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Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

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Editorial correspondence
Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples Federico II
Piazzale Tecchio, 80
80125 Naples (Italy)

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e-mail: redazione.tema@unina.it

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Aging population and the accessibility of public transportation services: policy perspective for Turkey

Süleyman Nurullah Adahi Şahin [a*], Abdulkadir Ozden [b], Ardeshir Faghri [c], Michael L. Vaughan [d]

[a] Civil Engineering, Sakarya University of Applied Sciences, Sakarya, Turkey
e-mail: adahisahin@subu.edu.tr
ORCID: https://orcid.org/0000-0002-9232-8104
* Corresponding author

[b] Civil Engineering, Sakarya University of Applied Sciences, Sakarya, Turkey
e-mail: aozden@subu.edu.tr
ORCID: https://orcid.org/0000-0002-3657-890X

[c] Department of Civil & Environmental Engineering, University of Delaware, Newark, DE, USA
e-mail: faghri@udel.edu

[d] Office of the Interim Vice Provost for Diversity & Inclusion, University of Delaware, Newark, DE, USA
e-mail: vaughan@udel.edu

Abstract
Projections indicate that elderly individuals will constitute approximately 25% of the total population within the next 30 years. As aging and mobility-challenged populations require targeted planning, policies and physical infrastructure related to public transportation must be reassessed with greater precision and inclusivity. This study offers a comprehensive evaluation of Turkey's national public transportation accessibility policies and explores their potential relevance for other countries. Additionally, interviews with four leading NGOs in Turkey were conducted to identify practical challenges faced by the elderly in urban transport systems. Thematic analysis of the feedback revealed critical deficiencies in vehicle design, fare policy, pedestrian infrastructure, traveler information systems, and driver behavior. Based on this multi-source analysis, the study proposes actionable policy recommendations to improve the accessibility, safety, and usability of public transportation services for elderly populations. The findings underscore the need for standardized design, stronger policy enforcement, and more inclusive digital and physical mobility solutions to ensure active aging and social participation.

Keywords
Accessibility; Urban mobility; Elderly people; Public transportation accessibility; Societal aging

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1. Introduction

In the past century, significant improvements in human longevity have led to noticeable changes in societal aging trends. According to the Organization for Economic Co-operation and Development (OECD), the proportion of the population aged 60 and over increased from 7.7% in 1950 to 17.8% in 2010, and is projected to reach 25.1% by 2050 (OECD, 2015). Fig.1 highlights the proportion of the elderly population in global averages between 1960 and 2023.

These aging trends have prompted research into the social and economic consequences of an aging population. The World Health Organization (WHO) identifies eight strategic domains essential to promoting age-friendly cities: "housing, outdoor spaces and buildings, transportation, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support and health services" (WHO, 2011). As the global population becomes increasingly urbanized, the demand for accessible and inclusive transportation systems is expected to rise accordingly.

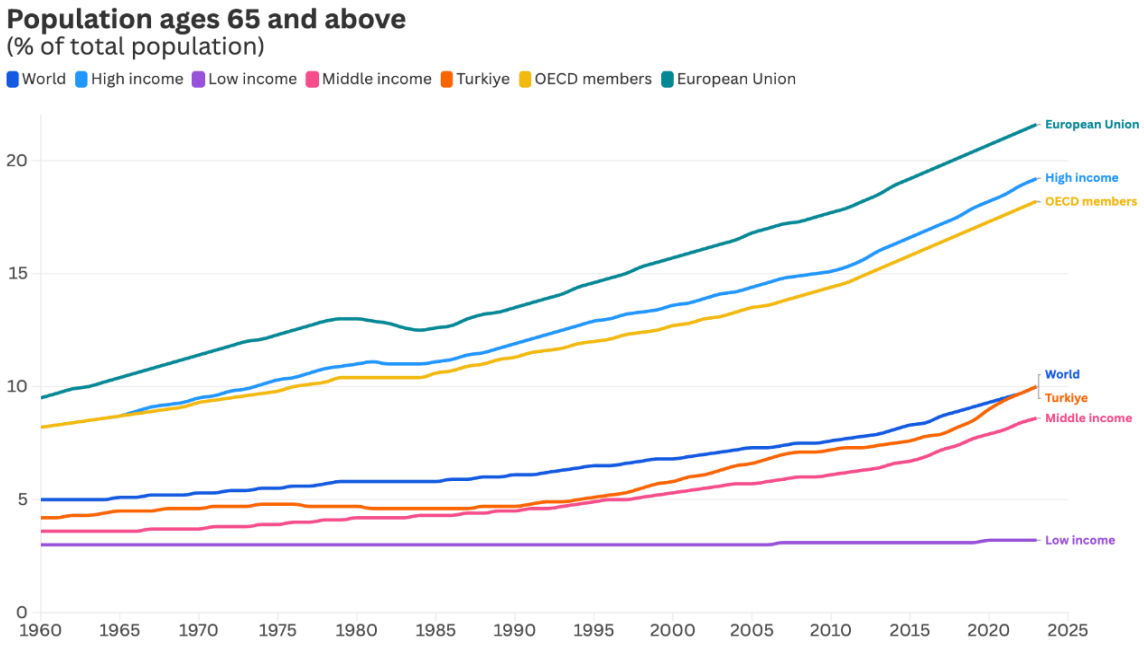


Fig.1 Trends in the proportion of the population aged 65 and above between 1960 and 2023, comparing Turkey with global averages, income-level groups, OECD members, and the European Union

Public transportation services, beyond forming the backbone of urban mobility, play a vital role in enabling daily activities. An efficient and inclusive public transport system can enhance urban mobility, reduce environmental impacts, contribute to public health, and support economic growth. Moreover, when "accessibility" is treated as a central parameter in the planning, design, and operation of transport systems, these services can more effectively meet the needs of mobility-challenged individuals, particularly the elderly. The steady growth of the elderly population underscores the urgent need to develop transportation approaches that enhance both accessibility and mobility. Urban strategies should be adapted to accommodate the needs of this demographic, making cities more accessible, safer, and inclusive through well-organized public spaces and mobility networks (Gargiulo et al., 2018).

1.1 Definition of accessibility and mobility

Mobility and accessibility are two foundational concepts in contemporary sustainable urban planning. Both contribute to the movement of people and goods in environmentally friendly ways that support our increasingly diverse, dense, and fast-paced lifestyles. Specifically, mobility and accessibility can pose significant barriers

for individuals with physical challenges, including the elderly. These factors are becoming increasingly important given the rising percentage of older adults in the global population.

