medellín, Colombia, in a series of messages in August, 2010.

## Section 2

# Problems with Pedestrian Bridges<sup>13</sup>



**The problem:** Even accessible pedestrian bridges built with ramps instead of stairs can result in fatigue for many passengers and difficulty for use by older persons and others with mobility concerns. Pedestrian bridges using only stairs are inaccessible not only to wheelchair users but to a broad range of persons with mobility concerns, including many of those with hidden disabilities such as arthritis or heart conditions.

**Solutions:** From the standpoint of access by persons with limited mobility, the solutions in ranking order are:

1<sup>st</sup> choice: At-grade crossings controlled by traffic lights

2<sup>nd</sup> choice: Pedestrian bridges or tunnels equipped with elevators

3<sup>rd</sup> choice: Pedestrian tunnels with inclined ramps built to international access standards.

4<sup>th</sup> choice: Pedestrian bridges with inclined ramps built to international access standards.

1. AT-GRADE CROSSINGS: The best solution for persons with disabilities

“At-grade crossings should always be the first choice when designing a BRT station. Only if this is physically impractical should a bridge or tunnel be considered,” notes the Pedestrian Section of *Safe Routes to Transit: Bus Rapid Transit Planning Guide*.<sup>14</sup> “Solutions that require pedestrians to climb up and down stairs can be physically difficult, dangerous, and oft ignored in favor of the shorter routes. Elevators and ramps partially mitigate this, but at considerable expense. . . . All too often pedestrian bridges have been constructed supposedly for the safety of pedestrians. The real reason though was to remove people from the roadway in an effort (to) improve vehicle flow and speed. (Yet) the people who need the safety of bridges the most – the elderly, those with disabilities, children in strollers – cannot climb stairs.”

<sup>13</sup> See Section 2 of the *BRT Accessibility Guidelines* and the Check List in Appendix A at rear

<sup>14</sup> Downloaded April 16, 2010, from *Safe Routes to Transit*, Nelson Nygaard Consulting Associates [www.nelsonnygaard.com/Documents/Reports/Safe\\_Routes\\_to\\_Transit.pdf](http://www.nelsonnygaard.com/Documents/Reports/Safe_Routes_to_Transit.pdf), Appendix C: Pedestrian Bridges and Underpasses. Published by the ITDP.



## **At-grade crossings exclusively for persons with disabilities are not recommended**

Persons with disabilities should cross with everyone else at marked zebra crossings with traffic and pedestrian flows controlled by traffic lights. Special at-grade crossings *just* for persons with disabilities are seldom if ever a wise solution. The use of such “special” crossings, because pedestrian bridges are inaccessible, must rely on signals from wheelchair users or others that they need to cross at grade level. This practice relies on the presence of security or traffic personnel who are responsible for stopping traffic. It can be dangerous and has been viewed as preventing access by persons with mobility impairments in Latin American and Asian countries. A major concern is skepticism that the use of staff to provide such assistance at all hours and throughout the life of the system is not sustainable. Staff at an Asian system report not seeing disabled people using their BRT system when access is limited in this way. A disability group in another Asian city notes that “When we want to cross to the other side, we have to use a taxi since roads . . . have many barriers to cross. . . . It is impractical since we are not sure that the staff can notice when we come (to the other side of the road).”<sup>15</sup>



**Photo left: The man on crutches is able to cross due to help of security personnel, but this approach requires a long-term commitment that is not**



**likely to endure for the life of the system. Photo right: A special crossing at another BRT system. Disabled persons have not been observed using the system.** (Photo left by Gerhard Menckhoff, photo right by Lloyd Wright)

## **2. PEDESTRIAN BRIDGES OR TUNNELS WITH ELEVATORS**

Clearly, this approach meets the needs of passengers with limited mobility, provided that elevators are properly maintained and designed to accommodate persons using wheelchairs. Care must be taken that older persons, women, or persons with hidden disabilities feel free to use the elevators. Elevator procurement and maintenance is a cost concern. It is recommended that elevators have transparent sides to promote safety and sanitary conditions.

## **3. PEDESTRIAN TUNNELS ACCESSED BY RAMPS**

Tunnels should be considered as an alternative to bridges when practical, because in most situations the level change from street surface to tunnel walkway is significantly less than the level change from street surface to pedestrian overpass. In such cases, tunnels will cause less fatigue for all passengers and will require shorter ramps.

---

<sup>15</sup> All comments by persons with disabilities cited in this publication are from correspondence with Access Exchange International kept on file.

The security issues found with the use of some tunnels may be mitigated with surveillance cameras and security personnel. In many cases the key is to promote use of the tunnel, possibly with the presence of vendors or commercial stalls or stores. Pedestrian tunnels require a method for handling water runoff and it may be especially expensive to relocate any underground utilities if this is required for tunnel construction. However, these and other problems are dealt with in subway systems around the world.



**Left: A pedestrian tunnel in Moscow. Right: Ramp from a BRT station into a pedestrian tunnel in Cali, Colombia**  
(Photo left by Valeria Sviatkina, photo right by AEI)



#### 4. PEDESTRIAN BRIDGES ACCESSED BY RAMPS



**Pedestrian bridges in Bucaramanga, Colombia (left) & Cali, Colombia (right) provide ramped access.**

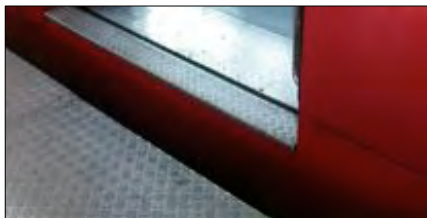
In spite of the positive features of grade-level or tunnel crossings, many BRT systems do require the use of pedestrian bridges at least at some stations. Care should be taken that passengers do not instead choose the alternative of crossing a dangerous roadway to reach the BRT station more rapidly. Elevators should be provided for those unable to use stairs. While they may be technically “accessible” to a wheelchair user, the sheer length of ramps to pedestrian bridges is so daunting that it is unlikely that most wheelchair users would use the ramp without the help of a friend to push the chair. This has led to complaints by users in many countries.

(Photos courtesy of World Bank, upper left; and AEI, upper right)

### Section 3

## Mitigating the bus-to-platform gap<sup>16</sup>

Around the world, there are problems with “the gap”



**The problem:** Excessive bus-to-platform gaps at BRT stations can make boarding and alighting more difficult for all passengers and especially for children, elderly or frail persons, blind persons, and passengers using wheelchairs. Complaints have been received from users in many countries. A wheelchair user in Africa, for example, states that “My most serious concern is the horizontal variance between a bus and the platform, which . . . renders the system inaccessible to wheelchair users.” A passenger with a disability in a Latin American city states that “when the bus is at the station, there is a 30 to 50 cm. gap that is dangerous for any person boarding or alighting from the bus.”

The photos at left show excessive gaps found during normal operations in BRT systems in other large cities in Asia and the Americas.

Excessive gaps require passengers to carefully watch the gap when they board or alight, causing delays and creating the risk of injuries as well as line delays.

**Solutions:** From the standpoint of accessibility for all passengers, the solutions in ranking order are

1st choice: Completely eliminate the gap for *all* passengers through a device that bridges the gap with minimum exposure of passengers to the space on either side of the bridge.

2nd choice: Reduce the space between bus and platform to nominal size for all passengers, through different methods of gap reduction.

3rd choice: While controlling the gap for all passengers as much as possible, reduce or eliminate the gap for wheelchair users and other persons with disabilities, usually with special attention to the gap at the bus door closest to the driver.

<sup>16</sup> See Section 5 of the *BRT Accessibility Guidelines* and the Check List in Appendix A at rear

## 1. ELIMINATE THE GAP FOR ALL PASSENGERS

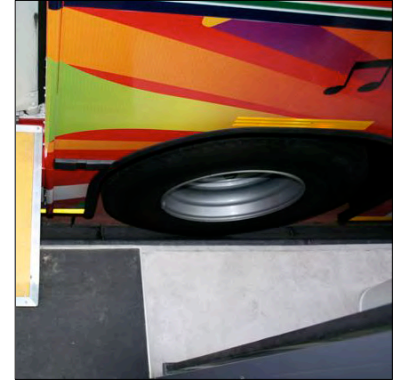


The use of a boarding bridge to eliminate the bus-to-platform gap goes back to the invention of full-featured Bus Rapid Transit systems in Curitiba, Brazil, more than two decades ago. In spite of concerns that the operation of the bridge mechanism adds a few seconds at each bus stop, no research has actually determined if this does in fact occur. It seems plausible, if passengers do not have to carefully observe their entrance into the bus but can board and alight with confidence, that the process may actually save time at stops handling many passengers. In addition the use of bridges affixed to all bus doors, as

shown in the photo above from Curitiba, provides an element of user security and convenience that sets BRT apart from other forms of surface transportation and thus helps to “brand” the system. Following the pioneering work of Curitiba, some modifications have been made in the use of bridges for all passengers, as discussed below. (Photo from Inter-Am. Dev. Bank)

1(a) The Ecuadorian solution: The use of boarding bridges serving all passengers has been successfully implemented in Quito and in Guayaquil, Ecuador. The photos below show front and side views of the deployed bridges that are affixed to each door of the high-floor buses. Because the bus is close to the platform edge, this solution also increases safety by minimizing the distance travelled over the bridge. (Photos courtesy of Unidad Operadora del Sistema Trolebús de Quito)

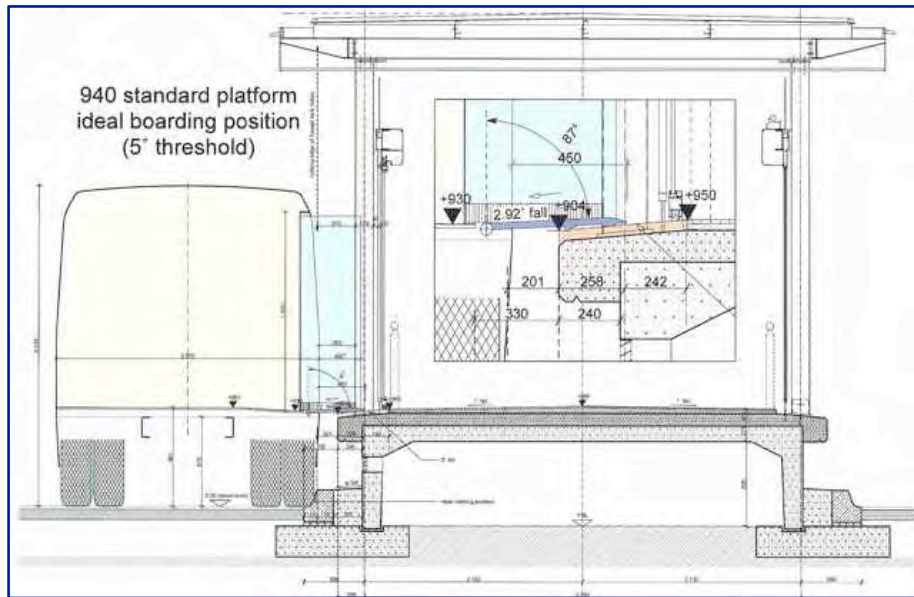




1(b) The Cape Town solution: Cape Town has a unique solution combining bus-mounted boarding bridges to cover the gap for all passengers with the use of special curbs to assure that the buses can dock near the platform without risk of damage to the bus. To prevent the bus from making contact with the platform edge, a specially smooth and hardened curb (photo at top left) is built into the station (photo center) to prevent the bus from making contact with the platform (photo right, top view looking down on bridge deployed at left). (Photos above left & center courtesy of Lloyd Wright; other photos by City of Cape Town – HHO Africa and ARG Design)



The curb used in Cape Town is called a “Kassel curb,” a type of beveled curb given this name because it originated in the German city of Kassel. Different versions of beveled curbs are produced by different companies. The manufacturer of the product used in Cape Town cites evidence showing a 40% reduction in tire wear when tires come into contact with the curb. In combination with the bridge, this would appear to definitively address the need to eliminate the bus-to-platform gap. Driver fear of scraping the platform edge is probably a major cause for the large gaps exhibited in some BRT systems. At all stations where buses stop frequently at the same location, care is needed to assure that the busway is built to withstand wear and prevent rutting. The drawing on the next page further illustrates the combined use of the bridge and curb.



