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The Empirical Study on Public Bus System for Elderly in Nanning Municipality

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Abstract- *This descriptive study aims to investigate empirical evidence regarding the provision of public buses in Nanning Municipality. A content analysis approach is employed to review 21 articles, creating a checklist of public metro buses across the dimensions of bus conditions, drivers and services, and bus stop facilities. Data is collected through street surveys conducted as a passenger on buses and through observations at bus stops. The data is then analyzed using a percentile formula and qualitative methods. Based on the empirical evidence, the Nanning public bus system-including bus conditions, bus stops and facilities, services and drivers, and affordability-meets the requirements of public transportation for the elderly, specifically in terms of availability, acceptability, accessibility, and affordability. Therefore, the public bus system in Nanning is suitable and available to effectively serve elderly passengers at all times.*

Keywords- *Public bus system, elderly, empirical study.*

I. INTRODUCTION

As population aging becomes a global phenomenon, many countries, including China, are facing the challenges of an aging society. According to data from the National Bureau of Statistics of China (2022), the population aged 65 and older in China reached 200.56 million in 2021, accounting for 14.20% of the total population. This percentage has been increasing yearly, rising to 14.88% in 2022, with the dependency ratio for the elderly as high as 21.83% (National Bureau of Statistics of China, 2023).

Population aging is characterized by an increased demand for routine healthcare and a growing reliance on public transportation. Older adults require various forms of support when using public transportation, especially buses, such as a comfortable and accessible sidewalk environment to enhance their mobility. These features help them maintain an active lifestyle and enjoy the benefits of active travel (Lin & Cui, 2021; Yoon & Park, 2022). Access to affordable and reliable transportation for the elderly plays a crucial role in their overall health (Roundtrip, 2020). Public transport significantly contributes to the quality of life for older adults by supporting their active lifestyle, sense of freedom, and independence (Shrestha et al., 2017). Accessible public transport and personal independence are closely linked to the quality of life in aging populations (Gilhooly et al., 2003). Additionally, the current family model often consists of single households, where working-age individuals form new families and live separately. As a result, elderly parents frequently live alone, increasing the importance of reliable public transportation to meet their daily needs. Some healthy elderly individuals can still actively engage in daily activities, such as grocery shopping, attending medical appointments, or traveling independently. They utilize both public transportation and private cars for their travel needs. Providing adequate public transportation to support an aging society is a crucial and urgent policy issue that requires the attention of both central and local governments. Policymakers must address the challenges posed by an aging population and ensure the availability of suitable public transport options. Raising awareness among the elderly about maintaining their physical abilities is equally important. This can be supported by ensuring access to well-designed public transportation systems that cater to their specific needs.

This study examines the facilities and services of public bus transportation in Nanning City, Guangxi Province, China. The investigation involves using public bus services as a passenger, observing activities at bus stops, and studying the behavior of elderly passengers using public buses. The aim is to gather empirical evidence on the provision of public buses in Nanning Municipality based on the following criteria: bus conditions, bus stops and pavement, services and drivers, and affordability.

II. LITERATURE REVIEWS

Walking mobility is a critical factor for healthy aging, helping elderly individuals maintain independent living, participate in social and community activities, visit friends and family, and travel—activities that enhance their quality of life (National Institute on Aging, 2020). Public metrobus transportation plays a vital role in providing necessary mobility for the elderly, offering significant benefits to their well-being (National Institute on Aging, 2020). Thus, all aspects of public metrobuses must be carefully considered. Public transportation systems for an aging society should address four key factors: availability, accessibility, acceptability, and affordability, along with safety and security (Shrestha et al., 2017; Lin & Cui, 2021). The requirements of urban elderly individuals using public bus transport were studied across four main dimensions: bus conditions, service quality, bus stop facilities and their environment, and affordability.