Accessibility is a broad concept with multiple definitions and perspectives in the literature. Among the various definitions, those related to cities, buildings, and transportation predominantly refer to individuals with reduced mobility. According to Vuchic (2017), accessibility can be broadly defined as the ability to travel between different activities. It is often associated with the ability to access goods, services, destinations, or the ease of doing so (Sinha & Labi, 2011). This aligns with Engwicht's (1993) interpretation of accessibility as "the ease with which exchange opportunities can be accessed." Lynch (1984) similarly emphasized the element of ease through the notion of proximity, defining accessibility as "the general proximity in terms of time of all points … to a given kind of activity or facility." He further identified three sub-attributes of accessibility: diversity, equity, and control. For Grava (2003), accessibility also serves as a measure of a community's operational effectiveness and quality. Recognizing that transit must serve everyone leads to the principle of fully accessible transit (Vuchic, 2017), and is supported by Corazza et al. (2017), who emphasize that "a public transportation system needs to be accessible to people who can use it." Similarly, Banister (2005) states that the primary aim of transportation is "to maintain a high level of accessibility with trip lengths being as short as possible." In this study, accessibility refers to both the ability to use transportation services and the ease of using transit systems.

Beyond definitions, accessible transportation applies to public transport services, terminals and facilities, personal vehicles, and road infrastructures—especially pedestrian networks (Somenahalli et al., 2016). After age 55, private car usage declines steadily, while walking increases, and public transport becomes a preferred option, especially for those aged 75 and above (Hounsell et al., 2016). Transforming a city center into a pedestrian-friendly zone affects both accessibility and modal choices while also increasing the attractiveness of the area for new residents, workplaces, and retail businesses—thus increasing transport demand (Wang et al., 2015). The Bocca (2024) provides a strong conceptual framework for understanding how urban design principles, such as the "15-minute city" and the strategic use of public spaces, directly contribute to the accessibility and livability of urban environments. Transportation is no longer used solely for commuting between home and work; people now rely on it for social interaction and other daily activities. Therefore, accessible transport systems should be recognized not only as a key means of social connection for individuals with limited mobility but also as universal systems from which all users can benefit (Zając, 2016).

Mobility is another essential concept in the context of societal aging, especially regarding daily life and transportation. From Schwanen's perspective, mobility and independence are key components of well-being: mobility allows older individuals to engage in meaningful activities outside the home, while independent living grants control over when and where those activities occur (Schwanen & Ziegler, 2011; Banister & Bowling, 2004; Schwanen et al., 2012). Mobility involves how an individual moves, the physical and infrastructural conditions encountered, the quality of transport services, and the ease of movement. In contrast, accessibility concerns the purpose of movement and reflects the time, distance, and available travel options between a given origin and destination (Levin, 2019). The difference lies in that mobility refers to the quantity of trips made, while accessibility indicates how easily those trips can be accomplished (Fatima & Moridpour, 2019). As urbanization and the pace of modern life accelerate, "we live in a 'hypermobile' society that requires a high degree of mobility to participate in family and social activities, services, and economic life" (Cohen & Gössling, 2015).

1.2 Societal aging and mobility

The main focus has been placed on this issue within urban policy frameworks (OECD, 2015), which should support the development of urban models aimed at reducing the social exclusion of elderly individuals (Gargiulo et al., 2018). For senior citizens who are no longer part of the workforce, transportation plays a critical role in maintaining social interaction (Aguiar & Macário, 2017) and community engagement (Davey, 2007). To ensure

that elderly individuals remain actively involved in daily life, it is essential that public transportation systems offer adequate levels of mobility that meet their specific needs (Browning & Thomas, 2013; Dickerson et al., 2007; Ranković Plazinić & Jović, 2018).

Moreover, older adults wish to remain active participants in society and avoid being marginalized due to their age (Metz, 2017). In fact, their travel needs may even exceed those of younger individuals, as they often require more time for non-home-based activities and make more frequent trips for health care and social services (Kara & Bilgiç, 2021; Kara et al., 2025; Kim & Ulfarsson, 2004). A lack of mobility and accessibility can discourage elderly individuals from participating in community life, potentially leading to depression and loneliness (Atkins, 2001). The rising proportion of elderly people underscores the need for transportation systems to be accessible—this should be a top priority for transportation policymakers (Wong et al., 2018). In many cases, developing countries, also known as the Global South, fail to adequately prioritize mobility and accessibility in the planning and decision-making processes related to transit operations, which calls for further evaluation (Aguiar & Macário, 2017; Saif et al., 2019).

The primary aim of this study is to evaluate current policies on the accessibility of public transportation systems and to offer policy recommendations by integrating findings from the literature, current practices, and feedback from contacted NGOs. This research is organized into three stages:

- A comprehensive assessment of accessibility-related policies and practices in Turkey and internationally;
- Engagement with selected NGOs to evaluate, explain, and conceptualize key accessibility challenges in Turkey, and to identify shortcomings in current practices;
- Development of policy suggestions for decision-makers to improve the accessibility of transportation systems and enhance the mobility of elderly populations.

The scope of this study and the discussions with NGOs primarily focus on transportation services and the accessibility of related infrastructure. Key themes include transit vehicles, bus stops, transfer points, sidewalks, fare policy, and driver behavior. In addition, the study evaluates mobility options and levels of accessibility. Other infrastructural elements — such as the accessibility of public buildings or the availability of services for elderly individuals with special needs — were not considered within the scope of this research.

This study aims to identify and document shortcomings and gaps in current transportation policies and practices concerning accessibility for elderly individuals. It is also anticipated that these findings will align with the feedback received from NGOs that represent and support those most affected by these issues. Accordingly, this evaluation and its recommendations are intended to support relevant institutions and policymakers in addressing accessibility challenges in public transportation by strengthening policies and improving implementation.

2. Methodology

Proper characterization of an existing problem is essential to solving it. This study begins by examining research from Europe, Asia, and Oceania focused on transportation accessibility and mobility for elderly populations. The evaluation adopts a public transportation perspective, specifically analyzing vehicle design, infrastructure (e.g., sidewalks, walking paths, bus stops), fare policy, and driver behavior. This approach enables a deeper understanding of the issues involved and allows for the consideration of policies and practices implemented in other regions. Furthermore, current national policies in Turkey are evaluated and compared with those of other countries. As a second step, interviews were conducted in November 2020 with four major NGOs in Turkey that advocate for the rights of elderly individuals across various platforms. These organizations, primarily based in Ankara and Istanbul but active nationwide, were selected based on their expertise in elderly issues. The interviews employed an unstructured, face-to-face format with NGO leaders who possess deep knowledge of the subject. This method allowed for flexible, open-ended discussions centered on the study's core themes. As noted by Sönmez and Alacapınar (2013), unstructured interviews are

particularly effective when working with experienced participants, allowing the researcher to explore emerging ideas in depth. Due to the second wave of the COVID-19 pandemic in late 2020, the interview process was adapted to a hybrid format. Initial contact was made by phone to explain the study's purpose, scope, and interview themes. The final interviews included 10 questions addressing challenges faced by elderly populations in daily life—particularly regarding transportation and mobility—as well as their views on existing national policies and alignment with literature-based recommendations.