Photos and the diagram above from Cape Town courtesy of City of Cape Town – HHO Africa & ARG Design  
 The inset provides detail on the alignment of the boarding bridge with the platform.

**2. REDUCE THE GAP TO A NOMINAL SIZE**

“A 10 cm. horizontal gap is the absolute maximum and smaller horizontal gaps are highly desirable. Vertical gaps should be minimized as much as possible to no more than 1-2 centimeters.”<sup>17</sup>



Most new BRT systems use alignment markers on the busway surface, in combination with markers on the bus windscreen, to assist drivers to dock with a minimal bus-to-platform gap (see photo). However, the very fact that so much experimentation is occurring to further reduce the size of the bus-to-platform gap is itself evidence that this remains an ongoing problem. Fortunately, there are several promising approaches that, in combination with proper driver training (see below), may result in long-term sustainable gap reduction without body damage to buses that make contact with the platform edge. Several of these are presented below. (Photo from Rea Vaya, Johannesburg, courtesy of Lloyd Wright)

**2(a) The use of platform edge bumper strips**



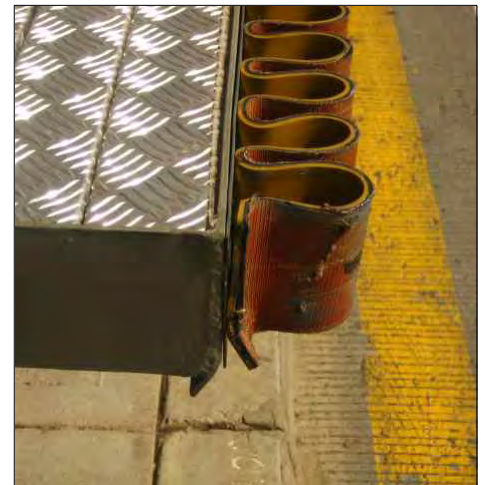
One of many examples of this approach is the recently opened BRT system in Bucaramanga, Colombia. The photo at left shows a wheelchair user boarding under operating conditions with a minimal gap. The platform edge is protected by a neoprene strip. Typically a protective strip opposite the platform edge runs along the length of the bus, providing further protection. (Photo courtesy of World Bank)

<sup>17</sup> World Bank, 2007, 5.1, page 17. Also see 5.0 in Check List in Appendix A at rear.

## 2(b) The use of a corrugated platform edge

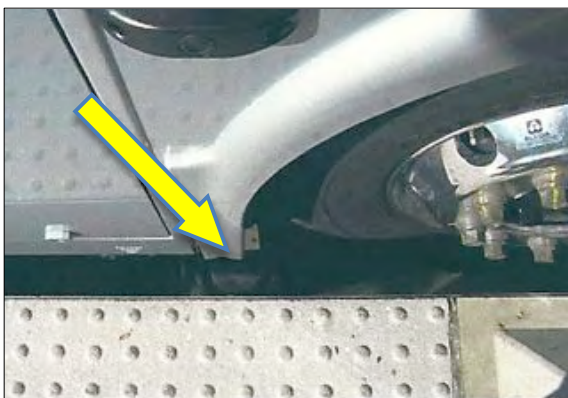


El MIO, the recently-opened BRT system in Cali, Colombia, uses an innovative corrugated platform edge with wavy material. The photos below provide a closer view of the material being used by MetroCali, the agency that operates the system. There will be a need to evaluate whether wear and tear on the corrugated edge becomes a problem. (Photos courtesy of MetroCali and AEI)



## 2(c) The use of a guide wheel to provide “precision docking”

The Cleveland Regional Transportation Agency in the USA uses an innovative guide wheel to indicate to the driver that the bus has touched the edge of the curb. This may be especially relevant to BRT systems using low-floor buses. The photo below on the left looks down on the front tire of the bus, while the photo on the right shows the guide wheel in greater detail. (Photos courtesy of Cleveland RTA)



## 2(d) The use of an optical guidance or magnetic alignment technology



Optical guidance systems are in use in some European cities, including Rouen, France; Castellón, Spain; and Bologna, Italy, using advanced technology to keep the bus positioned on the busway with the goal of having the bus dock immediately adjacent to the bus stop or station. The photo is from Castellón. Good road maintenance is required, and one American city discontinued the system due to concerns about

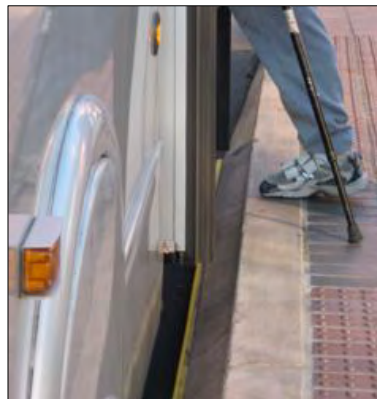
busway maintenance required to assure that the optical guidance would work. Magnetic alignment technology is employed in Eindhoven in The Netherlands. (Photo courtesy of Siemens)

## 3. ELIMINATE OR REDUCE THE GAP FOR PERSONS WITH DISABILITIES

A variety of approaches are used in different countries.

### 3(a) Pay special attention to coordination of bus and bus stop dimensions.

One low-floor BRT system that has been especially successful with this approach is Eugene, Oregon, in the USA. Well-constructed bus stops closely match the height of the bus floor in Eugene (left). This enables passengers to easily board (center), while a short ramp provides almost-level boarding for persons using wheelchairs (right). Also see the photos from Nantes in Section 4, below. (Photos courtesy of Richard Weiner of Nelson Nygaard)



### 3(b) Provide a dedicated platform and ramp for the use of wheelchair users.

The photo on the next page at top left is from the Beijing BRT system and the photo at right shows a dedicated wayside platform used in a demonstration project on the grounds of CSIR Transportek in Pretoria, South Africa, which illustrates a possible alternative to the approach used in Beijing (see also under “feeder lines,” below). (Photo left from China Sustainable Trans. Ctr., photo right from CSIR.)





**3(c) Provide a method to signal the bus driver that a waiting passenger requires a reduced gap.**



This approach is used to supplement other gap-reduction efforts by Metrobús, Mexico City's large and expanding Bus Rapid Transit system. It was suggested by Federico Fleischman (photo left) of Libre Acceso, a major disability NGO in Mexico. A passenger at the station door opposite the front entrance of the bus may press a button to activate a warning light seen by the driver of the approaching bus, who then has time to position the bus with special care. The driver then presses a button to turn off the light upon pulling out of the station. It should be noted that this approach should be

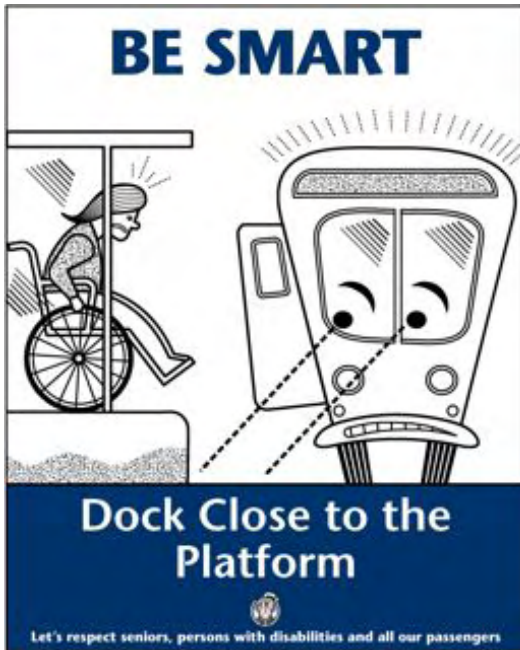
accompanied by driver training to assure that it is not seen as an "excuse" for not complying with required gap distances for all passengers. (Photo courtesy of AEI)

### **Training for BRT personnel**

The design solutions noted above are enhanced by proper training of bus drivers to avoid sudden starts and stops, to reduce speed before going around curves, and to drive carefully for the sake of all passengers. While some solutions to the bus-to-station platform gap do not require sustained training, other solutions do require such training. An innovative approach is reported from JANMARG, the recently-opened BRT system of Ahmedabad, India. They state "We have sensors at the bus stop doors for buses, and if the gap exceeds (the) applicable distance it will not allow the door to open and the driver has to re-align the bus."<sup>18</sup> It may be helpful when the station side is adjacent to the driver position rather than on the opposite side of the driver. This may assist drivers to better observe the distance between the bus and the station platform. The poster shown below highlights the importance of docking close to the platform and illustrates the need for specialized materials for Bus Rapid Transit drivers. The

<sup>18</sup> Correspondence from Anan Kiritkumar Sutaria of JANMARG, dated April 14, 2010

poster is contained in the World Bank's *Transit Access Training Toolkit*. Go to <http://go.worldbank.org/MQUMJCL1W1> to download this publication.



Station personnel also need periodic training and retraining, including the cross-training of station assistants, security staff, and fare personnel to provide courteous service to seniors, persons with disabilities, and other beneficiaries of universal design.

### Training for first-time users

Wheelchair users who have become accustomed to the bus-to-platform gap will probably improve their ability to cross a modest gap, for example by backing on and off so that the typically larger back wheels cross first, making it easier for the smaller front wheels to cross. As with most other life activities, repeated use of a bus system leads to improved ability to quickly board and alight if gap distances are minimized. Blind persons also benefit from the opportunity to familiarize themselves with buses and

transit stations before using them for the first time in revenue service. See the *Transit Access Training Toolkit* for methods to familiarize the general public (Section 4) and persons with disabilities (Section 5) in the use of public transit systems by persons with limited mobility.

## Section 4

# High floor & low floor buses: Accessibility issues

**The problem:** Low-floor buses (25-45 cm from roadway to bus floor) on feeder lines generally provide better accessibility to bus entrances at bus stops than do high-floor buses (approx. 90-95 cm). This advantage does not apply to trunk lines, where both low-floor and high-floor buses are boarded from station platforms, hopefully at the same height as the bus floor. From the standpoint of accessibility for passengers with disabilities, attention is needed to assure that the interior design of low-floor buses does not create some problems.

