# Accessible Transportation and Mobility

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Accessible transportation is the passport to independent living for everyone. Mobility means having transport services going where and when one wants to travel; being informed about the services; knowing how to use them; being able to use them; and having the means to pay for them. For people with mobility, sensory, or cognitive impairments—many of whom are elderly—such a goal offers many challenges.

Accessible transportation encompasses

- Public transport services (subway, buses, taxis, paratransit); related operational procedures, ticketing, and travel information; and the design of such vehicles, terminals, and stops;
- Intercity, regional, national, and international transport by motor coaches, railway, marine vessels, and aircraft;
- Intermodal linkages;
- Personal vehicles; and
- The pedestrian infrastructure.

The following concepts have taken 30 years to develop and be generally accepted throughout the developed world:

- Impairments only become barriers when the environment in general, and the transportation system in particular, creates demands that the individual cannot meet.
- Accessibility should be achieved through thoughtful design and system planning for the whole population.
- Mobility achieved by uncomfortable, dangerous, or undignified means is not acceptable.
- Independence and the mobility required for independent living are rights.

Accessible transportation practices are promoted through the series of international Conferences on Mobility and Transport for Elderly and Disabled People (COMOTRED), supported by the U.S. Transportation Research Board since 1978. This initiative is recognized as the world's leading forum for the exchange of research findings and policy approaches on the subject (*1*).

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## STATE OF THE ART
### Policies and Legislation
Approaches based on human rights, nondiscrimination, and cost-effectiveness have been debated (*2*). Many countries are introducing legislation that requires transport services to be made accessible (*3,4*). The United States, Canada, Australia, and the United Kingdom all have human rights legislation, and Sweden has legislation aimed at normalization and integration.

Section 504 of the U.S. Rehabilitation Act of 1973 (implemented in 1979) was the first U.S. federal regulation regarding accessibility and mobility. In 1990, the Americans with Disabilities Act (ADA) made accessible and usable transportation a qualified civil right. The ADA is unique in that it covers public and private transportation providers and services in all modes, regardless of funding sources. The Federal Transit Administration has become active in complaint investigation and compliance reviews related to the ADA. Evidence to date suggests that, unlike Section 504, the ADA is effective in providing for accessible transport.

In 1979, Sweden passed legislation mandating that public transport be adapted, over a 10-year period, to the needs of disabled people. This legislation led to a holistic approach, with provision for automobile subsidies and accessible urban and intercity transport services. Regulations published in 1985 define adapted public transport for buses, trains, trams, subways, taxis, ships, and aircraft—but only for people who do not use wheelchairs. Despite progress, many barriers remain to be overcome (*4*).

In 1988, the British government published a recommended specification for local buses that would be easy for elderly and ambulant disabled people to use. Metropolitan legislation has required all new taxis in London to be wheelchair accessible since 1989. In 1995, the Disability Discrimination Act set the general framework for accessibility legislation. Regulations now apply to all new rail vehicles, and draft regulations for buses and coaches were published for consultation in August 1999. Proposals for accessible taxis have been published and draft regulations were expected by the end of 1999.

In Canada, the National Transportation Act of 1987 entrenched the concept of equal access to all. The Canadian Transportation Agency investigates complaints and conducts compliance reviews with regard to the National Transportation Act and Codes of Practice established for air, rail, intercity bus, communication, and related accessibility matters. Codes of practice for water transport were published in June 1999.

Many developed countries now have or are moving toward legislation, regulations, standards, or codes of practice that require accessible transportation. Some governments call for accessible options only, but the disabled community advocates totally integrated accessible service, and several countries require it.

Less developed countries have no requirement for accessible transport and face severe problems with poor-quality, inaccessible pedestrian infrastructures.

### Programs
The legislation described earlier has led to implementation programs in many countries. Some examples include the provision for accessible vehicles and services in the United States, Sweden, and Britain and accessible vehicle and equipment acquisition and technology transfer programs as part of a national strategy in Canada (*5*). Protracted lead times of 10 to 15 years often are allowed for such implementations.

Access and mobility issues have been considered in all U.S. Federal Transit Administration programs. They include research (Transit Cooperative Research Program), training (the National Transit Institute and other efforts), and information sharing and transfer. Project ACTION (Accessible Community Transportation In Our Nation), created in 1988 to fund cooperative demonstration projects by transit agencies and people with disabilities, is also active in training and in disseminating information.

**Research and Development**
Two decades of research, development, and operational experience have established a knowledge base for designing accessible transport.

*Trip Chains*
One important concept for accessible transport is that of the "trip chain" (*6*). A typical trip consists of many links (for example, home to curb, curb to vehicle, ride in vehicle, transfers, vehicle to curb, curb to entrance of building, entrance to destination). If any one link is not accessible, then the journey becomes impossible. Every link in the chain must be considered and improved as necessary.