The NGOs involved in this process were:

- Plus Breath (Artı Nefes)[1];
- Elderly People's Rights Association (Yaşlı Hakları Derneği)[2];
- International Federation of Respect for the elderly people (UYSAK-Uluslararası Yaşlılara Saygı Federasyonu)[3];
- Seniors Council Association (TURYAK – Yaşlılık Konseyi Derneği)[4].

The qualitative data obtained from these interviews were analyzed using thematic analysis, following the approach proposed by Braun and Clarke (2006). This method was selected due to the relatively small number of interviews and the need for in-depth interpretation of open-ended stakeholder input. Thematic analysis enabled the identification of recurring themes while preserving the richness of participants' perspectives, making it particularly suitable for policy-focused qualitative research. Although alternative methods such as Framework Analysis might be appropriate for policy-oriented studies, the unstructured nature of the interviews limited its applicability here. Likewise, Content Analysis, which typically involves frequency-based coding and is more suited to larger data sets, would not have captured the depth of insight required in this context. Given that the study sits at the intersection of social policy and urban accessibility, and seeks to derive actionable recommendations through stakeholder engagement, thematic analysis proved to be the most appropriate. As Braun and Clarke (2006) emphasize, this method is widely used not only in psychology but also in social policy, education, urban planning, public service design, and participatory research. Feedback from interviewees — covering suggestions, critiques, and identified deficiencies — was compared against current Turkish national policies and large-scale practices. This comparison, along with international examples, helped assess key similarities and differences. By integrating expert NGO perspectives with relevant literature, the study proposes new policy recommendations aimed at improving national strategies for accessible transportation. These recommendations focus on promoting social inclusion, enhancing mobility and access, and supporting the physical and psychological well-being of elderly populations through improved service capacity.

3. Worldwide elderly people accessibility and mobility

Many policy, regulatory, and infrastructural decisions around the world aim to enhance the lives of individuals with reduced mobility. The European Commission's first formal identification of such individuals was presented in the Technical Specifications for Interoperability (Council of the European Union, 2008), offering a notably comprehensive definition. "Persons with Reduced Mobility" (PRM) refers to all individuals who experience difficulty when using transportation systems. These groups are summarized in Table 1.

A more recent version of the regulation (European Parliament & Council of the European Union, 2014) provides a broader and less disaggregated definition:

"Person with disabilities and person with reduced mobility means any person who has a permanent or temporary physical, mental, intellectual or sensory impairment which, in interaction with various barriers, may

[1] https://artinefes.org.tr
[2] https://yaslihaklaridernegi.org
[3] http://www.uysaf.org.tr
[4] http://www.uysaf.org.tr

hinder their full and effective use of transport on an equal basis with other passengers or whose mobility when using transport is reduced due to age."

TSI PRM
Wheelchair users
People with ambulant difficulties
People with children
People with heavy or bulky luggage
Elderly people
Blind people
Deaf people
Communication impaired
People of small stature (including children)

Tab.1 Categories of Persons with Reduced Mobility as defined by the European Commission, 2008

While it is clear that not all elderly individuals face the same mobility limitations, this study focuses on older adults who are capable of participating in daily travel. Under existing regulations, elderly individuals are generally included among persons with reduced mobility. Although maintaining mobility is a key goal, expanding accessibility opportunities is ultimately the most effective way to overcome mobility constraints. Elderly individuals primarily face three types of barriers to accessibility: facility and vehicle design, system operation, and cost (Ashford & Bell, 1979). Additionally, transportation and environmental planning efforts have historically tended to overlook the needs of older adults (Rosenbloom & Morris, 1998). As Wong et al. (2018) note, the growing impact of aging populations on transportation systems remains largely underrecognized by policymakers, despite evidence that many existing systems fall short of meeting the evolving needs of elderly users.

3.1 Seat and vehicle availability

Vehicle accessibility is among the most critical components of accessible transportation. One of the key difficulties faced by elderly individuals is the lack of available seating. Priority seats, often occupied by other passengers, are not always accessible or respected, compromising safety and comfort for elderly users (Wong et al., 2017). Ensuring seat availability is a top priority for improving accessibility for a large portion of this demographic. The culture of offering seats to those in need—including elderly individuals, persons with disabilities, and pregnant women—is generally promoted through education, in-vehicle signage, and public awareness campaigns encouraging respectful behavior (Wong et al., 2018). In addition, vehicle interior designs should prioritize safety and ease of movement, such as wider aisles, low-floor entries, and accessible seating arrangements across all public transport modes.

3.2 Fare policy

Accessibility and mobility in public transportation can be significantly improved for people with reduced mobility when cost-related barriers are eliminated. This can be achieved through fare policies that reflect the specific needs of elderly passengers (Zając, 2016). Providing transportation services through public subsidies or regulated fare discounts ensures affordability and encourages usage among elderly individuals (Metz, 2017). Wong et al. (2017) recommend expanding fare concession programs to include individuals aged 60–64 and offering full fare coverage for those over 80 to promote social engagement. In England, the concessionary

fare scheme—commonly known as the "free bus pass"—allows individuals over the retirement age for women to travel free of charge throughout the UK, with minor restrictions such as morning peak-hour exclusions (Shrestha et al., 2017).

3.3 Bus stop design

Walking distance and wait times are critical factors that influence public transport accessibility for elderly users. Excessive waiting times, compounded by weather exposure or inadequate seating, can discourage use. Therefore, it is essential that bus stops are designed to shield users from adverse conditions such as wind and rain and that they include seating areas (Shrestha et al., 2017; Wong et al., 2017). Visibility of incoming buses is also a significant design consideration. In Rome, a methodology was developed to assess the accessibility of bus stops, emphasizing the importance of weather protection, user-friendly information systems, and adequate infrastructure that corresponds to passenger demand (Corazza et al., 2017).

3.4 Traveler information system

Due to age-related limitations, many elderly individuals eventually cease driving, becoming increasingly reliant on public transportation (Whelan et al., 2006). As Goodwin and Lyons (2010) point out, elderly users rely on public transit more heavily than younger generations due to reduced driving and walking abilities. In this context, a reliable and accessible information system becomes essential. Information covering various operational aspects—such as schedules, routes, accessibility features, and fare structures—is crucial in empowering elderly users to navigate the system. Lack of access to such information remains one of the primary barriers for older adults (Hounsell et al., 2016). The rise of digital platforms poses further challenges, as many elderly individuals experience difficulties adapting to digital tools. In Beijing, Shi et al. (2020) analyzed smart card data to study travel patterns among the elderly, leading to policy suggestions that underscore the importance of information systems in understanding travel distance, duration, and frequency.