**HIGH-FLOOR BRT BUSES:** Because wheel wells intrude far less into the passenger cabins of high-floor buses (photo below by AEI), they have flatter floor plans and seating plans that are intuitively obvious to passengers. This results in a number of advantages.



- It is often possible to have an additional door at the rear of the bus because the flat floor extends for nearly the entire length of the bus. This is usually not an option with a low-floor bus and can slow boarding and alighting at high use stations. The use of high-floor buses may enhance boarding speed at such stations and so decrease the dwell time at BRT stations.
- There is room for more passengers on the bus.
- The placement of seats allows for easy movement within the passenger cabin with fewer trip hazards, which is especially important for persons with disabilities and frail seniors.
- Passengers who are blind or with reduced vision have fewer obstacles to contend with and can locate seats more intuitively.
- For wheelchair users, the flat floor design opens up the option of locating a wheelchair securement position directly across from the front entrance on the driver side of the bus,

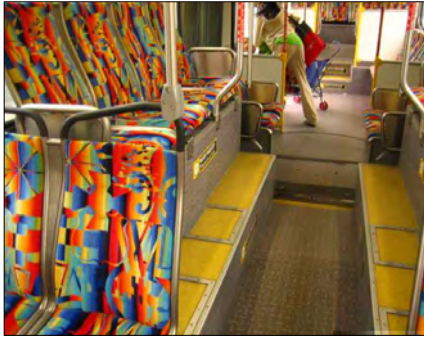
permitting straight entry across the bus with minimal turning movements into the securement area in order to ride in a forward-facing or rear-facing configuration. The lack of obstacles near the doors makes it possible to maneuver quickly into the securement area, using either the “North American” securement approach, with seat belts and other tie-downs or wheel clamps, or the “European” approach, without tiedowns but with a soft bulkhead behind the head of a rear-facing wheelchair user. It is recommended that a vertical stanchion be placed on the aisle side of the securement area to limit the movement of the wheelchair in the event of a sudden stop. (Note that the bulkhead is



relatively useless as a safety feature if the passenger is facing toward the front in the event of a sudden stop.) (Photo courtesy City of Cape Town – HHO Africa & ARG Design)

**LOW-FLOOR BRT BUSES:** Low-floor buses may require more attention to issues raised by the less regular floor and seating plan that often occurs with this type of bus. However, there is a trend toward improved design that may reduce or eliminate much of this concern.

Potential concerns with the use of low-floor buses:



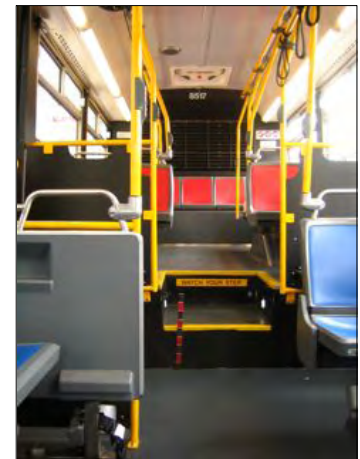
- Irregular floor plans (photo left) can cause the aisle to vary in width. While this would not normally impede the required dimensions at a wheelchair securement position, it can create an obstacle to movement by other passengers (including of course

passengers with mobility concerns or hidden disabilities) especially in the event of crush loads.



- Greater intrusion into the passenger cabin of wheel wells and other design elements normally under the bus floor (photo right) can result in seats being perched higher up from the floor of the bus. These seats require more maneuvering by passengers to gain access and also present safety issues when entering or leaving the seat. (Photos by Tom Rickert)

- Stairs are often required at the rear of a low-floor bus (photo at right), or, alternatively, a slanted floor is required which may in turn present safety issues. While this issue is minor when the stairs only impact a few seats at the very rear of the bus, in many designs the raised section at the rear of low-floor buses impacts a third or more of the passengers. Older or frail persons using a bus at peak hours may find themselves required by passenger movements to use this area of the bus. This may discourage such passengers from attempting to access the system at such times if they feel they will be at risk of a fall.



- For wheelchair users, the presence of the stairs has been observed to limit maneuvering room to get into a securement position. The photo at left illustrates this situation. This increases boarding time and may require relocation of the securement

area to an area where more turning motions are still required, thus also increasing the time required to board. (Photo courtesy of Eduardo Alvarez)

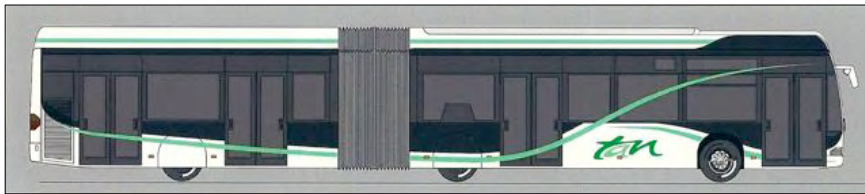
- Low-floor buses require low-level stations. Unless such stations are entirely enclosed, they may, in some configurations, be less secure if passersby can more easily enter the stations through the more easily reached open spaces opposite bus entrances. Unless such stations are equipped with fare gates and with sliding doors opening in tandem with bus doors, they

should be designed so that pedestrians will not take a “short cut” through them, and so that they will not be more vulnerable to thieves.

- In past years, low-floor buses in the USA have appeared to be less adaptable to true “level boarding” than high-floor buses observed in BRT systems in other countries.<sup>19</sup>

### **Recent improvements in the design of low-floor BRT buses**

Recent changes in low-floor bus and busway design in France, and elsewhere in western and northern Europe, may improve accessibility as bus wheel wells and engines are modified to create less intrusion into the passenger cabin. Several cities in France, including Rouen, Lille, and Paris, now have low-floor BRT systems that appear to perform well. A special case is Nantes, France, which is using higher-capacity low-floor articulated buses that permit boarding through four doors, thus enhancing passenger flows. (See graphic below from presentation by François Rambaud of CERTU, 6/07)



Nantes uses beveled curbs to assist buses to dock near the edge of the bus stops. Note that the curb is hardened and smooth to reduce wear on bus tires

(photo below). A short specialized “CD-style” boarding bridge at a single door is especially used by older persons and wheelchair users (photo at right). If extended to all doors, this superior approach could serve all passengers, as discussed on pages 10-12, above. A “European” securement system is used, without tiedowns. The photos are by Lloyd Wright. François Rambaud and others discuss systems such as that in Nantes, which are called Buses with a High



Level of Service (BHLS) rather than as the equivalent of Bus Rapid Transit, emphasizing passenger comfort.<sup>20</sup> Since BHLS is designed to meet the at-times unique conditions in Europe, it is possible that cost and other issues will make the BHLS concepts less relevant in

<sup>19</sup> Staff with the USA’s Federal Transit Administration, in a study of four low-floor BRT systems in the USA up to 2007, concluded that “No BRT line highlighted in this study has true level boarding. For loading and unloading, BRT is no better or worse than a top of the line conventional bus as far as many riders, including people with disabilities, are concerned,” noting that “the absence of level boarding . . . means that people using wheelchairs or other mobility aids and those who are unable to walk up steps must use lifts and ramps to board BRT vehicles.” Quoted from Winter, M, and Schneider, D, “Bus Rapid Transit and Accessibility: A synthesis of current practices in the United States,” at [www.tc.gc.ca/eng/policy/transed2007-pages-1283-1889.htm](http://www.tc.gc.ca/eng/policy/transed2007-pages-1283-1889.htm)

<sup>20</sup> Go to [www.bhls.eu](http://www.bhls.eu) for updates from European practitioners. A final report on BHLS by the European COST action is planned for the end of 2011.

developing countries. Nor have countries with BHLS systems faced the daunting magnitude of pedestrian infrastructure and feeder line issues discussed in Sections 5 and 6 below.

### **The larger context of this discussion**

This discussion looks at low-floor and high-floor buses from the viewpoint of accessibility for those who especially benefit from a more inclusive universal design approach. There are of course a great many other considerations and there is a long list of advantages and disadvantages that come from the use of one or the other approach. For example, the footprints of high-floor BRT stations may be longer due to the need for longer ramps leading to the station platform and this in turn may lead to more costly station design. On the other hand, the cost of high floor buses is lower in some countries than that of low-floor buses. However, this cost differential may disappear altogether in countries where economies of scale in manufacturing now favor low-entry. We have noted that the flexibility of enabling feeder line buses to enter BRT trunk lines will be strongly impacted by the selection of the main trunk line buses. Other concerns include the use of high-floor trunk line buses when deployed in emergencies, although bus stairwells, when covered by floor plates on the side away from the station, would permit emergency use albeit without access for wheelchair users unless lifts were installed and maintained for such emergencies.

Fortunately, research is going forward on matters affecting Bus Rapid Transit design and operation. The reader may wish to go to the websites of the USA's Transportation Research Board at [www.trb.org](http://www.trb.org), the Rehabilitation Engineering Research Center on Accessible Public Transportation at [www.ercapt.org](http://www.ercapt.org), or to a search engine for information on the Center of Excellence on Bus Rapid Transit, now in development.

### **Summing up the different advantages of low-floor and high-floor buses**

- |                                  |   |
|----------------------------------|---|
| <b>Low-floor bus advantages</b>  | <ul style="list-style-type: none"> <li>- Superior access for mobility-impaired passengers is a major advantage on feeder routes if stop infrastructure permits use of ramps</li> <li>- Faster boarding for all passengers on feeder routes if passengers are pre-paid and not delayed at the fare box</li> <li>- More compatible with use outside of trunk lines</li> <li>- May be more compatible with emergency services outside of trunk lines</li> <li>- Station may be less expensive due to shorter ramps, and the reduced station footprint may reduce the elimination of parking spaces for cars</li> <li>- History of use of highly accessible "CD-style" boarding bridges in Nantes, France, and Eugene, Oregon, at a door used by persons with disabilities</li> </ul> |
| <b>High-floor bus advantages</b> | <ul style="list-style-type: none"> <li>- Flat floor plan is more intuitive for most passengers</li> <li>- Superior seating plan more intuitive for most passengers</li> <li>- Greater capacity due to less intrusion into passenger cabin</li> <li>- Greater speed of boarding if space available for additional door</li> <li>- Faster boarding for passengers using wheelchairs, with shorter travel path to securement area</li> <li>- Possible safety advantage in higher stations with exposed open areas (possibly less fare evasion and better safety)</li> <li>- History of use of boarding bridges at all doors to provide level boarding for all passengers in Curitiba, Quito, Guayaquil, and Cape Town</li> </ul>   |

## Section 5

# Pedestrian infrastructure issues<sup>21</sup>

“Except (for the) BRT corridors the city has hardly any infrastructure for disabled people.” – a BRT planner in south Asia

The sheer size of the pedestrian infrastructures of large cities dwarfs even the largest transportation systems. The quality of this infrastructure is a major factor in the accessibility of all bus and BRT lines as passengers seek to access the system. A network of BRT corridors serving a city of a million inhabitants might include some 50 km of BRT corridors with 100 km of accessible sidewalks built alongside these corridors. But the same city might have far more than 2,000 kilometers of sidewalks or footpaths where sidewalks are needed. (Note: “sidewalks” are called “pavements” or “footways” in British English.)