Public bus conditions

Bus characteristics, including design and facilities, are essential factors for elderly individuals to access public transportation, as they require specific features to accommodate their needs. Suitable buses for the elderly should include a stepless entrance, such as low-floor or kneeling facilities, and well-lit interiors to provide a clear path and enhance safety by

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deterring criminal activity on the buses. Low-floor or non-step buses are particularly age-friendly and safe for elderly passengers, as the reduced step height and width make boarding and alighting easier without the worry of navigating high steps. For instance, the popularity of low-floor buses in Berlin has exceeded 95% (Koffman, et al., 2010; World Health Organization, 2017; Morris, et al., 2017; Shrestha et al., 2017; Yu, et al., 2018; Chaisomboon, et al., 2020; Yang & He, 2022; Hoof, et al., 2021; Sukto, 2021). Besides, aging-friendly buses should prioritize ergonomic design for priority seats. The height, material, and shape of the seats should be carefully tailored to meet the specific needs of elderly passengers.

Additionally, factors such as the walking distance to priority seats, seat pitch, and the location of stanchions or handrails should be carefully examined to facilitate elderly passengers and enhance their travel safety (Koffman, et al., 2010; World Health Organization, 2017; Morris, et al., 2017; Shrestha et al., 2017; Yu, et al., 2018; Fatima & Moridpour, 2019; Chaisomboon, et al., 2020; Yang & He, 2022; Hoof, et al., 2021; Sukto, 2021). Buses should also maintain cleanliness, ensure good interior circulation, and provide an appropriate temperature to make passengers feel comfortable and safe. To achieve this, improvements to the air-conditioning systems on all public buses are necessary (Gilhooly et al., 2003; Koffman, et al., 2010; Shrestha et al., 2017; Sen, et al., 2011).

Accessibility features tailored to the needs of elderly passengers are critical. These include visual information such as boarding devices and equipment with larger letters to clearly display routes and destinations, as well as accurate, real-time automated on-trip and pre-trip information with audio stop announcements (Koffman, et al., 2010; Holley-Moore & Creighton, 2015; World Health Organization, 2017; Shrestha et al., 2017; Fatima & Moridpour, 2019; Sen, et al.,2011). Additionally, sunshades designed to suit the local climate are essential for blocking sunlight and keeping the interior of buses cool, addressing the comfort needs of elderly passengers (Yang & He, 2022).

Affordability

Many elderly people who rely on public bus transportation likely have less disposable income in retirement (Shrestha et al., 2017). Economic barriers are an important issue for them in maintaining an active life, which impacts their quality of life. A report from the Statistics Division of the United Nations (2021) recommended that the poorest quintile should not spend more than 5% of their net household income on transportation (Statistics division, 2021). The provision of public bus fare subsidies or reductions for the elderly is widespread (Shrestha et al., 2017). Most governments subsidize public bus transport costs to ensure that elderly passengers can afford their journeys. Public bus transportation in Turkey is discounted or free for those aged 65 and above, while it is 50% discounted for older people aged 60 and above in Thailand, and free of charge in London (UNECE, 2020; Yang & He, 2022; Gilhooly et al., 2003).

Bus stop facilities and pavements

The main issues for urban elderly individuals using public bus transportation are the distance from their homes to the bus stop, and the quality of sidewalks and other infrastructure. The bus stop should be located within 500 meters of their home, as shorter and easier walking distances between home and bus stops are strongly correlated with increased public bus use among the elderly, which in turn supports their well-being and health (Morris, et al., 2017; Shrestha et al., 2017; Zhang, et al., 2018; UN-Habitat, 2018; Yu, et al., 2018). Walking distance is considered one of the main obstacles for elderly people in using public buses; therefore, the greater the distance from home, the lower the proportion of elderly individuals using public buses (Statistics division, 2021; Fatima & Moridpour, 2019; Lin & Cui, 2021). A higher density of bus stops should be provided to reduce the distance between homes and bus stops, which could encourage more elderly people to use public buses (Zhang, et al., 2018; Shrestha et al., 2017). The walking environment has a significant effect on the mobility of elderly people (Yu, et al., 2018; Yang & He, 2022). The sidewalk between their home and the bus stop should feature plenty of trees and green space along the walkways, which can encourage more elderly individuals to use public bus transportation. Benches and trash cans should be placed in a way that does not obstruct the mobility of elderly people (Zhang, et al., 2018; Hoof, et al., 2021). Sidewalks should be easily accessible and free of hazards that could lead to slips or falls. To ensure safety, pavements should be maintained to guarantee anti-skid performance and prevent vertical height differences or steps, as poor road and sidewalk conditions may be a major obstacle for elderly people walking to bus stops (Chaisomboon, et al., 2020; Fraade-Blanar, et al., 2022; Yang & He, 2022; Shrestha et al., 2017). Additionally, the roads should be adequately lit to ensure safety and comfort while walking and to prevent accidents such as slipping at night (Yang & He, 2022).