3.5 Accessibility to public transport facility

Various urban features—such as street lighting and traffic awareness—significantly influence elderly individuals' sense of safety and their ability to participate in social life (Gargiulo et al., 2018). Walking, a fundamental element of mobility, contributes to health and quality of life for many and is often the preferred mode of transport among elderly people. Enhancing walking paths is thus vital for promoting their greater integration into society. Alongside traditional methods for gathering, analyzing, and assessing data on walking behavior, new technologies such as GPS, GIS, and video-based techniques offer researchers more comprehensive data collection and analysis opportunities (Türken & Conticelli, 2024). Safety remains a serious concern, as elderly pedestrians are more susceptible to severe injuries, require longer recovery times, and may experience deeper psychological impacts than younger individuals in similar accidents (Shrestha et al., 2017). In Japan, new legal standards have reduced the slope of sidewalk ramps from 8% to 5%, and the curb height from 150 mm to 50 mm to improve pedestrian accessibility (Somenahalli et al., 2016). According to Mackett (2015), features such as more benches, public toilets, and improved street lighting can make walking more comfortable and appealing for elderly individuals.

3.6 Drivers' behavior

Many elderly passengers have reported that drivers often appear to be in a rush and fail to pay adequate attention to their specific needs. Some noted that vehicles frequently began moving before they were seated, while others mentioned that doors were closed too quickly, limiting safe boarding time. Therefore, road-based public transport operators must provide comprehensive training and guidance to drivers to raise awareness

about elderly passengers and to ensure safe, respectful driving behavior (Wong et al., 2017). In a study conducted in the United States, a joint training program involving interactive online modules—such as videos, presentations, quizzes, applications, and games—was developed as part of an EU Erasmus+ project and was identified by both trainers and drivers as a key tool for improving driver performance and motivation (Catenazzi et al., 2018). In addition, public transportation drivers should receive proper training in first aid and emergency response, which can be critical when transporting elderly passengers.

4. Turkey and NGOs' transportation policy perspective

In the population survey conducted by TURKSTAT, the population aged 65 and over—considered the elderly population—increased by 21.9% over the previous five years, reaching more than 7.5 million people in 2019. The proportion of elderly individuals in the total population rose from 8.0% in 2014 to 9.1% in 2019. The growth trends are illustrated in Fig.2, presenting projected elderly population through 2080.

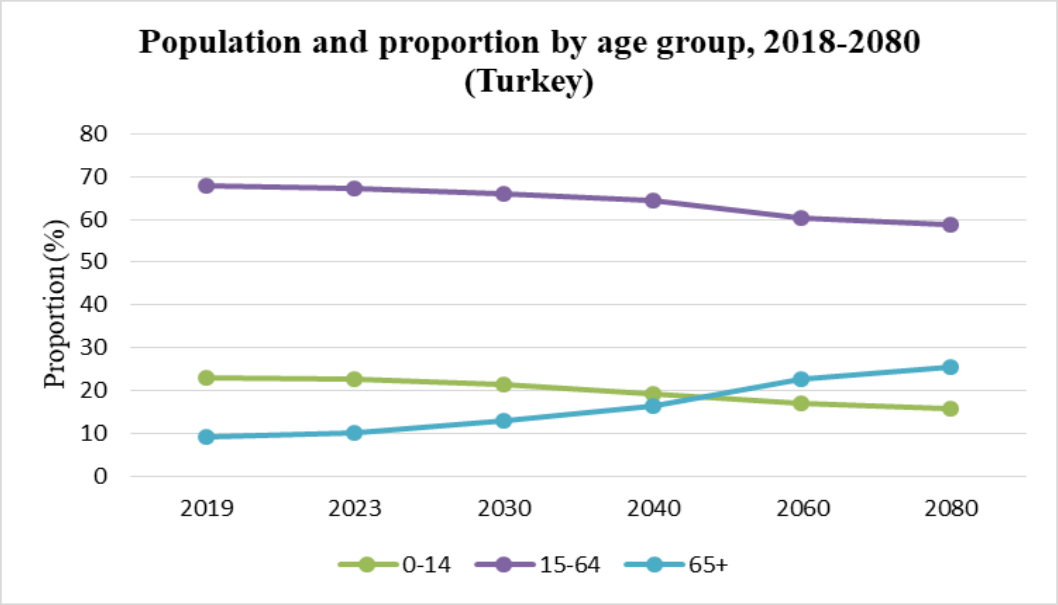


Fig.2 Population and proportion by age group, 2018-2080, Turkey

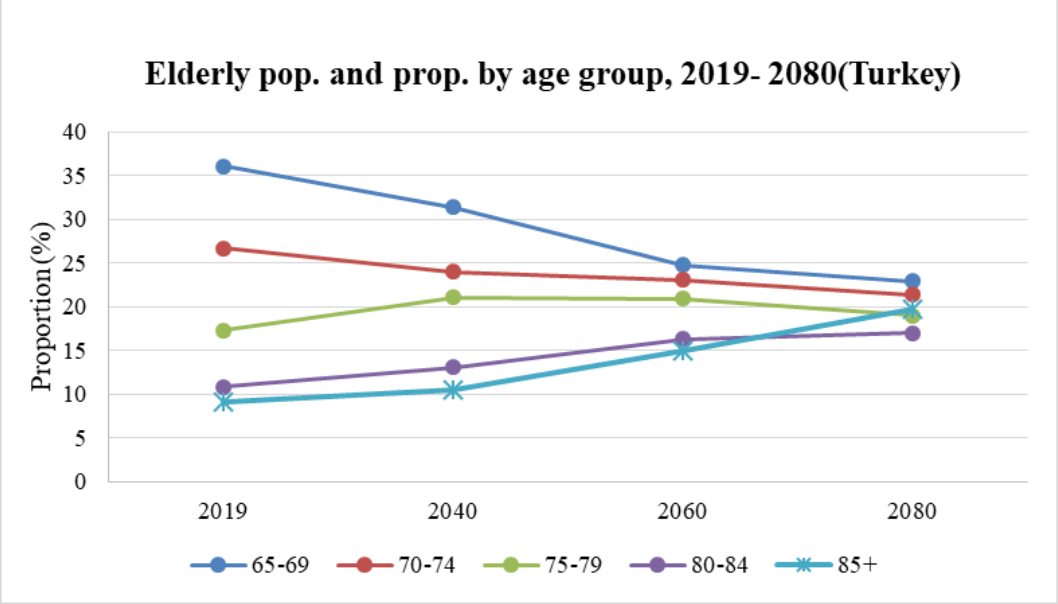


Fig.3 Elderly population and proportion by age group, 2019-2080, Turkey

In 2019, 62.8% were in the 65-74 age group, 28.2% were in the 75-84 age group, and 9.1% were in the age group of 85 and above. The population projections for elderly individuals and their age group proportions are shown in Fig.3.