A major reason why more seniors and persons with disabilities do not use public transit – especially in areas with emerging economies -- is simply that they cannot reach transit stops and stations. Roads with no sidewalks at all, broken sidewalks that are not contiguous, sidewalks jammed with vendors, motorcycles operating or parked on sidewalks, and the absence of a culture of safety may come together to sharply limit access to public transit.

*A full-featured Bus Rapid Transit corridor thus may begin its life as an island of accessibility in the midst of a sea of inaccessibility.* This does not make the access features of a well-designed BRT system irrelevant. Rather, it focuses on the role of BRT systems as a best practice to be copied by others. This comes about in two ways.

- 1) At their best, BRT systems provide a highly visible model of accessible design in the centers of a country’s largest cities. A BRT system can thus become a unique touchstone for exhibiting access features that can be copied elsewhere. BRT trunk line construction should incorporate access into the trunk line stations and into the sidewalks and intersections along both sides of each corridor as well as to major trip destinations near the trunk line. Indeed, trunk lines would normally be planned in order to serve these destinations. If at all possible, funds should also be budgeted to provide access features to key destinations along the entire length of feeder lines serving BRT trunk lines.
- 2) BRT systems can stimulate advocacy and planning for a growing network of accessible sidewalks reaching into neighborhoods that were previously inaccessible. By providing some access to many key trip generators such as shopping malls, hospitals, and universities, they stimulate demand for more access. For example, students at the Monterrey Technological Institute in Mexico City have carried out access audits to prioritize access to the “Insurgentes” line of Mexico City’s Metrobús BRT system.

The *Bus Rapid Transit Accessibility Guidelines* note that “Even when funds are currently lacking to upgrade access along feeder routes, the design of a BRT system should require a comprehensive long-term planning process to prioritize the systematic construction of accessible paths to feeder route bus stops.”<sup>22</sup> The box on the next page presents one approach to this concern.

<sup>21</sup> See Section 2 of the *BRT Accessibility Guidelines* and the Check List in Appendix A at rear

<sup>22</sup> From Section 2.5, Prioritizing Accessible Pedestrian Routes, *Bus Rapid Transit Accessibility Guidelines*

### **Composition of a typical planning body to coordinate the incremental growth of citywide pedestrian access to BRT and other public transit lines**

1) Clearly, several *disability advocates* would be participants, representing, for example, the city's Center for Independent Living or other major disability NGOs.

2) *Different city departments* (ministries) would also need to be represented, including (if they are organized this way)

- The Department of Public Works
- The Bus Rapid Transit operator and the BRTS fare concessionaire
- The Department of Transportation
- The Planning Department
- The Traffic Police
- The Departments of Social Services and of Public Health
- The Tourist administration
- The Chamber of Commerce or shopkeepers associations or other private sector agencies

In addition to the transportation department, the *Department of Public Works* is needed to make sure accessible sidewalks connect with transit stops and that the stops themselves are accessible. The *Traffic Police* help keep private cars and hawkers (vendors) from blocking sidewalks and transit stops. They also promote the safety of women, disabled passengers, older persons, and others who may fear for personal safety when using public transport. The departments responsible for *health and social services* would have suggestions for key sites to be prioritized for service by accessible transport, as would any government agency promoting *tourism*. And groups representing *commerce and businesses* have a stake in good sidewalks to attract customers.

3) *Transport providers* and *fare concessionaires* should be represented. Assuming the BRT system is run by one or more private providers under a concession with the city, and the other bus systems are run by many private providers in an association, representatives from the BRT operator and the bus association would be needed, and ideally from the larger bus companies as well. (The same may hold true for metered taxi operators or other operators of small vehicles.)

These various stakeholders could meet periodically to plan for accessible transport. They may call themselves an Accessible Transportation Committee (Rio de Janeiro) or an Accessible Transport Working Group (Mexico City) or some other name. Their functions are similar. The head of the working group will vary. In some cases this person may be an outstanding leader within the disability community and in other cases another "champion" of accessibility, perhaps from a government body, a social service agency, or a faith community. A single person or agency should be designated to coordinate or head up the planning process.

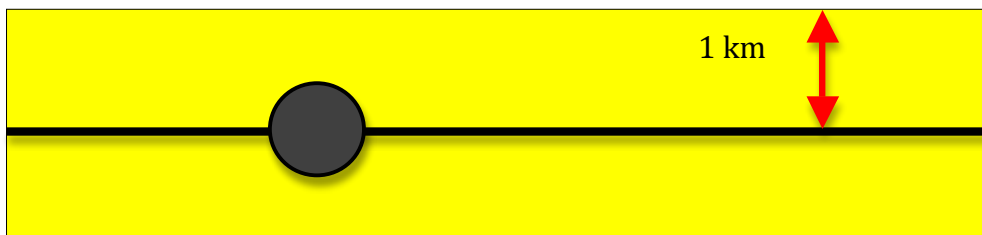
- Adapted from AEI, *Making Access Happen: Promoting and Planning Transport for All*, 2003, page 17.

It is not the responsibility of BRT planners working on relatively short-term projects of a few years to create massive improvements in pedestrian infrastructure in remote neighborhoods, often including urban slums at a distance from BRT trunk lines and sometimes ill-served by any public transit. But it is the responsibility of all stakeholders, including BRT planners, to call attention to good practice and hopefully initiate mechanisms to promote long-term incremental improvements. This is as much a reform that BRT systems can help bring about as the more obvious work of reducing traffic congestion or air pollution. The box above is based on observations in several cities over many years, including Mexico City, Rio de Janeiro, Moscow, and San Francisco.



The *BRT Accessibility Guidelines*, and more detailed guidelines for technical standards for access to public space and buildings, compile technical specifications that have evolved over many years based on research in several countries. Yet implementation in most countries reveals that there is a long way to go. The discussion below highlights some key issues that are especially creating problems in many cities. See Appendix B for technical resources.

Sidewalk issues: One of the biggest problems is sidewalks that lead directly into inaccessible places that trap wheelchair users, parents with baby carriages, or others with limited mobility. Blind persons and those with mobility concerns face special problems, although everyone suffers when they must navigate through trip hazards or slippery or muddy surfaces. The situation might be represented by the illustration below. If the black line represents a BRT trunk line and the black circle the accessible area around a BRT station, the yellow field up to 1 kilometer wide might represent the area from which many passengers could reach the trunk line. Yet only the black circle would represent the area from which the station could be reached by many frail seniors or persons with severe mobility concerns if the sidewalks were not accessible. Clearly, only a small portion of potential demand is captured in this situation.



Sidewalks need to be contiguous. Where property owners are required to construct sidewalks in front of their property, regulations should stipulate that the sidewalks must be continuous with adjacent sidewalks in order to provide a level path of travel along the entire street. Sidewalks also need to be well maintained. Today's accessible sidewalk may become tomorrow's inaccessible sidewalk due to lack of coordination between agencies installing utility poles, street signs, etc., encroachments by hawkers and street vendors, cars parked on the sidewalk, or trash or construction debris blocking sidewalk access. In many cases where minor obstacles on existing sidewalks and crossings block persons with disabilities and frail seniors, the investment of low funds can have a surprisingly positive impact on accessibility. This has been shown in a number of areas frequented by tourists.



Tactile guideway issues: The need for tactile guideways depends to a degree on the level at which blind or low-vision users are trained to navigate with a long cane. The need for tactile guideways may vary and this may explain their very low usage in North America and Europe, while they are far more common in many locales in Latin America, China, and Japan. The misuse of tactile guideways is very common. Guideways that lead into walls, street furniture, and other obstacles are found in most countries and contribute nothing to pedestrian accessibility. Guideways along sidewalks that are already bounded by a curb on one side and the side of a building on the other may not be needed. The tactile "guideway" at left is useless for blind persons on a footway that is already inaccessible to many persons. (Photo by Kit Mitchell)

**Tactile warning strips:** Warning strips are absolutely necessary when signaling a transition between safe and unsafe areas, as between a curb ramp and the street surface, or at the border of an unprotected transit platform. Warning strips should have a pattern of truncated



domes, also called attention patterns. Warning strips must highly contrast with their surroundings to assist all pedestrians, including those with limited vision. The photo at left is an example of poor color contrast while the photo at right shows better contrast



between a tactile warning strip and a transit platform. The emerging international standard clearly points to the use of bright yellow for such warning strips. (Photos courtesy of Lloyd Wright, left, and AEI, right)



**Curb ramps.**<sup>23</sup> On the one hand, curb ramps (curb cuts, or beveled curbs, to eliminate the obstacle caused by curbs at pedestrian crossings) should be as standardized as possible so that pedestrians, especially blind persons and those with mobility impairments, are readily able to use them. Yet few access features exhibit a greater variety than do curb ramps. Standardizing curb ramps in *new construction* along a corridor is achievable to a significant degree. Standardizing curb ramps when they are added to *existing sidewalks* may be difficult due to varying widths and slopes

of sidewalks and streets; the angles at which sidewalks, streets crossings (zebras), and streets intersect each other; overall terrain, and many other factors. Where possible, curb ramps should point directly at the opposite curb ramp across the street, not at an angle that would cause blind pedestrians to walk into the middle of the intersection, as in the above photo of an access point to a center-island BRT station. There should be at least color and tactile differentiation in the material used to mark the edge of a curb ramp where it meets the street. In all cases, curb ramps should have a smooth transition to the street, without ridges, especially because the angle of the curb ramp is typically compounded by the angle of the street approaching the ramp, combining to create a “trap” for the wheels of a wheelchair if a smooth transition and other good practices are not observed. The following priorities may be observed. (Photo above by Tom Rickert)

1<sup>st</sup> choice: Concrete curb ramps with *high-quality* tactile warning insets that provide color, sound, and tactile differentiation, patterned to face the pattern of the ramp on the opposite corner to provide guidance to blind pedestrians. Note that low-quality tactile warning material may quickly break down with use and should be avoided.

<sup>23</sup> See Section 2.2.1, Curb ramps, *Bus Rapid Transit Accessibility Guidelines*

2<sup>nd</sup> choice: Concrete curb ramps using colored material and without insets, with the tactile pattern in the concrete itself. Such curb ramps can be felt with a long cane and provide color contrast for persons who have low vision. This approach is durable and less expensive, but does not provide the best tactile contrast and cannot be felt underfoot.

“There was a fear of leaving an ... opening for wheelchairs (to reach a BRT station), as it might be used by two wheeler drivers.” – A comment from south Asia

### **A culture of safety and security is needed for all pedestrians**

A report from southeast Asia\* speaks of “the overwhelming importance of institutional and cultural problems” that prevent footways and bus stops from being used for their intended purpose. Part of this problem is what is known as “the tragedy of the commons,” that is, a tendency for people to feel they have a right to use public space without considering the rights of others. Access and mobility for everyone is harmed by motorcycles driving through underpasses meant for pedestrians, vehicles driving on what were meant to be pedestrian paths, delivery trucks parking in bus stops, or, in some cities, of intending passengers waiting for their bus by crowding into the traffic lane in front of a bus stop and making it impossible for bus drivers to pull up adjacent to the curb where it is easier for everyone to board. The first to suffer from these situations are women, children, seniors, persons with disabilities and others who must risk injury in order to navigate public space.