Bus stops should provide a safe and comfortable environment. They should be located in visible, clean, and well-lit areas to make elderly individuals feel safe from criminals (UN-Habitat, 2018; Shrestha et al., 2017; Hoof, et al., 2021; Chaisomboon, et al., 2020). There should be enough clean seating to ensure the safety and health of elderly passengers waiting for buses (Shrestha et al., 2017; Yang & He, 2022;). Sunshades should be designed to protect against the local climate, blocking strong sunlight and rain, creating a comfortable atmosphere for elderly people while waiting for the bus (Shrestha et al., 2017; Yang & He, 2022; Chaisomboon, et al., 2020). Clear and easily identifiable bus route information should be displayed at the bus stop. The font design should be suitable for elderly individuals, and visual boards should avoid complex or unclear visual effects, as well as overly bright lighting (Koffman, et al., 2010; Shrestha et al., 2017; UNECE, 2020; Chaisomboon, et al., 2020; Yang & He, 2022). Safety, security, and comfort are essential for elderly individuals using public buses. Bus stops should have sloped roads and sidewalks to support safe road crossings. Additionally, the traffic speed around bus stops should be reduced (Shrestha et al., 2017; UN-Habitat, 2018; UNECE, 2020; Yang & He, 2022). Public metrobus services should connect to other modes of transport, such as train stations and intercity bus stations. Complete interchange information should be available, and full comfort facilities should be provided at interchange stations to assist

elderly passengers in moving or handling their belongings (Chaisomboon, et al., 2020; Lin & Cui, 2021). These bus stop conditions can help elderly individuals benefit from using public bus services.

Public bus services and drivers

Most elderly people are highly concerned about the safety of using public metrobuses, as they are more likely to suffer severe injuries and take a long time to recover in the event of an accident (Shrestha et al., 2017). Public bus transportation should prioritize reliability and safety to ensure elderly passengers feel secure using existing metrobus services. Bus services should ensure the safety and mobility of elderly passengers when getting on and off the bus, with an optimal gap between the bus door and the sidewalk when the bus stops at the station (Yang & He, 2022; Kulachai, 2015). Additionally, elderly passengers should be protected from slipping or falling by stanchions or handrails while walking or sitting on the bus, as they often worry about missing their stop and may stand up before the bus reaches the station (Morris, et al., 2017). All urban districts should be covered by bus lines and provide several key destinations that elderly individuals need to visit, such as hospitals, government offices, and commercial banks (Hoof, et al., 2021; UNECE, 2020; Zhang, et al., 2018; Sukto, 2021).

Elderly people mostly avoid rush hour traffic, so urban public bus schedules should be adjusted to better accommodate times outside of peak hours (Fatima & Moridpour, 2019; Chaisomboon, et al., 2020; World Health Organization, 2017). However, the appropriateness of routes and the density of bus stops may not be sufficient if the waiting time at bus stops is long and the frequency of service is low (World Health Organization, 2017; Statistics division, 2021). The frequency of bus services should be increased to reduce waiting times at bus stops and minimize travel time for elderly passengers. While providing regular bus service in low-demand areas can be costly (Statistics division, 2021; Shrestha et al., 2017), it is important to prioritize accessibility for the elderly. Additionally, real-time information services at bus stops should provide clear and accurate travel times to help alleviate concerns and reduce uncertainty for elderly passengers. This service is especially useful given their physical restrictions (Shrestha et al., 2017). Various forms of information, including automated audio and visual updates and real-time electronic schedule displays, are beneficial for older passengers, as they are often concerned about missing their stop (World Health Organization, 2017).