4.1 Current national policies in Turkey

Considering the steady increase in the elderly population, policy recommendations and strategic planning for accessibility and mobility within national transportation systems have become increasingly critical. The travel behavior of elderly individuals largely depends on their residential environment, the geographical characteristics of the area, access to public transportation, cost of trips, and trip purposes (Goodwin & Lyons, 2010). Understanding the available public transport services, especially in terms of accessibility, is essential for elderly passengers (Hounsell et al., 2016). With regard to affordability, elderly individuals expect concessions such as discounted fares, simple and user-friendly ticketing systems, and transferable fare cards. Fare subsidies are widely used policy instruments to encourage public transportation usage among elderly populations. Such fare reductions are implemented at both national and local levels by governments and operators (Wong et al., 2017).

Vehicle accessibility

Low-floor public transport vehicles are used in many metropolitan municipalities — particularly in Istanbul — but this practice has not yet been adopted as a nationwide policy (Public Buses Operation Instructions, 2009). According to Articles 3 and 7 of Law No. 5379 on Persons with Disabilities (Official Gazette, 2014), all public and private transportation providers offering shuttle services are obligated to provide accessible transport services to persons with reduced mobility or students upon request, by the deadline of July 7, 2018. However, there is insufficient evidence confirming the full implementation of this regulation since 2012. Although priority seating for the elderly, individuals with disabilities, and pregnant women is a common practice nationwide, compliance is often weak, and such seats are frequently occupied by other passengers.

Fare policy

According to the "Free or Discounted Travel Cards Regulation," published in the Official Gazette on March 4, 2014 (No. 28931), Article 5 includes eligibility for elderly individuals, disabled persons and their companions, veterans, relatives of martyrs, and certain other groups. The Ministry of Transportation and Infrastructure (MTI) and the Ministry of Family and Social Policies (MFSP) are the two main authorities responsible for developing fare policies for elderly individuals and those with reduced mobility. Under the current policy framework, state-operated urban public transportation systems are free of charge for individuals aged 65 and over, while those aged 60–64 benefit from reduced fares. Additionally, these age groups are eligible for substantial discounts (often up to 50%) on rail, maritime, and intercity transportation services operated or supported by state institutions according to Free or Discounted Travel Cards Regulation (Official Gazette, 2014).

Bus stop design

According to the national guideline titled (Turkish Standards Institution, 2003) the design of bus stops plays a vital role in enabling safe and comfortable boarding and alighting for elderly and mobility-challenged individuals. Elevation differences between bus stops and sidewalks must be minimized to improve accessibility. Additionally, seating benches and grab bars must be placed appropriately, with consideration for wheelchair areas and protection from environmental factors. National design standards, such as TS 12576, provide guidance for minimizing barriers for persons with reduced mobility. However, these standards are

inconsistently applied due to infrastructure limitations such as narrow sidewalks, unauthorized curbside parking, and other physical barriers that hinder proper access to bus stops.

Traveler information system

Traveler information systems are currently implemented by local transport authorities and municipalities at varying levels of completeness. These systems include in-vehicle travel announcements, smart boards at stations and stops, as well as transportation information on websites and mobile applications (Turkish Standards Institution, 2003). However, challenges related to financial investment, technological capacity, and municipal size prevent standardization across the country. The Ministry of Transportation and Infrastructure (MTI) addressed this issue through the *National ITS Strategy Document and 2020–2023 Action Plan*, which aims to promote technology adoption and standardize traveler information systems by outlining the responsibilities of relevant stakeholders (Ministry of Transport and Infrastructure, 2020).

Accessibility to public transport facility

Sidewalks must be kept clear of physical obstacles to allow free movement for individuals with reduced mobility. Steep, narrow, angular, or uneven roads and pavements limit mobility and pose serious safety concerns. Pedestrian infrastructure must be designed with consistent elevation, smooth surfaces, and minimal gradient. Dangerous irregularities — such as drainage grids, extended parking chains, uneven paving, potholes, and sudden level differences — should be eliminated (Turkish Standards Institution, 2003). Despite the existence of national and local standards, many individuals with reduced mobility still face access challenges across Turkey. To ensure safe and unobstructed movement, sidewalks must offer adequate width, non-slippery surfaces, tactile routing, visual or audible warning elements, and clear headroom (Turkish Standards Institution, 2003).

Driver behavior

The *Urban Public Transport Bus Driver Level 3* national standard, published by the Turkish Confederation of Tradesmen and Craftsmen and announced in the Official Gazette on December 26, 2013 (No. 28863), outlines technical, behavioral, and attitudinal expectations for public transport drivers (National Occupational Standard, 2013). However, despite its comprehensive scope, implementation has been inconsistent, and the standard does not offer sufficient guidance regarding accessibility and mobility for elderly individuals. This lack of effective application is an important concern that policymakers must address in future policy revisions. In this regard, the establishment of the Accessibility Unit within the Ministry of Transportation and Infrastructure represents a promising step. The work and authority of this unit are crucial for enhancing transportation access and services for all individuals with reduced mobility, including elderly populations.

4.2 NGOs' perspective

Four prominent NGOs were contacted to gather insights on the state of public transportation with respect to elderly individuals. The interview questions were structured around the categories listed in Tab.2 and included open-ended questions to collect detailed views and suggestions from the participants.

Interview Categories
Increasing mobility as a result of the elderly people traveling less than other individuals
Deficiencies in public transportation due to the low frequency of using
Difficulties encountered on walking and pedestrian paths and infrastructural deficiencies

Deficiencies in public transportation in terms of social and psychological recovery
Transportation safety for elderly people
Driver behavior and training
Accessibility of bus stop
Five important policy suggestions for more accessible and mobile transportation
Current price policy consideration

Tab.2 Interview Categories Used in NGO Consultations on Elderly Accessibility and Mobility in Public Transportation

Vehicle accessibility

As the population ages, the need for accessible public transportation increases. However, NGOs emphasized several barriers that limit its usability for elderly individuals. The most common concerns included the insufficient use of low-floor vehicles and the frequent occupation of priority seating by other passengers. Additionally, NGOs pointed out the mismatch between sidewalk curb heights and the entrance steps of vehicles, making boarding difficult for elderly passengers.

Fare policy

NGOs expressed support for the current national fare policy, noting that free or reduced fares significantly enhance the daily mobility of elderly individuals. Increased mobility was credited with improving the physical and mental health of the elderly—particularly retirees who would otherwise remain at home. NGOs further suggested expanding these benefits to include intercity buses and air transport to better support the travel needs of elderly populations.

Bus stop design

It was reported that the integration between transport modes remains insufficient, particularly for elderly passengers. Long distances between transfer points were cited as a major issue. Additional concerns included inadequate infrastructure at stops — such as limited protection from weather conditions and insufficient seating capacity. NGOs recommended dedicated seating areas at bus stops for individuals with reduced mobility, similar to those found inside public transport vehicles.