A related concern is crime, where the same categories of persons who most benefit from universal design are again the most vulnerable. Children, seniors, disabled persons and others may be afraid to travel to bus stops for fear of thefts or muggings. Women may fear to use public transport out of fear of being molested or becoming victims of rape. Deserted streets, a lack of “ownership” of public space by residents, poor lighting at night, and a lack of public space for local residents to gather may all contribute to this situation.

Different approaches are needed to these megaproblems in the world’s growing cities:

1. Opinion leaders, the media, and others need to publicly and consistently promote a culture of safety and security by not tolerating lawless behavior. Traffic police and other security personnel need the backing of municipal and other levels of government.
2. Different city agencies and other stakeholders need to coordinate their activities and work plans, meeting periodically to consider how to address crime and safety issues.
3. Targeted public education campaigns need to be coordinated with other approaches to involve the community.
4. Neighborhoods need to organize themselves to promote safety and accessibility. For example, an agency called Ciudad Viva is leading the way in bringing neighborhoods together in Santiago, Chile, to promote environmental action, mobility for all, and safe and sustainable neighborhoods. Similar groups are found in many countries and cities.
5. BRT systems could provide public restrooms at stations monitored by security personnel, as is being done in Mexico City, Johannesburg, Curitiba, and elsewhere. This could be a public convenience that also enhances safety and security.

\* “Improving accessibility in Penang State, Malaysia,” CGB Mitchell and Judy Wee, TRANSED Conference, Hong Kong, 2010.

Section 6Feeder bus, taxi, and service route issues<sup>24</sup>

Bus Rapid Transit systems have promoted a spectrum of reforms, including the reduction of pollution by using “green” buses to enhance air quality and the reduction of congestion by providing an attractive alternative to the private car. Another reform created by BRT systems is to introduce a transportation system that provides faster, safer, more comfortable rides for all passengers and new freedom for passengers with disabilities and others who especially benefit from universal design. On opening day many passengers may find a BRT system – and especially the trunk line BRT corridors – to be more inclusive in their design than other bus transportation modes, and also more inclusive than the varying degrees of access exhibited by pedestrian infrastructure in much of the city. This may come as a shock, because once people have an ability to travel on a BRT system, any difficulty in reaching the bus feeder line or getting to the BRT trunk line is more clearly revealed. But this shock can also motivate stakeholders *to use BRT systems as a catalyst to improve the quality of sidewalks and bus routes throughout the city*. Actions can be taken (1) to improve pedestrian infrastructure, discussed in Section 5, above, and also (2) to improve access to feeder line buses, taxis, and other public transport connecting with BRT lines, discussed in this section.

ACCESSIBLE FEEDER SERVICE

Although feeder service for disabled persons will mainly take the form of accessible fixed route bus or mini-bus service, accessible door-to-door taxi and van services should also be encouraged even if their scope lies outside of the mandate of BRT planners. This section will deal with both fixed route and door-to-door feeder services because both are needed.

Feeder lines in some BRT systems are newly created to formally connect with BRT corridors at transfer stations, while in other cases they in effect include the entire grid of existing bus routes served by nearly all the large and small buses that less formally connect with BRT trunk lines. Feeder lines may use low-floor or high-floor buses that may or may not also enter BRT trunk lines under different levels of control by and integration with the BRT operator. This results in different options and each option presents different issues in terms of universal design and accessibility.

The most difficult decision, with the greatest cost implications, is the method of providing feeder line access to passengers who cannot quickly climb steps to the bus floor. These groups include

- (1) most frail seniors,
- (2) many semi-ambulatory passengers including persons using crutches or canes, as well as others with hidden disabilities such as arthritis or heart disease,
- (3) many passengers who are carrying heavy packages,
- (4) pregnant women, or parents carrying children, and
- (5) wheelchair users.<sup>25</sup>

---

<sup>24</sup> See Sections 6 through 9 of the *BRT Accessibility Guidelines* and Sections 6 through 9 of Appendix A at rear.

<sup>25</sup> Of course wheelchair users in turn may be carrying packages or children.

Since wheelchair users are usually the smallest of these five groups, any solution that focuses on wheelchair users to the exclusion of the other groups is only capturing a small portion of the potential demand for level boarding. *Transit agencies should avoid the temptation to claim they are “fully accessible” when they provide partial solutions for wheelchair users while ignoring these other groups.* A discussion of some of the issues presented by feeder route accessibility, and tradeoffs that occur as different approaches are used, is best divided between feeder routes that do not enter BRT trunk lines and feeder routes that enter the trunk lines under varying degrees of control

### BUSES THAT OPERATE ON FEEDER LINES ONLY

The accessibility of all buses, whether low-floor or high-floor, is highly dependent on the design and maintenance of the bus stops or stations, the training and periodic retraining of drivers to drive safely and to align the buses correctly with the curb or platform edge, and the ability to keep other vehicles from blocking bus stops through the use of (1) sidewalk extensions or “bus bulbs,” (2) coordination with traffic police to enforce laws against illegal use of bus stops, and, when needed, (3) public education and enforcement to prevent passengers from standing in traffic lanes in front of bus stops.

These and related concerns depend a great deal on the local culture of safety and the enforcement of traffic and pedestrian regulations. While a well-designed BRT trunk line with exclusive bus lanes may be somewhat insulated from chaotic conditions in the surrounding environment, feeder lines are typically far more exposed to the obstacles created when different pedestrian, non-motorized, and motorized traffic modes indiscriminately use sidewalks and traffic lanes. Especially in congested urban areas, accessibility is one of the first victims of a lack of respect for traffic laws.

Although there are exceptions, in general low-floor buses provide a greater degree of accessibility at bus entrances than do high-floor buses serving stops along feeder lines. Low-floor buses are increasingly used on BRT feeder lines.<sup>26</sup> Ideally, low-floor buses permit each of the five groups mentioned above to board without climbing stairs. Most, but by no means all, of those in the five subgroups (except for wheelchair users) are able to board without the use of a ramp to further minimize horizontal or vertical bus-to-curb gaps. Often, a mechanical ramp is used to eliminate the gap for wheelchair users. If the vertical gap between the bus stop and the floor of the bus is significant, wheelchair users may find the angle of the ramp to be too steep to safely enter without the aid of an accompanying friend or of the bus driver. This is especially so when the bus is forced to stop away from the sidewalk and must deploy the ramp at a sharper angle to the street surface.

The section above on the advantages and disadvantages of low-floor buses indicates the need to procure feeder buses that mitigate the issues of seating and floor design that have historically created some accessibility issues once passengers have boarded.<sup>27</sup> Low-floor buses are increasingly common in North America and Europe and in other regions as well, in both BRT and non-BRT use.

---

<sup>26</sup> This also includes the use of “semi-low-floor” buses that are still able to board passengers using a ramp, under certain conditions.

<sup>27</sup> The floor plans of low-floor buses may dictate the location of the wheelchair securement area. Helpful diagrams with dimensions of a securement position on a low-floor bus are available by contacting Dr. Kit Mitchell at CGB (“Kit”) Mitchell at [kitmitch@googlemail.com](mailto:kitmitch@googlemail.com).

However, bus companies that operate over rough or unpaved surfaces or in rugged terrain may not be able to use low-floor buses but rather need to provide access to wheelchair users with lift-equipped high-floor buses with greater clearance between the bus body and the road surface. Also, high-floor buses may be chosen because in some cases they are less expensive, easier to maintain, and more robust in service.

### FEEDER LINE BUSES THAT ALSO OPERATE ON BRT TRUNK LINES

Preferred: Feeder buses that also operate on highly controlled “closed” BRT trunk lines.

Not recommended: Feeder buses that also operate on less controlled “open” BRT trunk lines.

#### Feeder buses on “closed” BRT trunk lines

A feeder bus system that is carefully integrated into a larger BRT trunk line system is more likely to be operated in an accessible manner. This approach is found in several cities. Typically, a single feeder bus design is chosen that can exhibit accessibility features such as audio and visual on-board signage and, to different degrees, access for those who cannot climb steps. Often, as in Cali, Colombia, the feeder buses may have high doors on one side for use at trunk line stations and low doors with steps, supplemented by ramps or lifts for those requiring them, on the other side for use at curb-side stops along feeder lines.

#### Feeder buses on “open” BRT trunk lines

This approach, which varies from region to region, would typically use various models of buses, perhaps operated by several companies, that then freely enter and operate along the BRT trunk lines. The trunk lines could also feature higher-capacity articulated buses limited to providing trunk line service. This interlining of feeder buses can create a number of concerns, especially if a variety of bus designs use the system. In general, it would be very difficult for such a system to consistently exhibit the driver training, audio and visual signage, minimal bus-to-curb and bus-to-platform distances, and so on that form the basis of inclusive transport design and operation.

High-floor buses will normally need wheelchair lifts to assist wheelchair users to board and alight at feeder line bus stops. While lift-equipped high-floor buses serve wheelchair users, they often fail to adequately serve the other four categories of passengers who cannot quickly climb the steps at the bus entrance. This is in sharp distinction to the level boarding made possible on BRT trunk lines that often combine high-floor buses with high platforms to provide level boarding for all categories of passengers.

### **Should lift- or ramp-equipped buses be mixed with other buses on feeder line routes?**

Option 1: Deploy a few lift- or ramp-equipped buses on many or all bus lines

There has been a tendency to compromise on the issue of access for wheelchair users by providing a fraction (e.g., one tenth in some countries, more in others) of the buses with ramps or lifts on feeder lines. In theory, a well managed and reliable bus service with strict schedule adherence could serve a significant portion of travel demand by wheelchair users with such service. However, the *Bus Rapid Transit Accessibility Guidelines*<sup>28</sup> list several challenges that must be overcome to achieve reliable service in practice for wheelchair users

---

<sup>28</sup> Section 10.1: Deployment issues on feeder line buses

when only a small fraction of the buses are lift- or ramp-equipped and these are scattered throughout the system. Deploying a sub-fleet of lift-equipped buses spread out over most or all lines may have an appearance of equality that appeals to everyone, including users within the disability community. But this may result in sub-standard service and create a vicious circle of unreliable service causing a lack of ridership that discourages all stakeholders. Hard-pressed transit agencies may then be tempted to skimp on wheelchair lift maintenance and the training of bus drivers to use the lifts, resulting in still lower ridership, in turn resulting in disillusionment by wheelchair users combined with discouragement on the part of transit personnel. In other words, this can readily become a lose-lose model marked by declining ridership by wheelchair users. This is not to say that such a model might not work as an interim measure, but it will require the ongoing attention of professional management to make it work.

