

ACCESSIBILITY AND INCLUSIVE MOBILITY IN PUBLIC TRANSPORT: CURRENT PERSPECTIVES AND DEVELOPMENT DIRECTIONS

Abstract: Inclusive mobility is an essential pillar of sustainable urban development, ensuring equitable access to public transport for all categories of users, including people with disabilities, the elderly and other vulnerable groups. The study analyses the policies and strategies adopted by several European countries, with a focus on Germany, Sweden, France, Spain and Romania. It highlights good practices, such as accessible infrastructure, digitalisation of services and integration of public transport. At the same time, major challenges are identified, such as lack of funding, implementation gaps and resistance to change. Innovative solutions, such as modular capsules for the transport of people with disabilities, are also explored. The study provides recommendations for improving inclusive mobility in Romania, highlighting the need for a coherent national strategy, investments in modernisation and digitalisation.

Key words: inclusive mobility, accessibility, public transport, transport policies, digitalization

1. INTRODUCTION

Inclusive mobility is a fundamental concept in the sustainable development of cities, ensuring equal access to transport for all categories of users, including people with disabilities, the elderly and other vulnerable groups.

According to the United Nations, accessibility in transport is a fundamental right that contributes to the social and economic integration of people. However, the implementation of effective inclusive transport solutions faces numerous challenges, from insufficiently adapted infrastructure to the lack of coherent strategies at national and international levels.

[Figure 1] presents a conceptual logo illustrating an inclusive, accessible and fair public transport system. Inclusive mobility represents an accessible and equitable public transport system for all users, including people with disabilities and the elderly.



Figure 1. An inclusive, accessible, affordable, and fair transport system design logo

1.1. Clarifying the concept of inclusive mobility

Inclusive mobility refers to the ability of all users to benefit from public transport services without physical, economic or digital barriers. This concept includes:

- Physical accessibility – adapted infrastructure, low-floor vehicles, accessible platforms [1].
- Digital accessibility – intuitive mobile applications, digital billboards and audio announcements [2].

- Economic accessibility – fair fares and subsidy policies for vulnerable groups [3].

According to the International Association of Public Transport (UITP), more than 60 European cities have introduced strategies to improve transport accessibility. Nevertheless, the European Commission reports persistent gaps between strategic objectives and their practical implementation, especially in funding, monitoring and rural mobility [2][4].

1.2. Literature review and identification of gaps

The literature explores various aspects of inclusive mobility, but several important gaps remain:

- Policy and implementation gaps – while countries such as Germany, Sweden and France have fully integrated accessibility standards, in others such as Romania and Poland, implementation remains partial or delayed despite regulatory commitments [4].
- Digital accessibility – smart technologies are insufficiently integrated into public transport systems to support people with special needs [2].
- Social and economic impact – more studies are needed on the economic benefits of inclusive transport [3].

A deeper analysis of these aspects is essential for the development of viable and effective solutions.

2. COMPARATIVE ANALYSIS OF INCLUSIVE MOBILITY IN PUBLIC TRANSPORT IN SEVERAL EU COUNTRIES, INCLUDING ROMANIA

The comparative analysis shows that countries that have adopted an integrated approach, combining accessible infrastructure with digitalisation and coherent policies, have managed to develop more efficient inclusive transport systems.

Inclusive mobility is an essential element of modern public transport policies, ensuring equitable access to services for all categories of users, including people with disabilities, the elderly and other vulnerable groups. [5]

In the European Union, approaches to inclusive mobility vary significantly between countries, depending

on the existing infrastructure, national regulations and the level of digitalisation of transport services. This comparative analysis highlights the strengths and challenges of each country, focusing on the case of Romania.

2.1. Germany – A model of accessible infrastructure and advanced digitalisation

2.1.1. Strengths:

- Fully accessible infrastructure: Germany has implemented an extensive system of buses, trams and low-floor trains, stations equipped with lifts and ramps. According to the UITP report (2022), Berlin and Hamburg are model cities in terms of public transport accessibility [5].

- Advanced technology: Intuitive mobile applications, audio and visual announcement systems, and tactile terminals for visually impaired users.

- Effective national strategies: The Barrier-Free City programme financially supports the modernisation of public infrastructure for accessibility.