Traveler information system

NGOs stressed the need to improve real-time information systems, ensure service continuity and frequency, and support trip planning from door to door. TURYAK, in particular, noted that current information—such as departure times and vehicle numbers—is often inadequate. NGOs emphasized the importance of installing electronic boards at bus stops that are both visible and easily readable for elderly passengers. They also underlined the need for mobile applications to be fully accessible. In large cities like Istanbul, providing large digital displays at modal transfer points—similar to those used in air travel—was recommended as a way to increase usability and confidence among elderly passengers.

Accessibility to public transport facility

While younger individuals may be able to navigate infrastructural deficiencies more easily, many elderly individuals experience significant difficulty and a sense of insecurity. NGOs considered this issue highly important. Specific concerns included excessive stair use and step heights exceeding 15 cm, lack of rest areas along walking routes, poor-quality sidewalk materials that cause tripping hazards, and slippery surfaces in wet

conditions. Proposed solutions included using non-slip materials, installing more urban furniture, and improving overall pavement design.

Driver Behavior

The effect of driver behaviors on elderly people, which in many ways can constitute a security problem, should be considered. Driving formats and vehicle placement techniques that cause drivers to pick up passengers without fully approaching the stations, opening and closing the doors quickly during boarding and alighting, and driving techniques that cause sudden acceleration and deceleration are among the main problems mentioned by NGOs. This situation considerably reduces the sense of trust experienced by elderly users within the transportation system. Transportation systems that are more accessible and mobile for elderly populations, encourages increased participation and integration into society. Encouragement of active aging, connection of other individuals, and dynamic and contemporary understanding of society are among the factors that will come as benefits of increased transportation accessibility and mobility.

5. Discussion and policy suggestions

Expectations of elderly populations for better and more accessible transportation were identified through a review of the literature and consultations with NGOs. These findings are presented under five main categories: vehicle design, fare policy, facility and sidewalk infrastructure, driver behavior and operations, and traveler information systems. Based on these evaluations, policy recommendations are provided for decision-makers to address the deficiencies identified in both the literature and stakeholder feedback.

5.1 In-vehicle accessibility

Vehicle accessibility is a common challenge for elderly individuals, both in terms of in-vehicle design features and ease of boarding and alighting. Although modern buses increasingly include features such as slip-resistant and low-glare flooring, low-floor (kneeling) platforms, and wheelchair ramps, these enhancements should be standardized across all public transport vehicles through comprehensive regulations and, where necessary, incentivized implementation.

In Turkey, vehicle accessibility is regulated by Law No. 5378, Article 50/Temporary Article 3, enacted in 2005, which states:

"Municipalities and metropolitan municipalities shall take the necessary measures to ensure that public transportation services offered or controlled by them are accessible to persons with disabilities. All public and private vehicles in operation must be made accessible within eight years from the effective date of this law." (Official Gazette, 2005).

Despite this legal framework, the definition and enforcement of "accessibility" remain ambiguous, particularly in vehicles not operated by municipalities—an issue most evident in small and mid-sized cities. NGO feedback highlighted the urgent need for low-floor and kneeling buses, especially in minibus services, which are often privately operated. Given that more than half of Turkey's public transportation fleet is managed by the private sector (including buses, minibuses, and paratransit vehicles), mid - and long-term policies — supported by enforcement mechanisms — are essential to ensure consistency and improve accessibility standards nationwide.

Another key concern raised by NGOs and supported in the literature (Wong et al., 2018) is the lack of enforcement regarding priority seating for elderly passengers. Public awareness campaigns should be launched to promote respectful seat use, and related educational materials should be disseminated through schools and public institutions. Additionally, in-vehicle visual aids — such as color-coded seats and stickers — should be

implemented not only on municipal buses but also across all modes of public transport, including privately operated services.

Interior design also plays a critical role in passenger safety. To reduce the risk of injury during sudden stops or turns, vehicles should be designed to minimize the severity of falls. This includes the careful placement and shaping of interior elements such as handrails, poles, and partitions, as illustrated in Fig.4.

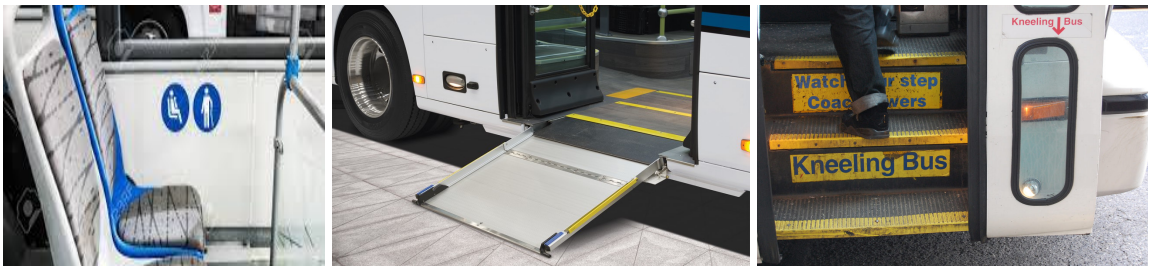


Fig.4 In-vehicle design and signage for elderly accessibility and fall prevention

5.2 Fare policy

Fare policies differ across countries, however, many provide free or discounted public transportation access for individuals over a certain age—commonly 65 and above, and in some cases, specifically for elderly women (Shrestha et al., 2017). Turkey's national policy is comparatively generous, offering free transportation for individuals aged 65+ and discounted fares for those aged 60–64 (Public Buses Operation Instructions, 2009). This policy was highly appreciated by the NGOs consulted in this study. However, NGOs also advocated for the expansion of fare concessions to include intercity bus services and domestic flights.