**Option 2:** Phase in lift- or ramp-equipped buses on one line at a time, with all equipment accessible.

An attractive alternative may be to focus on one line at a time during a transition to a fully lift-equipped or ramp-equipped fleet. This should maximize ridership by providing a more reliable service at a level available to all other passengers. It also makes it easier to prioritize improvements to make bus stops and pedestrian infrastructure more accessible. Ideally, the most heavily travelled lines could be chosen for conversion first, or lines serving major trip generators such as universities or major shopping and residential centers. This can promote ridership and, in turn, help assure service reliability.

**Where should bus lifts be located?:** It is generally preferred that bus lifts or ramps are at or under the front entrance of the bus, under direct supervision of the bus driver without requiring the driver to leave his/her seat. Low-floor buses with lifts or ramps may not be able to accommodate wheelchairs passing between the protruding wheel wells toward the front of the bus, thus requiring access at the rear door. Lifts and ramps must of course have appropriate safety features that fully meet the requirements of a given city or country.

### **Do lifts or ramps slow down a feeder bus system?**

Transit agencies that opt for lifts on buses should avoid the extremes of predicting that “no one will use the lifts,” on the one hand, and “so many passengers will use the lifts that they will slow down the system,” on the other. Neither of these extremes is the experience of major transit systems with decades of experience operating lift- or ramp-equipped buses. The key to avoid slowing down the system is to make sure that wheelchair users know how to use the lifts and that bus doors and interiors are designed to allow room to maneuver into the wheelchair securement position(s). With practice, the boarding time is only a fraction of the time required when using a lift the first time. Research that quantifies boarding times of inexperienced wheelchair users needs to take this into consideration. Most human activities require practice and the use of wheelchair lifts or ramps is certainly not an exception. It must also be kept in mind that wheelchair users exhibit great variation in their ability to use wheelchairs with confidence, ranging from athletic persons with a great deal of upper body strength who can readily maneuver their wheelchairs in athletic contests or “pop a wheely” to overcome surprising gaps, to others who require a friend or attendant to accompany them when crossing even a small gap. In turn, some wheelchair users may wish to back onto a bus while others may find it works best to enter facing forward. Their preferences should be

honored in most situations, especially after they have accustomed themselves to using the system.

### Advantages of lift-equipped buses

- 1) They are flexible, permitting high-floor buses to provide access, often in rough terrain, to riders using wheelchairs.
- 2) They are somewhat less dependent on bus stop design than are low-floor ramp-equipped buses, as many models of lifts can be lowered to different ground levels ranging from a road surface to sidewalks of varying heights. Lift-equipped buses can readily be transferred from one route to another. This flexibility enables some transit operators to be less dependent upon close collaboration with departments or ministries of public works that are responsible for pedestrian infrastructure.
- 3) When new lift-equipped buses are procured, they can quickly be put into service in a highly visible manner that may appeal to stakeholders ranging from persons with disabilities to transit agencies and public officials.

### Disadvantages of lift-equipped buses

- 1) Lifts are expensive to procure and maintain.
- 2) Drivers must be well trained and motivated to use the lifts.
- 3) Lifts are not examples of “design for all.” They do not serve all categories of passengers unable to climb stairs at bus entrances and experience around the world shows that they end up being used primarily by wheelchair riders. This is partly due to attitudes by the general public, especially when passengers with hidden disabilities may not *appear* to require a lift.

### Two important access features that may be forgotten



Probably there is no combination of features that makes it possible for more passengers to begin to use a bus system than (1) reducing the height of the first step above the bus stop and (2) providing handrails parallel to the steps on *both* sides of the entrance and exit doors. Note that the passenger at right is stepping into the bus without the need to lift his body into the entranceway. Once within the stairwell, he is better able to use his upper body strength to mount the remaining stairs. The passenger at left must bend his knee at a 90-degree angle due to the height of the first step above the roadway. Consideration should be given to providing



feeder buses with a kneeler feature to lower the bus an additional several cm. when needed.

(Photos courtesy of TRL, Ltd.)



## Turnstiles make feeder buses inaccessible to many passengers

Turnstiles at bus entrances should be avoided. They make travel more difficult for seniors, passengers with disabilities, passengers carrying children or packages, and many others.

### What can be done about the thousands of small mini-buses and vans used in less-wealthy countries around the world?

The photo at left illustrates a problem that especially afflicts informal public transit systems, usually using small vehicles. Inexperienced and untrained drivers often drive unsafe vehicles on unsafe roads. This may be the largest challenge facing passengers who need to get to a BRT corridor that may or may not extend to the outlying area where they live. Better training, along with inducements for safe and accessible driving, are needed for many drivers, as well as better design and maintenance of mini-buses and the roads and stops used by them. Many cities are considering financial inducements to encourage drivers to replace older and contaminating small vehicles with newer “greener” vehicles that carry more passengers, thus reducing congestion. This is

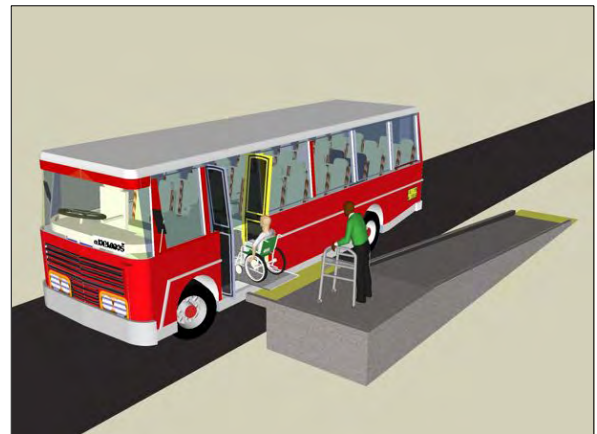


also an excellent opportunity to provide a spectrum of inclusive design features. The reader is referred to studies on this subject.<sup>29</sup> (Photo courtesy of AEI)

### Is there a “best option”



An ideal option would be to have bus stops provide truly level entry into feeder buses, using low-floor or high-floor buses with entrances closely aligned with bus stop surfaces or using high-floor buses with covered stairwells with boarding bridges to permit floor-level boarding in a semi-BRT mode. Illustrations of the concept show a low-floor bus (photo left), or a high-floor bus, shown at right with safety rails omitted for clarity. This approach could enhance the rapid



boarding and alighting of passengers while maximizing access for all passengers with difficulty climbing stairs. Either approach requires close and ongoing coordination between transit and public works authorities. A demonstration project is needed to clarify the advantages and disadvantages of such an

<sup>29</sup> Go to <http://www.research4development.info/SearchResearchDatabase.asp?OutputID=5544> to download “Access to Small Vehicles in Developing Countries,” by T. Rickert, C. Venter, et al.

approach to feeder line service. An alternative and less demanding approach would provide boarding platforms only at key sites, for use by persons with disabilities.<sup>30</sup> Note that the concept requires that the bus stop not be blocked by other traffic. The use of curb extenders (bus bulbs) would help address this concern. (Photo above at left provided by Kit Mitchell; Diagram at right courtesy of Jaime Osborne, for AEI)

**An update from Curitiba:** In addition to an accessible BRT fleet, 86% of Curitiba's feeder and other buses are lift-equipped with securement positions for wheelchair users. Curitiba's goal is to have 100% of its buses accessible to all passengers by 2014. All transit terminals in Curitiba are accessible via ramps and accessible bathrooms: the result of an improvement program that was completed in 2009. -- Report by Silvia Mara dos Santos Ramos, URBS – Urbanização de Curitiba, SA. August 23, 2010. sent to Juan Pineda in Medellín, Colombia.

## DOOR-TO-DOOR SERVICES USING TAXIS, VANS, OR MINI-BUSES

In some cases bus operators have stated that it would be more cost-effective if persons with disabilities were served by door-to-door vehicles such as metered taxis or vans or mini-buses. The implication is that such service is inherently more efficient than fixed route buses for this purpose. This is usually not the case.

### **Two myths about door-to-door service**

Myth # 1: A city can choose between providing access through fixed-route bus and rail systems or providing access with door-to-door service with smaller vehicles.



In fact, both are needed. There will always be a significant number of disabled persons and frail seniors who cannot use regular buses and trains much or all of the time. They will need door-to-door service of some kind, whether provided by automobile, taxis, vans, or mini-buses. Accessible fixed-route bus and rail services do not eliminate the need for such door-to-door services. (Photo courtesy of H.W.A. RehabBus in Singapore.)

Myth # 2: Door-to-door services are *less expensive* than accessible fixed route services

It is also a myth that door-to-door services are less expensive than fixed route bus or rail services. Door-to-door services may be provided by commercial operators at high cost per trip for wealthier persons. Or such services may be provided by government subsidized programs (e.g., Hong Kong, Cape Town, São Paulo, Curitiba, Moscow, and under consideration in Bogotá) or other agencies (e.g., Istanbul, Kuala Lumpur). The cost of door-to-door service is sufficiently high that in many countries, including the USA, efforts are focused on keeping door-to-door service exclusively for those who cannot use fixed route bus or rail services. As an expert in Sweden notes, "The main focus is to get disabled persons to

<sup>30</sup> Go to <http://www.research4development.info/SearchResearchDatabase.asp?OutputID=5542> to download "Entry into high-floor vehicles using wayside platforms," by C. Venter, T. Rickert, M. Mashiri, and K. de Deus.

travel by public transport instead of the special transportation services” even by offering public transport service free of charge.<sup>31</sup>

### **How do commercial taxis compare to subsidized vans or mini-buses in door-to-door service?**

- 1) Experience in the United States and Sweden illustrates that subsidized taxi service can play an important role in high-density metropolitan areas with large taxi fleets charging metered or zoned fares. Because taxis are distributed according to market demand, the cost of “deadheading” (running empty with no passengers) is reduced. Accessible taxis play a major role in providing service to passengers with disabilities in cities such as London or San Francisco. Ramped taxis could form an important component of any large city’s accessible services. Yet starting up subsidized taxi services in major cities has proven to be complicated in countries with emerging economies. Taxi services tend to be highly competitive and often weakly regulated. The initiation of ramped taxi services has been hindered by the higher cost of specialized vehicles, leading to complex and time-consuming initiatives to provide financial subsidies of various kinds to reduce procurement costs for taxis or to enable additional taxi licenses to be granted in exchange for operating these vehicles at least partially for accessible service. While some models of accessible vans may provide a partial solution by offering lower cost, research is needed to further lower the cost of accessible vehicles for door-to-door service.
- 2) Due to cost issues, door-to-door van or mini-bus services are usually limited as to trip purpose, for example for medical or school trips. Pickups can be clustered, or along corridors, to lower the costs per passenger mile of service. When serving central destinations (“many to one” or “many to few” trips, e.g., to a social service agency or selected stops at a university), a minimum load per vehicle could be required to lower the cost per passenger kilometer. In large metropolitan areas, a city could be divided into zones, with door-to-door service confined within each zone to lower costs per passenger mile by eliminating long cross-city trips.