Polite and service-minded bus drivers are a crucial part of public metrobus services, as the attitude and behavior of bus drivers are significantly related to the risk of injury for elderly passengers during boarding, alighting, or while on the bus (Hoof, et al., 2021; Morris, et al., 2017). Additionally, the attitude and behavior of bus drivers also affect the acceptance of public bus transportation by elderly individuals (Shrestha et al., 2017). A positive attitude toward the elderly from bus drivers will lead to polite and dedicated service, sensitivity to the needs of elderly passengers, and safe driving (Shrestha et al., 2017; Chaisomboon, et al., 2020; World Health Organization, 2023). For example, bus drivers should ensure the safety of elderly passengers by helping them board and alight the bus safely, ensuring they are seated properly, and not moving the bus until all passengers are secure (Chaisomboon, et al., 2020; World Health Organization, 2017; Morris, et al., 2017; Sukto, 2021). Bus drivers should drive smoothly, both when accelerating from stops and decelerating to stops. In addition, bus drivers should be helpful and informative (Shrestha et al., 2017). Important strategies for interventions include training bus drivers on aging awareness, enforcing traffic rules, and regularly evaluating bus drivers' performance (World Health Organization, 2017). Training can improve bus drivers' service skills for elderly passengers, as seen in Germany, where bus drivers are regularly trained to ensure safety and security for people in need (Yu, et al., 2018; Yang & He, 2022).

III. Methodology

Studies from English and Thai language journals were searched using databases related to public buses, public transportation, elderly, and pavements. This study reviewed 21 articles on public transportation and public buses in relation to elderly requirements, with research conducted in several countries, including Singapore, Japan, Brazil, England, the USA, and others. A content analysis approach was adopted to create a checklist for public metro buses.

The content analysis concluded that there are four key factors elderly people consider when using buses: 1) Bus conditions, which include ten criteria: Boards displaying the route and destination; Air-conditioning system; Good interior circulation; Cleanliness; Real-time information with audio; Stanchions or handrails; Ergonomic priority seats; Seat pitches; Well-lit interiors; Stepless entrance (low floor). 2) Service and drivers include eight criteria as follows: Ensuring passengers are safely seated before the bus moves; Ensuring all passengers have completely gotten off before the bus moves; Optimal gap between the bus entrance and sidewalk; Smooth driving (both speed and deceleration); Driver training; Waiting time; Density of bus stops; Covered service area. 3) Bus stops and pavements include 13 criteria as follows: Walking distance from residence to bus stop; Green space along walkways; Benches and trash cans along the walkway; Flat pavements; Stepless pavements; Sidewalk lighting; Well-lit bus stops; Cleanliness; Waiting seats; Sunshades; Bus route information signs; Stepless zebra crossings; Connections to other modes of transport. 4) Affordability

The study was conducted in Nanning City, Guangxi Province. The research involved developmental studies that included street surveys using a checklist. Researchers collected data by using public bus services as passengers and observing at bus stops. A total of 203 buses, 95 bus lines, and 154 bus stops across 48 roads were surveyed. The data were primarily analyzed using a percentile formula and qualitative conclusions.

IV. Results

This study observes 95 bus lines and 203 buses operating on the roads in Nanning City. Additionally, 154 bus stops on 48 streets were surveyed. The study also includes an examination

of five coach stations: Xixiangtang, Jiangxiao, Jiangnan, Langdong, and Anji.

Public bus conditions

The physical condition of buses reflects the availability and safety of services for passengers, particularly elderly individuals who require more care than other age groups. This is a crucial factor that decision-makers should prioritize. The physical conditions of buses suitable for elderly passengers include:

1) Boards displaying the route and destination: All surveyed buses have signs indicating the route from the first stop to the destination. The letters on these signs are appropriately sized and clearly legible, even for elderly passengers with vision impairments.

2) Air-conditioning system: All surveyed buses are equipped with air-conditioning systems to maintain a cool and comfortable temperature, especially during hot weather.

3) Good interior circulation: All service buses are designed to stop and open their doors at every station, with passengers boarding through the front door and disembarking through the back door. This design promotes good ventilation between the interior and exterior of the bus, ensuring proper air circulation inside.