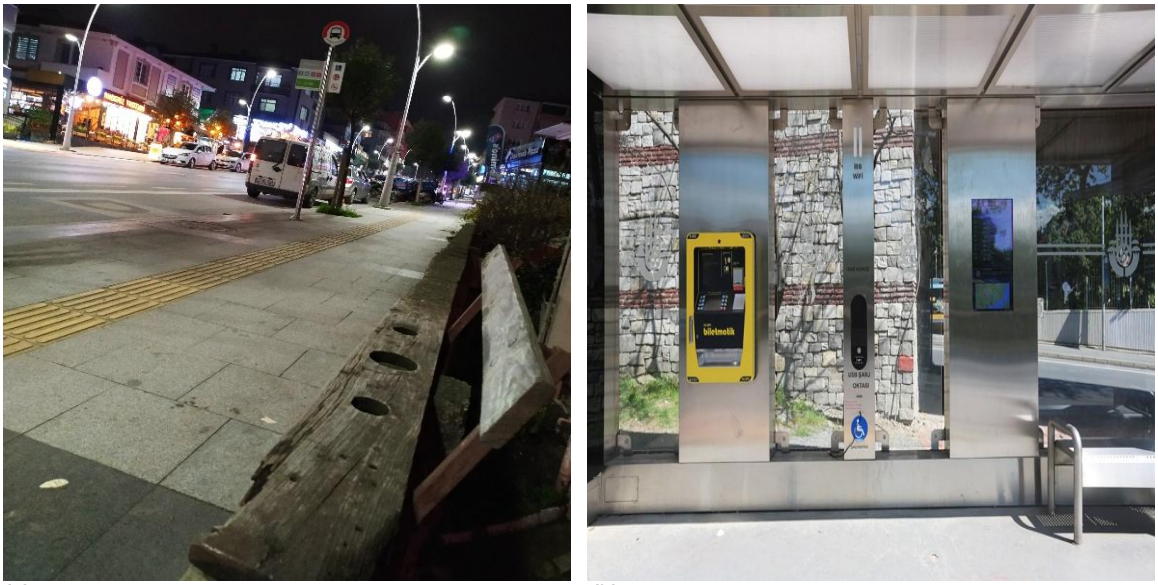
Higher usage rates of the public transportation by the elderly population raises the question of fare policy, specifically for the peak hours. The incentives provided to the elderly population should be managed in a way that does not constrain the use of public transportation by others. The most prominent solution was cited as limiting the free or discounted use during rush hours; however, it should also be noted that some of this 65+ age group may still be a part of the workforce and need to travel in these specific hours with commuters. Therefore, it is important that these individuals continue to receive this benefit.

5.3 Facility and sidewalks design policy

One of the most critical issues in public transportation infrastructure is the inadequate design of vehicle stops. Specifically, the lack of weather protection and insufficient seating at bus stops significantly contribute to elderly individuals' hesitation in using public transport (Wong et al., 2017). Pedestrian perception studies from developing countries also highlight how poor infrastructure and lack of pedestrian-friendly design exacerbate walkability barriers, especially for vulnerable groups such as the elderly (Ahsan et al., 2023). On the other hand, well-designed pedestrian infrastructure encourages active mobility and contribute to social sustainability (Rainieri et al., 2024). While not all stops are in poor condition (Fig.5), there is clear room for improvement. In contrast, urban rail stations, subways, and major transit hubs are generally satisfactory in terms of design, though issues related to crowding and limited seating can still make them less user-friendly for elderly passengers attempting to follow schedules or wait comfortably.

Improvement strategies can be grouped into two categories. First, physical upgrades to bus stops should include shelter from adverse weather, adequate and clearly designated seating for elderly users, improved visibility of approaching vehicles, and the use of clear markings and signage for seating priority and real-time or printed timetables. Second, enhancements to pedestrian access routes leading to vehicle stops should focus on uninterrupted, level sidewalks; standardized curb heights; and the use of non-slip, durable paving materials. Specific curb designs, such as Kassel-type curbs, can further facilitate safer and easier boarding and alighting for elderly passengers.

In suburban and peripheral areas—where public transport is less frequent and stop infrastructure is often neglected—traveler information becomes even more essential. While printed timetables and real-time digital boards are effective, reliance on mobile applications may not adequately serve elderly populations due to lower digital literacy rates. Therefore, information must also be presented clearly and accessibly at the stop itself.
NGOs also emphasized that service reliability plays a vital role in building trust among elderly users. Furthermore, during transfers between modes, the distance between connection points and the coordination of schedules are key factors influencing user decisions and perceived service quality.



(a) (b)

Fig.5 Bus stop example in Turkey: (a) poor condition (b) good condition

Public transportation accessibility for elderly individuals must consider the full journey chain, including walking to and from vehicle stops. Literature highlights the importance of pedestrian infrastructure, including adequate lighting (Gargiulo et al., 2018), consistent and low curb heights (Wong et al., 2017), and urban furniture such as benches and public toilets (Shrestha et al., 2017).
NGO feedback also raised concerns about inconsistent curb standards, even within the same neighborhood, which creates physical barriers for elderly users. Standardizing curb heights and ramp slopes—along with implementing traffic-calming measures at pedestrian crossings—would enable safer mobility for all, as illustrated in Fig.6.

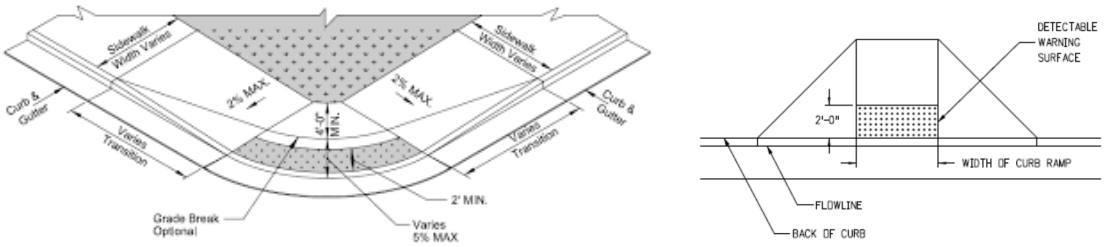


Fig.6 Examples of proper curb design

Additional concerns include sidewalk paving materials becoming slippery in poor weather, broken or uneven surfaces, and various physical obstacles. The design of sidewalks, walkways, and curbs has long been debated among urban design authorities in Turkey.
NGOs and civil society organizations should advocate for stricter implementation of national standards and push local governments to improve pedestrian infrastructure, especially during winter and rainy seasons.

Particular attention should be paid to ensuring that intermodal transfer surfaces are slip-resistant and elderly-friendly.

5.4 Driver behavior policy

Driver behavior is one of the most frequently cited concerns in both the literature and NGO feedback regarding elderly users' public transportation experiences (Mackett, 2015). Elderly passengers are particularly vulnerable to unsafe driving practices such as sudden acceleration and deceleration, which may result in falls or injuries. Failure to properly position the vehicle close to the stop, premature door opening or closing, and a general lack of attentiveness during boarding and alighting further complicate travel for elderly individuals. In many instances, drivers often fail to wait for all passengers to be safely seated before moving the vehicle, significantly increasing the risk of accidents. These issues are often attributed to the pressure placed on drivers to adhere strictly to time schedules, leading them to rush through passenger boarding and overlook critical safety considerations (Svärd, 2017).

To address these challenges, driver behavior should be continuously monitored, and regular theoretical and practical training programs should be implemented. Such training may include driving technique refinement, effective communication strategies, and psychotechnical assessments. In addition, transportation operations should be reviewed to reduce schedule pressure, thereby allowing drivers sufficient time to support safe boarding and alighting for all passengers—particularly elderly individuals. Lastly, roadway design and curb access must be improved to enable vehicles to stop safely and closely to boarding areas. Proper parking regulations and stop geometry should be enforced to support consistent and secure boarding conditions for elderly users, contributing to safer and more inclusive public transportation systems.