*Access for All*
Many travelers have mobility limitations or handicaps due to a physical, sensory, or cognitive impairment; accompanying children or baggage; a language barrier; or unfamiliarity with the local area. In most countries, some 12 to 16 percent of the population have an impairment that limits mobility; however, 20 to 25 percent of public transport passengers at any one time usually have mobility handicaps. Therefore, designing and operating transport systems to be easy for everybody to use ("universal design," or "access for all") will improve transportation services for disabled travelers (*7*).

*Family of Services*
The Swedish experience shows that accessible public transport is best provided through a family of services (*4*):

- Mainstream public transport services (road and rail) accessible to people in wheelchairs, ambulant disabled people, and frail elderly people;
- Service routes that use accessible low-floor midi- or minibuses on routes close to housing for elderly and disabled people, health facilities, shopping, and other common destinations;
- Accessible taxi services with user-side subsidies to assist older travelers and those with mobility limitations; and
- Door-to-door services such as dial-a-ride, community buses, and voluntary car services for passengers who need assistance from house to vehicle, during travel, or at their destination.

In descending order, the above options cater to people with increasing mobility limitations, cost more to operate, and offer less opportunity for spontaneous travel.

To be effective, accessible public transport also requires accessible

- Pedestrian infrastructure (sidewalks, traffic signals, street crossings);
- Terminals, stations, and stops; and
- Travel information for people with sensory, cognitive, or linguistic impairments.

Access is best achieved when all sources of funding and all transport providers are considered, including public and private transport companies, nonprofit agencies, and private agencies for whom transportation is a supplemental service.

*Matching Supply to Demand*
Dial-a-ride has forced transit operators to examine the demand side of the equation, rather than simply supplying fixed route service. Early dial-a-rides were aimed at serving low-density areas, but the net result opened up a whole range of service possibilities (paratransit) for elderly and disabled passengers. For a passenger to be able to dial for service and request an estimated pick-up and drop-off time, the transit system must have automated dispatch and vehicle location systems. The travel market also can be segmented and trips matched and brokered to different providers according to multiple funding sources (for example, social service agencies and hospitals).

*Accessible Vehicles*
In Europe, and more recently in North America, access to urban transit has been transformed by the introduction of low-floor vehicles (*8*). Passengers in wheelchairs can board the bus via a simple ramp or directly from the sidewalk if the curb is raised at stops. In Europe, passengers in wheelchairs travel unsecured, facing backward against a backrest in a designated area. In the United States, riders in wheelchairs travel facing forward, secured. In Canada, both approaches are used. Introduction of low-floor buses invariably increases bus travel by people with small children or baggage, ambulant disabled people, and frail elderly people.

Accessible taxis, both purpose-built and modified vans, are becoming more prevalent. The use of lift-equipped intercity buses and accessible ferries, commuter trains, and intercity trains also is increasing.

In recent years, the number of physically disabled drivers has increased rapidly, largely because of more effective driver evaluation and training by driver rehabilitation specialists in formalized programs and technological innovations in vehicle conversion and adaptive automotive equipment. The safety issues involved are being addressed by developing national and international standards.

*Accessible Infrastructure*
New subways, extensions to old systems, and light rapid transit systems are being built to be accessible to passengers in wheelchairs (*9*). Germany is making existing subways accessible, and Sweden already has done so. The technical and financial challenges of retrofitting old systems are formidable, but several cities in Europe and North America are making progress. The Swedish railways are one example of what can be done for heavy-rail intercity services (*7*).

*Accessible Information*
Travel information about transit and paratransit services is being made accessible for people with sensory impairments. During travel, real-time information is available visually and audibly at stations, at bus stops, and inside trains and buses. Inductive loops are being used at booking and information desks, in stations (for public address systems), and in trains for travelers with hearing impairments. Travelers with visual impairments are being assisted with tactile and audible signage systems.

*Human Factors Studies*
Studies have established the ergonomic requirements for people with physical and locomotive impairments, and the requirements for people with sensory impairments are being established. The problems and requirements for people with cognitive, developmental, or mental impairments have yet to be clearly defined.

Human factors experts must be involved in the development of these accessibility guidelines. There are examples of guidelines developed without this involvement; these show that good intentions might not produce effective guidelines or regulations, even though the necessary information might be available.

## ISSUES

### Sustainability of Accessible Improvements
Issues raised by the cost of improved accessibility should be resolved by legislation and the progressive application of universal design. Improvements that benefit people with impairments should be viewed as improvements that benefit all passengers (*7*).