4) Cleanliness: All surveyed buses maintain a high level of cleanliness, including the floors, seats, and surrounding mirrors. Additionally, there are no unpleasant odors to disturb passengers.

5) Ergonomic priority seats: All buses are equipped with blue and orange seats. The orange seats, located near the entrance, are designated as priority seats for individuals in need, such as elderly people, children, pregnant women, and people with disabilities.

6) Seat pitches: The spacing between each row of seats is designed to accommodate passengers of all heights comfortably. Even passengers who are 180 centimeters tall can sit without discomfort. This ensures that both sitting and standing are convenient for elderly passengers.

7) Stanchions or handrails: The buses are equipped with pillars, railings, and handles for passengers to hold onto while standing. The seat backs are designed as additional grab points for individuals who are not tall enough to reach higher handrails, providing extra support for elderly passengers whether they are sitting or standing.

8) Well-lighting: The use of semi-transparent glass on the front and sides of the bus allows ample natural light to enter during the day, ensuring good visibility inside. Additionally, bright light bulbs are installed to provide adequate illumination at night, ensuring safety when boarding, disembarking, or moving within the bus.

9) Stepless entrance as low floor: Among the 203 buses surveyed across 95 routes, 136 buses (approximately 67%) are equipped with low-floor designs, including boarding gates and priority seats. The remaining 33% are step-floor buses. However, some buses with low-floor entrances still have priority seats located on a raised platform, which can be inconvenient for elderly passengers, especially those with knee problems.

10) Real-time information with audio: All surveyed buses provide audio announcements to inform passengers of the current station and the name of the next station as the bus departs. This feature helps elderly passengers reduce concerns about missing their stop. It eliminates the need for them to stand up and check the route signs themselves, which could otherwise increase the risk of accidents due to mobility restrictions.

Besides, Nanning public buses are equipped with two additional facilities to enhance safety and accessibility:

1) CCTV Cameras: All public buses are required to have at least two closed-circuit television (CCTV) cameras. One camera is installed near the rear door to ensure all passengers have safely exited the bus before the door closes. Another camera is positioned at the front of the bus, monitoring the interior to allow the driver to check if elderly passengers have safely risen from their seats and disembarked. This reflects a high level of concern for elderly passenger safety among policymakers and transportation personnel. In addition to ensuring efficient services for elderly passengers, these cameras also help prevent crimes that could jeopardize the safety and property of passengers.

2) Digital Boards: Some buses are equipped with digital boards that display service usage warnings and the next stop. These boards are particularly beneficial for passengers with hearing impairments, offering an alternative means of receiving important information.

The public buses in Nanning municipality are thoughtfully designed to provide inclusive services that cater to everyone's needs.

Bus stop facilities and pavements

Changes in physical health can significantly impact the mobility of elderly individuals, affecting activities such as walking, stepping, and crossing barriers. The availability of a well-designed public transportation system is essential for supporting the daily needs of the elderly. Factors such as the placement and accessibility of bus stops, along with the condition of sidewalks, can strongly influence the decision of elderly people to use bus services. In Nanning municipality, the bus stops are highly suitable for elderly users as they meet the 12 conditions identified in previous studies, ensuring accessibility, safety, and convenience.

1) Sunshades: Of the 154 surveyed bus stops, 120 (77.92%) are equipped with sunshades to provide protection from the sun and rain. The remaining 34 stops (22.08%) lack sunshades, primarily due to unsuitable conditions for installation, such as narrow spaces.

2) Bus Route Information: All bus stops have clear, easy-to-read signs displaying the bus number, service route, station name, and direction of travel, which helps prevent confusion about route directions. Additionally, some bus stops are equipped with LCD widescreen displays showing information about upcoming bus lines. This feature significantly reduces passenger anxiety while waiting for buses.