5.5 Traveler information system

Providing accessible and reliable travel information is essential for enabling elderly individuals to confidently use public transportation systems. As aging populations often experience challenges with rapidly changing technologies and digital tools, well-designed traveler information systems can help bridge the gap between service availability and actual usability (Hounsell et al., 2016). Real-time travel information — such as arrival times, route changes, and service disruptions — should be made available through multiple channels, including mobile applications, audible announcements, and digital displays at stations and stops. In international contexts, countries like the UK and Japan have implemented inclusive information systems that incorporate large-font digital displays, tactile interfaces, and multilingual options to accommodate elderly users (Wong et al., 2017; Lin & Cui, 2021). In contrast, Turkey's deployment of such systems remains uneven and limited to larger metropolitan areas. In many mid-sized cities and rural regions, the absence of real-time information at bus stops or the lack of user-friendly mobile platforms significantly impairs the travel experience of elderly passengers (Bozdağ et al., 2017). To enhance accessibility, Turkey can adopt policies that mandate standardized digital signage at transport hubs, simplify mobile application interfaces, and offer digital literacy support programs tailored for older adults. Additionally, audible announcements on vehicle arrival times and route changes can further improve confidence and independence among elderly travelers. The integration of traveler information systems must be accompanied by user-oriented design principles and inclusive technological infrastructure to ensure that elderly populations can plan their journeys effectively and safely.

5.6 Comparison of national policies with international practices

While the international literature offers a wide spectrum of best practices on accessibility for the elderly, Turkey's policy landscape shows only partial alignment with these models. For instance, Japan and the UK have implemented cohesive frameworks that integrate infrastructure, service design, and passenger support with the specific needs of elderly populations in mind (Wong et al., 2017; Lin & Cui, 2021). In contrast, Turkey's

approach has been more fragmented, with limited enforcement and regionally inconsistent applications, as observed in fare concessions and vehicle accessibility (Bozdağ et al., 2017). This gap between global benchmarks and national implementation suggests a need for more robust and centralized policy enforcement in Turkey. Moreover, while both Japan and the UK have institutionalized inclusive design principles—ranging from tactile guidance and step-free access to driver behavior training—Turkey's regulatory framework tends to focus more on compliance rather than proactive inclusivity (Bozdağ et al., 2017; Szeto et al., 2017). For example, despite the presence of relevant regulations such as Law No. 5378 in Turkey, practical adoption remains limited, particularly among privately operated vehicles. In contrast, the UK's Equality Act has not only shaped vehicle and infrastructure design but also mandated continuous monitoring and staff education, ensuring sustained attention to elderly users' needs (Wong et al., 2018). These contrasts highlight the opportunity for Turkey to translate its formal policy intentions into concrete and enforceable practices aligned with proven international models.

6. Conclusion

Transportation in Turkey plays a crucial role in reducing physical, psychological, and social disadvantages; and has become an essential component of daily life for elderly individuals. It supports their societal participation, fulfills their mobility needs, and facilitates access to vital services. However, in light of the growing elderly population, increasing urban density, and evolving lifestyle demands, current public transportation systems remain inadequately designed to meet the needs of individuals with physical and mobility-related challenges, including older adults. Despite certain improvements, significant progress is still required to enhance the accessibility of public transportation systems and infrastructure for disadvantaged populations.

This study provided a comprehensive evaluation of national and international policies and practices concerning public transportation accessibility for elderly populations. In addition to literature-based insights, interviews conducted with leaders of four major NGOs helped identify key challenges faced by elderly individuals in Turkey. The findings revealed that bus stop conditions, infrastructural deficiencies, and driver behavior are among the most pressing issues. Simple yet effective solutions—such as improved shelter design and seating at stops—were identified as practical and cost-efficient interventions. Furthermore, it is recommended that transportation authorities and municipalities establish regular in-service training programs for drivers and staff, in collaboration with relevant institutions. These programs should focus on communication skills, vehicle positioning, passenger safety, first aid, and emergency response.Although accessibility features such as low-floor platforms and user-friendly vehicle interiors have become more common in municipality-owned buses, these improvements are not consistently adopted by privately operated vehicles, including minibuses and paratransit services. Enforcement of existing accessibility regulations, along with gradual retrofitting of older vehicles, should be prioritized through coordinated efforts involving relevant stakeholders.

The introduction of free fare policies for individuals aged 65 and over, and discounted fares for those aged 60–64, has been well received by elderly passengers. However, there is a growing need to extend these policies to intercity transportation services, including rail and air travel. Another major concern is the accessibility of traveler information. Many elderly individuals face difficulties due to digital illiteracy, making the availability of printed or real-time information at transit stops particularly important for ensuring independent travel.

Finally, improvements to the physical infrastructure—such as standardized curb heights, the repair of broken sidewalks, installation of adequate lighting, and use of non-slip materials—are essential for increasing the walkability and overall accessibility of public transportation in both urban districts and residential neighborhoods. These enhancements would significantly support the mobility, independence, and well-being of elderly populations.

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Fig.4: Elaboration by authors;

Fig.5: Elaboration by authors;

Fig.6: Colorado Department of Transportation. (2019). *Curb ramp designers resource* (Version 1.2). Accessed from: https://www.codot.gov/business/civilrights/assets/curb-ramp-design-tool_v1-2_01-10-19.pdf

Author's profile

Süleyman Nurullah Adahi Şahin

He is a civil engineer with a Ph.D. in Transportation. He has a strong research background in sustainable mobility and public transportation systems. His academic interests include mobility justice, transport policy evaluation, and age-friendly infrastructure planning. He is currently a researcher at Sakarya University of Applied Sciences.

Abdulkadir Ozden

He is a civil engineer with a Ph.D. in Transportation from the University of Delaware. He is currently an Assistant Professor at Sakarya University of Applied Sciences, where he focuses on sustainable transportation systems, accessibility, and infrastructure planning. His research interests include traffic safety analysis, inclusive mobility, and public transport operations. He also contributes to interdisciplinary studies related to urban resilience and social policy.

Ardeshir Faghri

He is a civil engineer with a Ph.D. in Transportation from the University of Virginia. He is a professor in the Department of Civil and Environmental Engineering at the University of Delaware. His areas of expertise include travel behavior modeling, intelligent transportation systems, and infrastructure design. He has led numerous research projects funded by federal and state agencies in the United States.

Michael L. Vaughan

He is a scholar in diversity and inclusion policy with a strong interdisciplinary focus. He holds bachelor's and master's degrees in electrical engineering from North Carolina A&T State University, and a Ph.D. in Civil Engineering from the University of Delaware. His work integrates institutional equity, inclusive education, and urban planning strategies.