Good practice example: Berlin has implemented tactile guidance in all metro stations, making it easier for blind people to get around. [Figure 2] shows an example of accessible infrastructure in Berlin. [6]



Figure 2. Accessible infrastructure in Berlin [6]

2.2. Sweden – Integrated public transport and inclusion policies

2.2.1. Strengths:

- Universal accessibility: Free transport for people with disabilities and the elderly, low-floor vehicles, special spaces and adapted audio-visual systems.

- Integrated transport system: Connectivity between buses, trains and ferries, ensured by accessible infrastructure

- Progressive policies: The 2017 Accessibility Act obliges transport operators to ensure a barrier-free system.

2.2.2. Good practice example:

Stockholm offers on-demand transport services for users with reduced mobility, operating special vehicles through a digital booking system. [7]

2.3. France – Standardisation and financing for accessible transport

2.3.1. Strengths:

- Strict regulations: French cities must ensure full accessibility in public transport by 2030.

- Optimised infrastructure: Modernisation of metro stations by installing lifts and ramps, barrier-free pavements, tactile strips for the guidance of visually impaired people.

- Subsidies for accessible transport: People with disabilities benefit from reduced or free fares on public transport.

2.3.2. Good practice example:

Paris has developed the 'Île-de-France Mobilités' app, which provides accessible routes and real-time updates for users with special needs [8].

2.4. Spain – Focus on adapting infrastructure and educating staff

2.4.1. Strengths:

- Accessible transport: Vehicles equipped with wheelchair spaces, audio and visual announcements. [Figure 3] illustrates an accessible metro line in Madrid, demonstrating adapted infrastructure for passengers with reduced mobility.



Figure 3. Inclusive transport – metro - Madrid - May2024.

- Effective local policies: Barcelona and Madrid have adopted strategies for inclusive transport, with an extensive network of adapted buses.

- Staff training: Awareness campaigns and training programmes for public transport drivers.

2.4.2. Good practice example:

Barcelona has implemented automatic lifting platforms on buses to facilitate access for passengers with reduced mobility [9].

2.5. Romania – Significant progress in large cities, challenges in small towns

The population of Romania according to the 2021 Population and Housing Census is approximately 19 million inhabitants. Data collected by the National Authority for the Protection of the Rights of Persons with Disabilities within the Ministry of Labor and Social Solidarity, through the county and local general directorates of social assistance and child protection of the sectors of Bucharest municipality, show that, on

December 31, 2024, the number of people with various types of disabilities, classified as disabled, was 960,428, representing approximately 5.05% of the population of Romania. [10]

2.5.1. Strengths:

- Investments in modernised public transport: In cities such as Bucharest, Cluj-Napoca, Iași and Timișoara, electric buses and low-floor trams have been purchased.

Recent upgrades in Bucharest include the introduction of low-floor trams equipped with accessible doors and ramps. [Figure 4] presents an example of accessible low-floor tram access in Bucharest, in addition to accessible boarding areas, shows the interior of a modern highlighting reserved spaces for wheelchairs and visual guidance systems.



Figure 4. Inclusive transport – access door and interior with ramp - tram - Bucharest – October 2024

- Adaptation of metro stations: Some stations in Bucharest are equipped with lifts and ramps for accessibility, but there is no full coverage.
- Local initiatives for digitalization: Mobile applications such as “InfoTB” and “Cluj Bus” provide information on accessible routes.

2.5.2. Challenges:

- Uneven implementation: In small towns, adapted infrastructure is lacking or insufficient.
- Lack of a coherent national strategy: There is no clear legislation imposing uniform standards at national level.

Non-accessible intercity transport remains a major challenge in Romania. Most trains and bus stations are still not adapted for people with disabilities [11]. Inclusive transport in Bucharest, however, extends to buses equipped with ramps and designated spaces for passengers with reduced mobility. [Figure 5] illustrates one of these adapted vehicles.



Figure 5. Inclusive transport – bus - Bucharest – March 2025

2.5.3. Good practice example:

Cluj-Napoca introduced fully electric buses with ramps and low floors, providing one of the most accessible transport systems in Romania [12].

Good practices identified:

- Accessible infrastructure – adapted stations and vehicles, barrier-free sidewalks.
- Digital technology – accessible navigation apps, digital displays, audio announcements.
- Education policies – staff training and awareness campaigns

As a summary of Chapter 3, [Table 1] provides a multicriteria comparison of inclusive mobility in selected EU Member States, based on accessibility regulations, national strategies, and transport reports from Germany, Sweden, France, Spain, and Romania.