3) Cleanliness: Every bus stop is regularly maintained by cleaning staff, ensuring there is no litter, including cigarette butts, in the surrounding area. Trash bins are appropriately placed to avoid obstructing the use of the bus stop. They are

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routinely cleaned, eliminating unpleasant odors that could disturb passengers waiting for the bus.
4) Clean Seats: Bus stops equipped with sunshades always provide a sufficient number of clean seats for passengers. These seats are regularly cleaned by staff, ensuring they remain suitable and comfortable for waiting. The number of seats available at each bus stop depends on the population density of the surrounding area.
5) Stepless Crosswalks: This study examined 154 bus stops and found that 46 bus stops were located directly on sidewalks, while 108 bus stops were situated with a zebra crossing bike lane between the sidewalk and the station. Of these, only 37 bus stops featured stepless pedestrian crossings on both sides. Consequently, bus stops with bike lanes and stepped crosswalks may hinder elderly people from safely crossing to access the buses. However, pedestrian crossings do contribute to safer road crossing for passengers.
6) Connecting to Other Modes of Transport: To enhance passenger convenience, the public transportation system in Nanning is well-integrated with the city's entire transportation network, including railways, subways, buses, and intercity coaches. Both railway stations in Nanning are connected to multiple bus lines, including regular buses, Bus Rapid Transit (BRT), and the subway, as well as the airport. The connection between buses and subways is seamless, with subway entrances located near bus stops. Additionally, the five coach stations in Nanning serve as starting and ending points for several bus lines, offering greater convenience for passengers traveling to other cities. However, there are still some issues with the connection between bus stops and coach stations. For instance, some corridors between bus stops and coach stations have steps and uneven surfaces that hinder elderly passengers from walking or dragging luggage. Additionally, these corridors lack roofs, exposing passengers to sunlight and rain. Some coach stations also have bus stops without sunshades or waiting seats. In one case, a coach station has no bus stop within the station itself.
7) Bus Stops and Sidewalk Lighting: All surveyed bus stops and roads are equipped with adequate lighting for safe passage at night. Additionally, closed-circuit television (CCTV) cameras are installed to enhance the safety of pedestrians.
8) Stepless Pavement: The sidewalks on the 48 surveyed roads feature ramps at the entrances of buildings and alleys, ensuring there are no barriers for elderly people walking on the sidewalks.
9) Flat Pavement: According to the pavement survey of 48 roads, the pavement can be divided into two categories: (1) Asphalt Mixture: The pavement is flat and non-slip, effectively preventing slipping and falling. Therefore, it is convenient and safe for elderly people with mobility problems to walk or engage in activities. (2) Paving Bricks (Pavers): The bricks are laid on sandy ground, allowing rainwater to penetrate the joints, thereby reducing flooding on the road surface. The rough texture of the bricks helps to reduce slipping. However, over time, the sand foundation may erode, causing the pavement to become uneven, which can hinder the movement of elderly people.
10) Benches and Trash Cans on Walkways: Most sidewalks are quite wide, with regular trash cans placed along the way. Some sidewalks also feature benches surrounded by lush greenery, providing spaces for relaxation during leisure time, truly reflecting Nanning's "green city" slogan. However, a significant obstacle for pedestrians is the chaotic presence of commercial and private electric bikes. These bikes are often parked on the sidewalk untidily, and at times, they are ridden on the sidewalk, which can hinder the mobility of pedestrians.
11) Green Space on Walkways: The sidewalks of the 48 surveyed roads are lined with perennial trees that provide shade for pedestrians. However, some sections of the roads, currently under infrastructure construction or recently completed, have not yet developed the tree coverage needed to offer shade. Nonetheless, Nanning truly lives up to its reputation as a green city.
12) Walking Distance from Home: Most bus stops are conveniently located near residential and community areas, with short walking distances to the stops. However, for residences located in deep alleys, far from the main road, the walking distance may exceed 500 meters.