Paratransit services face continuing funding problems because fares are insufficient to cover costs and because demand almost always exceeds capacity. Achieving sustainability will depend on developing the right mix of services and creating innovative funding schemes. This topic is of particular concern in countries where public transport is privately provided.

### Suburban and Rural Mobility
Mobility in rural and suburban communities remains an issue. In the United States, the ADA eventually will ensure access to fixed-route transit systems and to complementary paratransit services. For areas without fixed-route service, no comprehensive program addresses transportation needs.

If demand-responsive services exist, they must provide equivalent service to people with disabilities. Often, however, such services do not exist. The broader mobility of seniors, people with disabilities, the poor, and others, regardless of locale, remains a challenge.

### Personal Vehicles
Personal vehicles account for more than 80 percent of trips made by older people. For seniors, the use of a personal vehicle is the single most important factor in maintaining an independent way of life. Until recently, emphasis has been placed on assisting younger, physically disabled drivers in terms of vehicle conversions, training, and other aspects. However, elderly drivers present a whole new range of challenges related to vehicle and equipment issues and to the physiological and cognitive aspects of driving.

Safety standards, codes of practice, assessment tools, and training, as well as research into Intelligent Transport Systems (ITSs) will be needed. In addition, a new class of vehicle will be required to provide independent local mobility for those who can no longer drive an automobile.

**Intelligent Transportation Systems**
ITSs have much to offer people with impairments. For drivers, ITSs can partly compensate for the physiological changes that make driving more difficult for older people while improving everyone's safety (*10*). The application of ITSs in public transport improves the efficiency of transit operations and enables the provision of multimodal trip planning information. Real-time information can be provided at bus stops and stations, in vehicles, and in the home (via the Internet and pagers).

The application of ITSs to guide visually impaired people as pedestrians and through terminals is under way. The requirements of elderly and disabled people must be incorporated during the development of ITS applications and in the presentation of electronic information.

**Research Funding and Dissemination of Results**
After two decades of steady progress, research funding for accessible transportation is being cut back throughout the developed world. Unless national research programs are rebuilt to address emerging issues, progress toward accessible transportation will falter, and substantial groups of people will remain unserved.

A systematic approach to disseminating best practices and facilitating technology transfer is essential to prevent duplication and to foster universal standards.

## LOOKING AHEAD
Worldwide, the population is aging, and the segment of the population older than 80 years old is increasing fastest of all. Because disabilities increase with age, the demand for accessible transport is expected to grow. Mobility is important for daily living, but people increasingly will have to stop driving because of health problems such as dementia and strokes. This shift will lead to greater pressure for alternatives to the car. Even the best public transport and paratransit services cannot provide the spontaneity and independence that car drivers desire.

Early in the millennium, an urgent need will develop for some form of neighborhood transport similar to the automobile, designed to meet the needs of people who can no longer drive. At the same time, concern over road safety will increase, because older people are more fragile and thus more vulnerable to accidents as pedestrians, transit users, and drivers.

**Policy Outlook**
As the concepts of accessible transportation and universal design become widely accepted, we anticipate the following developments:

- National and state legislation (similar to the ADA) that provides for accessible services in other parts of the world;
- Standardized accessibility regulations and codes of practice to provide uniform accessibility throughout the world and for all modes of transportation;
- Reciprocity of services regionally, nationally, and internationally to achieve complete mobility in the global village;
- Improved methods for consulting with disabled people;

- Improved training of management and front-line personnel on accessibility issues; and
- Increased emphasis on safe and secure travel for elderly and disabled people.

## Information Technology

Continuing development of ITSs and computers will mean that almost any technical improvement involving sensors, information, and control that we can imagine should become first possible, then affordable. Any information we require will be available via the Internet, pagers, and hand-held receivers. Sensors will show us what is around us and what hazards lie ahead. Automated vehicles and automated highways could transform cars into a new mode that combines the best features of public and private transport and is available to everyone. Nevertheless, controls and electronic displays must be accessible.

## Millennium Priorities

Research and Development in the next millennium will be geared toward universal design that will provide access for all. The following areas will be priorities.

*Socioeconomic Studies*

- Cost-benefit ratios of accessible systems and services, including analysis of cross-sector benefits and sustainability of accessible transport;
- Better demand forecasting methods;
- Needs of transportation disadvantaged people with cognitive impairments, multiple disabilities, and mental illness; and
- Increased emphasis on human factors studies.

*Technology and Systems*

- Securement and storage of mobility aids (especially scooters) in vehicles;
- Transfer systems in terminals and vehicles;
- Design considerations for elderly and disabled people in ITS developments, including accessible information;
- Accessible private cars for drivers who use wheelchairs;
- Accessible personal vehicles for neighborhood travel;
- Accessible water transport; and
- Worldwide accessibility standards.

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