Table 1. Multicriteria analysis of inclusive mobility in selected EU Member States

Country \ Criteria	Germany	Sweden	France	Spain	Romania
Accessible infrastructure	5	5	4	4	2
Adapted vehicles	5	5	4	4	3
Digital accessibility	4	5	4	4	2
Legislation & policies	5	5	4	4	3
Practical implementation	4	5	4	4	2
Intercity transport accessibility	4	4	3	3	1

The values presented in [Table 1] are based on a comparative analysis of national transport policies, accessibility legislation, official reports from transport authorities and international organisations including the European Commission. [13]

Each country was assessed using a 1 to 5 scale, where 1 represents a very low level of accessibility implementation and 5 represents full or near-complete implementation at national or metropolitan level. The scores reflect the extent to which accessible

infrastructure, adapted vehicles, digital technologies and policies are implemented in practice and not only defined at legislative level. Therefore, this matrix supports the comparison between countries and helps identify implementation gaps, rather than providing exact statistical measurements.

3. SEPARATE PODS FOR THE TRANSPORT OF PEOPLE WITH DISABILITIES IN PUBLIC TRANSPORT

Currently, there is no large-scale implementation of separate “pods” attached to buses or trams for people with disabilities, but there are innovative solutions and experimental concepts that try to improve their comfort and safety, avoiding congestion at peak times.

3.1. Modular autonomous vehicles

Some companies are developing modular autonomous vehicles that can operate independently or can be attached to other means of public transport, thus creating dedicated spaces for people with special needs.

For example, the NEXT Future Transportation project in the USA proposed a system of pluggable modules, which can be attached to buses or operate individually, providing a separate space for passengers with reduced mobility [14].

3.2. Dedicated areas in buses and trams

- Several European countries, including Germany and Sweden have integrated dedicated areas for people with disabilities into buses and trams.

- In Japan, some buses have mini compartments separated by transparent panels to provide added safety and comfort for people with reduced mobility [15].

- In Germany, in cities such as Berlin and Hamburg, modern buses are equipped with separate spaces for wheelchairs and have easy-to-use access, including ramps and seats that adapt to different needs [16].

- Similarly, in the United Kingdom, recent models of public buses integrate flexible layouts and assistive technologies to improve accessibility for all passengers. [Figure 6] presents accessibility features such as adjustable ramps and priority seating [17].

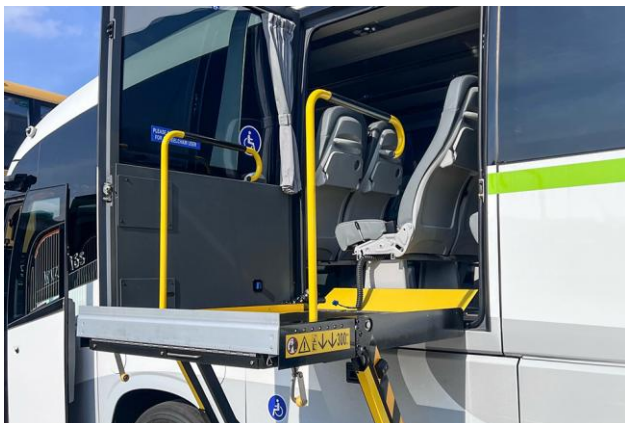


Figure 6. Inclusive transport – features for disabled people [17]

3.3. Trams and buses with extendable cabins

Another emerging concept is that of extendable modules that can be added to vehicles to provide additional space dedicated to users with special needs.

- In 2020, transport designers in France proposed a concept of extendable modules, which could be attached to the side of a bus to create a separate compartment for passengers with disabilities, thus reducing crowding in the main vehicle [18].

3.4. Hyperloop and individual pods

Although not a classic form of public transport, Hyperloop systems are futuristic concepts that propose individual pods for passengers, including those with reduced mobility. These systems may become, in the future, alternative solutions for fast and accessible transport.

The Hyperloop concept develops individual pods that could be adapted for urban transport, including for passengers with disabilities, providing an isolated and comfortable environment [19].

What could be implemented in the future?

- Autonomous modules that could be attached to buses and trams, providing a dedicated compartment for people with disabilities.