### **SERVICE ROUTES**

The “service route,” also known as “community bus” in some countries, uses smaller vehicles on a defined route serving primarily seniors and persons with disabilities and with stops at trip generators of special utility to these users.<sup>32</sup> The concept originated in Sweden as an intermediate service between regular accessible bus service and accessible door-to-door van or taxi service. However, the trend in Sweden in recent years has been to phase out service routes. Nor has the use of service routes proven sustainable in some Latin American cities known to the author. One problem with service routes is the tendency to have insufficient passengers to help them pay their way, since the destinations are so limited. On the other hand, if the vehicles then offer service to other passengers, they may become too full to provide service for those for whom they are prioritized. With these cautions in mind concerning financial sustainability, service routes may nevertheless be a viable option for passengers whose needs cannot be met by accessible “mainstream” bus and rail transport.

---

<sup>31</sup> Email communication from Jan Petzäll of the Swedish Transport Agency, Dec. 17, 2009

<sup>32</sup> Some variations permit minor deviations from the route, perhaps in response to telephone requests between the mini-bus driver and the intending passenger.

## Section 7

# Working with the community

**The Problem:** It is important to enhance the role of persons with disabilities as advocates of Bus Rapid Transit systems in the midst of the “give and take” of different perspectives that impact on their final design. This role should inherently be a positive one, given that the trunk line corridors of BRT systems should readily lend themselves to the access features that assist the many groups that benefit from universal design. Due to fear, mutual incomprehension, and a lack of knowledge on all sides, this is often not the case. Too often, the opening day of a BRT system has been accompanied by media coverage of persons with disabilities stating that various access features are either inferior or lacking altogether. The largest single complaint heard from disability NGOs is that their input is not sought early on in the planning process.

### **Solutions:**

1. During the planning process: Bus Rapid Transit planners should be proactive in seeking out established disability NGOs and their friends to inform them about the positive features of BRT design and seek their input concerning how to enhance these features so that everyone benefits. Input can be informal, or one or more formal “focus groups” can be held with seniors and persons with different types of disabilities, keeping in mind that persons living along the main BRT corridors may have different input than persons living alongside feeder routes. As noted in a design guide for BRT systems in the USA, “The ability to focus on BRT characteristics unique to communities or system users during the design phase of the project allows early solutions and reduces potential for expensive fixes during the construction phases of the project. . . . By taking into consideration user safety, comfort, and accessibility right from the start, transit agencies can move forward more quickly and avoid the pitfalls and expensive cost of retrofitting.”<sup>33</sup>



It is important to provide orientation to leaders of disability NGOs to help them to understand the BRT planning process and the main technical issues that relate to their inclusive design and operation. For example, the South African Dept. of Transport brought together this group of disability NGO leaders and accessible transit experts from around the country for a one-day workshop to enhance the ability of

stakeholders to input into plans for inclusive BRT and other transit modes. This is one of a spectrum of approaches to better incorporate those who benefit from BRT as informed advisors and advocates for safe, accessible, and reliable public transportation. Helpful

---

<sup>33</sup> Project Action, *Accessibility Design Guide for Bus Rapid Transit Systems*, Executive Summary, page 11

orientation also can be provided by bringing disabled persons in a city which is only in the planning process to personally experience a BRT system in operation in a nearby city. In much the same way, it is important that BRT planners be oriented to the needs of seniors, persons with disabilities and others who especially benefit from universal design. **We have included a model text in this section, called “BRT and You” that may serve as a draft for the type of flyer that BRT planners may wish to use to introduce their work to persons with disabilities and their friends.** The flyer discusses some of the characteristics of BRT and how planners and potential passengers with disabilities can work together. (Photo on previous page by AEI)

2. During the construction process: It is a good idea to have knowledgeable members of the



disability community inspect construction of access features, as well as plans for the buses themselves, to point out any matters that may have been overlooked. For example, members of Mexico City’s Libre Acceso, a major disability agency, were invited by city authorities to inspect this ramp during construction of a BRT station on “Line 3,” one of a series of new corridors for Mexico City’s large and expanding Metrobús system. This is also a good time to prepare special orientation materials needed by disabled persons, including a guide to the system’s access features and also a Braille guide, as was done in Pereira, Colombia. (Photo provided by the

Secretaría de Obras y Servicios de la Ciudad de México, courtesy of Libre Acceso.)

3. Once the system is opened: There is always a need for an Advisory Committee, which can vary in composition. For example, Section 5 discusses an advisory committee composed of many different stakeholders on page 22 above, including persons with disabilities. Many systems find it is helpful to include knowledgeable persons with disabilities in various roles once the system is in operation. Persons with disabilities can serve at customer service or fare vending points in the city, or can help orient new customers to the features of the BRT system once it opens. This has been done with success in both Pereira and Bucaramanga, Colombia.

## BRT and You

For many people, “Bus Rapid Transit” (BRT) sounds like some technical term that would not interest them.

But the truth can be very different for persons with disabilities, because **BRT systems usually are built with a broad range of accessibility features that help all passengers but especially help persons with disabilities!**

- Wheelchair users should benefit from level boarding at BRT stations.
- Blind passengers, or passengers with reduced vision, should join visitors and tourists in benefitting from audio announcements on buses and at BRT stops and stations.
- Deaf, deafened, or hard-of-hearing passengers should benefit from text announcements in the buses and at stations.
- And women, seniors, and everyone else should benefit from safe, well-lit stations, easy fare payment, fast trips on special lanes just for the BRT buses, and a lot of other features of many or most Bus Rapid Transit systems.

**Planners must negotiate with many different stakeholders in order to build a BRT system.** These include local government, transit agencies, informal transit operators, driver associations, business groups, neighborhood associations, and many others. Everyone wants to have their say and sometimes people disagree. Some people may be afraid that a new BRT system will be against their interests. If disabled people do not speak up, their voices may not be heard. Persons with disabilities need to work with others to create options for mutual gain and to make sure they end up with a bus system that gives them reliable mobility.



**Many passengers benefit from the accessible design of León, Mexico’s, BRT system (photo courtesy of León BRTS)**

So here are some tips on how to make your needs known when the planning begins for a new BRT system, rather than after it is built and everything is harder to do. And here are some tips on how you can join other stakeholders and *support* a safe accessible BRT system.

1) **Find out** who the BRT planners are and how to contact them. **Set up a meeting** with them at an early stage when the planning process is easy to change. Treat planners and other transit officials with the same respect that you expect from them toward you. Try to avoid being too formal – a breakfast or lunch meeting may be a good way to begin. Remember, BRT planners should be your allies. So ask them how you can help them. Learn about the challenges they face in doing their job.

2) **Offer to participate** in discussion groups to recommend access features. And get to

know what features are most easily obtained. Sometimes there is surprisingly little that needs to be done. For example, if BRT stations can be reached by crosswalks near station entrances, there is less concern than if they must be reached by pedestrian overpasses that need elevators or very long ramps. Be alert to these important matters.

3) Realize that a BRT system helps to **reform** the way a city looks at its public transport. BRT bus drivers are paid by the hour or shift and will not need to race ahead to pick up passengers in order to take home more pay.

4) **Make sure there are plans** for level paved sidewalks, beveled curb ramps at intersections, access to the ramped BRT stations and into the buses, and on to your destination. But remember that a BRT system cannot reform everything at one time. While a newly built BRT system should provide pedestrian access to major BRT corridors and to feeder line service to these corridors, it may take a lot more time to extend a network of accessible sidewalks to areas far from the BRT corridors. Try to encourage a long-term planning process for better sidewalks everywhere, *alongside* the planning of the BRT system. (Sidewalks in distant neighborhoods cannot easily be *part* of these plans, because a BRT system is built in a shorter time span than is required to provide sidewalks throughout a city.) A new BRT system can be a great *beginning* to build a more accessible city. It should serve as an *example* to be copied by others in future years and it should stimulate future accessibility improvements.

5) In addition to design issues, persons with disabilities need to promote **good training** of bus drivers and station fare collectors and security personnel, so that everyone knows how to be helpful and when to be helpful to persons with different types of disabilities. Make sure planners include special training so that bus drivers know how to dock their buses as close as possible to the station platforms. Offer to participate in training sessions so that BRT staff understand your needs and you understand the needs of BRT personnel.

6) Remember that mistakes do occur in the best BRT systems and that opening day is not a good time to assess what the system will be like a week or a month or a year later when lessons that are learned can hopefully be put into practice to improve the system. **Do not expect perfection on Day One**, but do identify problems and share your findings with the BRT management. For example, if bus drivers are stopping too far from the platform edge, request the BRT managers to provide them with better training.

7) If you feel you will benefit from fast and accessible BRT service, then **support those who also are promoting Bus Rapid Transit in your city**. Passengers have a right to have their voice heard by planners and the media. Persons with disabilities have a right to join others in requesting the benefits that can come from fast, accessible, and reliable public transport. Consider contacting public officials, newspapers, radio and TV stations, and social networks to add *your* voice to all the people who will benefit from Bus Rapid Transit in your community.

[Appendix A](#)

## Check list for task managers

Source: *Bus Rapid Transit Accessibility Guidelines*. See these Guidelines for background information. Some guidelines may have higher priority than others in given situations.

\* indicates new guideline based on recent international experience

See Resources in Appendix B for more detailed technical information

<b>1.0 PUBLIC PARTICIPATION ELEMENTS IN PLACE</b>	YES	NO
Has active outreach been conducted to identify and communicate with organizations of older persons and of persons with disabilities? *		
Focus groups of disabled persons have been utilized		
Advisory committee of disabled persons and seniors in place		
<b>2.0 ACCESSIBLE STANDARDS MET FOR PUBLIC SPACE ELEMENTS</b>	YES	NO
Sidewalks along length of trunk line corridors are at least 1500-2000 mm wide, with at least 900 mm clearance at obstructions, with proper overhead clearance		
Sidewalks in key side roads providing neighborhood access to BRT corridors are at least 1500-2000 mm wide, with at least 900 mm clearance at obstructions, with proper overhead clearance		
Surface condition of sidewalks OK (level, paved, side slopes not greater than 1-2%, drainage OK, non-skid, lighting OK)		
Tactile guideway design and use OK (guideways may not be required)		
Tactile warnings where required (e.g., at curb ramps & unguarded platform edges), with proper attention patterns and color contrast *		
Careful consideration given to advantages of grade-level crossings for passengers with disabilities and other passengers, as opposed to overhead crossings or underpasses *		
If grade-level crossing not possible, consideration given to advantages of underpasses to reduce vertical distance, assuming adequate safety and security features *		
Full-width curb ramps at all pedestrian crossings with gradient from horizontal not more than 1:12 (8%) and with smooth transition to street AND/OR continuous sidewalks (raised crossings) planned		
Other ramps with gradients appropriate to length		
Traffic signals pedestrian-friendly		
Audible signals where appropriate at crossings		
Pedestrian bridges include access features to assist disabled persons		
Long-term planning process in place for phasing in accessible sidewalks leading to feeder route bus stops		
<b>3.0 FARE COLLECTION</b>	YES	NO
Have the advantages of a flat fare for many disabled passengers been taken into consideration in weighing the relative merits of different fare structures?		
Fare cards user-friendly		
Fare card vending sites accessible to disabled persons		