- Flexible compartments, which can be adjusted to adapt to transport requirements and passenger needs.

- Individual wheelchair pods, which would be automatically lifted and attached to the main vehicle for easier access.

The Ultra Vehicle represents a conceptual model of autonomous public transport. [Figure 7] shows the Ultra Vehicle design, which enables level boarding and space for wheelchairs. The Ultra Vehicle is based on conventional automotive technologies and is electrically powered with four rubber-tired wheels. Alternative interiors are available with individual or bench seats accommodating four to six seated passengers. The vehicle has a level entry from the station to allow easy access for wheelchairs, shopping or pushchairs.[20]



Figure 7. Inclusive transport – The Ultra Vehicle [20]

4. DISCUSSIONS AND FUTURE DIRECTIONS

Inclusive public transport is an essential component of sustainable urban mobility. Although there is significant progress internationally, many transport systems still face barriers to implementing accessible solutions. Future directions for development should include:

- Expanding accessible infrastructure and modernising transport vehicles.
- Implementing digital technologies for guidance and information.
- Increasing funding and improving regulations for inclusive mobility.

By adopting an integrated approach, public transport can become more equitable and efficient, ensuring access to sustainable mobility for all users.

4.1. Different countries and cities have adopted various policies to improve inclusive mobility:

- European Union: Strategy for sustainable and smart mobility promotes accessibility of public transport. [21]
- Germany and Sweden: Major investments in accessible infrastructure and digitalised transport.
- Romania: Regulations are in line with EU directives, but practical implementation is uneven, especially in small cities.

4.2. The comparative analysis shows that:

Western European countries have managed to integrate accessible infrastructure with digitalisation and coherent policies.[22]

Spain and Romania have made progress in large cities, but there are significant differences between developed and less accessible regions.

Romania needs to accelerate the adoption of coherent policies and allocate funds for the adaptation of interurban and rural transport.

4.3. Recommendations for Romania:

- Implement a unified national strategy, similar to the models in France and Germany.
- Invest in the modernisation of rail and interurban infrastructure to ensure full accessibility.
- Expand on-demand transport services for people with reduced mobility.
- Increase funding for digitalisation, including the development of real-time applications and information systems.

4.4. Challenges and implementation gaps in Romania

In Romania, the legislative framework concerning accessibility in public spaces and public transport is broadly aligned with European directives and provides a sufficient basis for the development of inclusive mobility policies. However, the transition from legislation to effective implementation remains inconsistent. Many public authorities face institutional limitations, insufficient financial resources and a lack of enforcement mechanisms to ensure compliance with accessibility standards.

As highlighted by Popescu [23], the principles of inclusive design require not only legal compliance, but also the creation of environments that enable independent, safe and dignified mobility for all users, including people with disabilities. Despite existing regulations, individuals with disabilities still encounter structural barriers such as inaccessible railway platforms, uneven or obstructed sidewalks, inadequate tactile paving

and limited access to public buildings and transport stations. These issues reduce autonomy and restrict participation in social and economic life.

Therefore, strengthening the enforcement of accessibility legislation, allocating stable funding and involving users with disabilities in planning and monitoring processes are essential steps toward bridging the gap between policy and practice and enhancing inclusive mobility at the national level.

CONCLUSIONS

This paper analysed inclusive mobility in public transport across several European countries, highlighting both progress and remaining challenges. Germany, Sweden and France demonstrate coherent strategies that integrate accessible infrastructure, digital technologies and supportive legislation, while Spain and Romania show partial implementation with significant regional disparities.

The comparative analysis confirms that inclusive mobility is most effective when accessibility standards are supported by national strategies, consistent funding mechanisms and local implementation capacity.

Countries with strong institutional coordination and user-oriented approaches—such as Germany and Sweden—achieve higher levels of accessibility in both urban and interurban transport systems. In contrast, Romania and other Eastern European states still face issues related to fragmented policies, insufficient funding and limited rural accessibility.

Inclusive mobility is not only a technical requirement but also a social obligation, contributing to equal opportunities and quality of life for people with disabilities, the elderly and other vulnerable groups. The findings underline the need for continuing efforts to bridge the gap between policy design and practical implementation, especially in regions where accessibility remains limited.

Future progress depends on sustained investment, digital innovation, stronger legislation enforcement and increased collaboration between authorities, transport operators and users.

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