<b>4.0 ACCESS AT TRUNK LINE STATIONS</b>	<b>YES</b>	<b>NO</b>
All stations served by trained station assistants and/or security personnel		
Stations display uniform design understandable to new users		
Ramps to stations not greater than 1:12 (8%) gradient		
Long stations have exits at both ends where possible		
One fare gate at least 900 mm wide		
Folding seats and isquiatic supports if off-peak waiting time exceeds 5 minutes		
Stations have sliding doors which automatically open with bus doors		
Adequate lighting		
Adequate color contrast		
Uniform signage, with icons and color coding to assist disabled or new users		
Audible warning at sliding doors		
Transit information in audible and visual formats, tactile format if desired by blind advisors		
Elevators planned where needed		
Transfer terminals have clear information		
Consideration given to bathrooms in stations monitored by security personnel*		
Accessible routes planned to connect stations and terminals with other transport modes (pedestrian paths, bicycle paths, inter-city buses, ferries, etc.)		
<b>5.0 PLATFORM TO BUS FLOOR GAP: 10 cm. maximum gap at front entrance, 7.5 cm. maximum gap preferred; gap eliminated if possible</b>	<b>YES</b>	<b>NO</b>
Station door prioritized for disabled users at front entrance of bus		
Station assistants trained to assist persons with disabilities and frail seniors		
Drivers trained to approach platforms with bus parallel to platform edge		
Bus design and platform design coordinated to eliminate vertical gaps and minimize horizontal gaps		
Gap eliminated for all passengers by boarding bridges lowered from all bus doors (typically refers to high-floor buses)		
Gap eliminated for all passengers by "CD-style" boarding bridges, preferably at all doors for all passengers (typically refers to low-floor buses)*		
Gap mitigated by use of beveled curbs, precision docking, and/or gap fillers		
<b>6.0 ACCESS AT FEEDER LINE STOPS</b>	<b>YES</b>	<b>NO</b>
Accessibility features phased in, prioritizing high-use bus stops		
Enforcement planned to keep bus stops free of other vehicles		
Shelters and waiting areas meet accessibility criteria		
All-weather concrete pads where no pavement exists		
<b>7.0 SPECIFYING ACCESS FOR TRUNK LINE AND FEEDER LINE BUSES</b>	<b>YES</b>	<b>NO</b>
Seamless integration of accessible station and bus design and operational features		
Full spectrum of access features included in specifications for trunk line and new feeder line buses		
<b>8.0 SIGNAGE AND ANNOUNCEMENTS</b>	<b>YES</b>	<b>NO</b>
Exterior signage meets or exceeds size and color specifications		
Interior signage and announcements meet needs of visually impaired and hearing impaired passengers		

<b>9.0 BUS ENTRANCES AND INTERIOR DESIGN</b>	<b>YES</b>	<b>NO</b>
Accessible travel paths checked on any buses with doors on both sides		
If low-floor buses used, floor and seating plans provide for smooth flow of passengers and do not present obstacles to passengers with disabilities, including but not limited to persons using wheelchairs *		
First step of new feeder buses not more than 25 cm above ground level		
Hand grasps on both sides of entrances and exits and meet specifications		
All turnstiles removed from feeder buses		
Consideration given to including a retractable first step or kneeler feature on those feeder line buses with a design where this can be done inexpensively		
Flooring is nonskid		
Adequate (plentiful) use of vertical stanchions and hand holds painted in bright yellow or other contrasting color		
Seating meets standards to keep passengers from sliding		
Prioritized seats for seniors, persons with disabilities		
Visual and audible stop request signals		
If wheelchair access, has consideration been given to the advantages of lifts or ramps deployable from under or at the front entrance, under direct observation of driver without driver having to leave seat? *		
If wheelchair access, securements meet all norms and safety regulations		
Have special circumstances (e.g., steep hills) been taken into consideration in specifying wheelchair securement methods and equipment?		
<b>10.0 FEEDER LINE BUS DEPLOYMENT AND WHEELCHAIR ACCESS</b>	<b>YES</b>	<b>NO</b>
Consideration given to deployment of wheelchair-accessible buses on prioritized lines with integrated phase-in of pedestrian access to prioritized bus stops		
Access for wheelchair users provided or to be phased in by some combination of raised bus stops, low-floor buses, lifts, ramps, and/or wayside platforms		
If personal assistance required to board/debark wheelchair users, service is reliably available using trained personnel		
<b>11.0 PUBLIC INFORMATION</b>	<b>YES</b>	<b>NO</b>
Public information will be available in alternative formats		
Phone and text phone number for complaints and commendations		
Accessible service center for walk-in passengers		
Accessible web site		
Public education campaign		
<b>12.0 TRAINING</b>	<b>YES</b>	<b>NO</b>
Driver training to include courteous and appropriate treatment of seniors, disabled passengers, and women, as well as smooth operation (avoiding abrupt starts and stops, slowing down before curves)		
Station assistants, security personnel, and fare personnel cross-trained to better serve passengers with disabilities *		
Consideration given to provision of orientation of new users with disabilities		
Training for emergencies includes policies regarding disabled passengers		

## Appendix B:

## Resources

The website is noted if available for downloading. For more information on inclusive public transport, go to the Resources section at [www.globalride-sf.org](http://www.globalride-sf.org) (and to “Accessibility of Bus Rapid Transit Systems” in the Resources section) or to <http://go.worldbank.org/MQUMJCL1W1>.

TITLE IN FOOTNOTE	DESCRIPTION
ADA	ADA Accessibility Guidelines (USA regulations), at <a href="http://www.access-board.gov">www.access-board.gov</a> .
AEI 2003	Access Exchange International (2003) <i>Making Access Happen: Promoting and Planning Transport for All</i> , at <a href="http://www.independentliving.org">www.independentliving.org</a> .
AEI 1998	Access Exchange International (1998) <i>Mobility for All: Accessible Transportation Around the World</i> , at <a href="http://www.independentliving.org">www.independentliving.org</a> .
AEI 2005	Access Exchange International (2005) <i>Transport for All: What Should We Measure?</i> , at <a href="http://www.globalride-sf.org">www.globalride-sf.org</a> .
BHLS	COST BHLS Buses with High Level of Service, <a href="http://www.bhls.eu">www.bhls.eu</a>
BRT PLANNING	ITDP (2007) <i>Bus Rapid Transit Planning Guide</i> , by Lloyd Wright, et al., at <a href="http://www.itdp.org">www.itdp.org</a> .
DfT	Department for Transport of the United Kingdom (2002) <i>Inclusive Mobility: A guide to best practice on access to pedestrian and transport infrastructure</i> , by Philip R. Oxley, at <a href="http://www.dft.gov.uk">www.dft.gov.uk</a> .
EMBARQ	World Resources Institute. News and events in the field of Bus Rapid Transit at <a href="http://www.embarq.wri.org">www.embarq.wri.org</a> .
ITDP	Institute for Transportation Development and Policy. For information on BRT systems in developing countries as well as accessible pedestrian and bicycle paths, at <a href="http://www.itdp.org">www.itdp.org</a> .
NN	Nelson Nygaard Consulting Associates, <i>Safe Routes to Transit: Bus Rapid Transit Planning Guide, Pedestrian Section</i> , at <a href="http://www.nelsonnygaard.com/Documents/Reports/Safe_Routes_to_Transit.pdf">www.nelsonnygaard.com/Documents/Reports/Safe_Routes_to_Transit.pdf</a> .
PROJECT ACTION	Easter Seals Project ACTION (2009) <i>Accessibility Design Guide for Bus Rapid Transit Systems: Executive Summary</i> , prepared by TransSystems Corp, at <a href="http://www.projectaction.org">www.projectaction.org</a> .
TRL, 2004	TRL Ltd. (2004) <i>Enhancing the mobility of disabled people: Guidelines for practitioners</i> , by C. Venter, J Sentinella, T. Rickert, D. Maunder, and A. Venkatesh. Published as Overseas Road Note 21, a project of the UK's Dept. for International Development, at <a href="http://www.transport-links.org/transport_links/filearea/documentstore/307_ORN%2021.pdf">http://www.transport-links.org/transport_links/filearea/documentstore/307_ORN%2021.pdf</a> .
US DOT	U.S Dept. of Transportation, “From Buses to BRT: Case Studies of Incremental BRT Projects in North America.” Mineta Transportation Institute, 2010
WINTER	Transport Canada, Proceedings of 11 <sup>th</sup> TRANSED, Michael Winter & David Schneider, “Bus Rapid Transit and Accessibility: A synthesis of current practices in the United States,” 2007
WORLD BANK, 2009	World Bank (2009) <i>Transit Access Training Toolkit</i> , compiled by Tom Rickert, at <a href="http://go.worldbank.org/MQUMJCL1W1">http://go.worldbank.org/MQUMJCL1W1</a> .
WORLD BANK, 2007	World Bank (2007) <i>Bus Rapid Transit Accessibility Guidelines</i> , compiled by Tom Rickert, at <a href="http://go.worldbank.org/MQUMJCL1W1">http://go.worldbank.org/MQUMJCL1W1</a> .
WORLD BANK, 2006	“Universal design features within the context of the costs and benefits of Bus Rapid Transit Systems,” by Tom Rickert. Available from <a href="mailto:tom@globalride-sf.org">tom@globalride-sf.org</a> .

## APPRECIATION IS EXPRESSED TO ALL WHO HAVE ASSISTED THE AUTHOR IN COMPILING THIS GUIDE

- Special appreciation to those who have reviewed sections of this guide: Mauricio Cuellar (Bogotá); Cheryl Damico (San Francisco), Amanda Gibberd (Pretoria), Gerhard Menckhoff (Washington), CGB Mitchell (United Kingdom), Juan Pineda (Medellín), Richard Weiner (San Francisco), and Lloyd Wright (Cape Town). While we thank our reviewers, they are not responsible for any inadequacies in this publication. The views expressed are those of the author.
- And we thank those who have made major contributions in terms of sharing their knowledge and resources over the past year, including but not limited to the personnel of Colombia's Ministry of Transport, Bogotá's Secretaría de Movilidad, Pereira's Megabús, Bucaramanga's Metrolínea, Cali's MIO, Medellín's MetroPlus, and also Lloyd Wright, Gerhard Menckhoff, and Kit Mitchell.

PHOTO CREDITS: Access Exchange International, Eduardo Alvarez, China Sustainable Transportation Center, City of Cape Town – HHO Africa & ARG Design, CSIR Transportek, Dept. of International Development of the UK, Karl Fjellstrom/ITDP, Greater Cleveland RTA, HWA RehabBus, Inter-American Development Bank, León BRTS, Libre Acceso, Gerhard Menckhoff, MetroCali, Mexico City Metrobús, Kit Mitchell, Nelson Nygaard Consulting Associates, Jamie Osborne, Carlos Pardo, Pereira Megabús, François Rambaud (CERTU), San Francisco Municipal Transportation Agency, Secretaría de Obras y Servicios (Mexico City), Siemens, South African Department of Transport, Valeria Sviatkina, TRL Limited, Unidad Operadora del Sistema Trolebús de Quito, The World Bank, and Lloyd Wright.

The findings, interpretations, and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the International Bank for Reconstruction and Development / The World Bank and its affiliated organizations, or those of the Executive Directors of The World Bank or the governments they represent.

The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgement on the part of The World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.