Services and Drivers

Good service and customer satisfaction are the core principles of all service industries, including public bus services for the elderly, where safety is a crucial concern. Therefore, public transportation staff, especially drivers, must be well-trained and consistently provide attentive service with a service-oriented mindset. In this study, researchers utilized public bus services as passengers and observed the bus stops. Observations of bus services in Nanning revealed that passengers board the bus through the front door, pay their fare, and disembark through the back door. The fare can be paid in cash, by scanning a QR code through a mobile payment application, or by using a card that is compatible with both buses and subways, offering convenience for passengers who need to use both transportation systems. The observation results of public bus services in Nanning municipality show that:
1) All buses stop at every station and open their doors without passengers needing to signal or wait at the station.
2) When elderly passengers board the bus, the driver ensures they are seated properly before driving away, with a smooth and gentle departure.
3) When elderly passengers disembark, the drivers can monitor the process through closed-circuit television. The drivers wait for all passengers to safely exit before closing the doors and departing. This ensures that elderly passengers can wait for the bus to come to a complete stop before standing up and leaving their seats. This practice reflects Nanning’s commitment to prioritizing the safety of elderly passengers on its public buses.
4) Driving Smoothly (Speed and Deceleration): Drivers should operate the bus carefully, adhering to speed limits, avoiding sudden lane changes, and preventing abrupt stops. Furthermore, drivers always stop at zebra crossings to allow pedestrians to cross safely. These practices demonstrate that the drivers follow traffic rules and behave responsibly.
5) Optimal Gap Between Bus Door and Sidewalk: The driver makes an effort to park the bus as close as possible to the edge of the sidewalk, ensuring the gap between the bus and the sidewalk is suitable for passengers to board safely, which is particularly helpful for elderly passengers with knee problems.

This is done unless obstacles, such as insufficient space to park or a drainage pipe on the roadside, prevent it.
6) Driver Responsibilities: Since there is only one driver on the bus, they are responsible for several tasks, including safe driving, checking passengers' fare payments, ensuring the safety of elderly passengers, and overseeing the safe disembarking of all passengers. Additionally, drivers must provide information about all bus services. They are also willing to offer various services without displaying any signs of annoyance, which reflects their training and dedication.
7) Waiting Time: Elderly passengers typically avoid peak hours to avoid crowded buses. Therefore, surveys are conducted during non-rush hours, between 9:00 am and 4:00 pm. The waiting time for buses can vary widely, ranging from three minutes to 30 minutes. Bus lines that pass through densely populated residential and community areas tend to have more frequent service compared to other routes.
8) Density of Bus Lines and Bus Stops: Bus routes are more frequent in densely populated residential and community areas, commercial districts, schools, and hospitals compared to other areas, such as the suburbs. However, in some areas, the distance between bus stops exceeds 500 meters, which could pose a challenge for elderly passengers using public buses.
9) Coverage: The survey of bus stops on 48 roads shows that many routes are repeated across several roads. Even smaller roads with only two lanes are served by public buses. This suggests that nearly all areas of Nanning city are covered by the bus service.

Affordability

A key concern for elderly individuals with limited disposable income is affordability. Many elderly people rely on public buses to access essential services such as hospitals and fresh markets. Concessionary fares are crucial in making public buses more accessible. In Nanning, the full fare for air-conditioned buses is 2 RMB, which is relatively inexpensive compared to bus fares in Bangkok, Thailand. In Bangkok, the fare for ordinary air-conditioned buses ranges from 12 to 20 baht (approximately 2.53 to 4.21 RMB at an exchange rate of 1 RMB = 4.75 Baht), while NGV buses cost between 15 and 25 baht (3.16 to 6.26 RMB) (Bangkok Mass Transit Authority, 2024).

V. Conclusions and Suggestion

The requirements for public transportation services for older people should include availability, acceptability, accessibility, and affordability (Shrestha et al., 2017). Availability: Public transportation should be provided in close proximity to communities, residential areas, and essential destinations, with service times and frequencies that meet the needs of elderly passengers. Acceptability: Buses must be equipped with physical features and facilities that are suitable for elderly users. This includes ensuring the safety of passengers and their property, as well as fostering a driver-friendly environment where the staff is willing to assist. Accessibility: Bus stops should offer safety features that allow the elderly to wait comfortably and access services easily. Additionally, pavements should be designed to accommodate elderly individuals, ensuring safe and convenient walking paths. Affordability: The fare structure must be affordable for elderly individuals, particularly those with limited income or those who rely on pensions.

The empirical evidence gathered from the investigation of Nanning's public bus system largely aligns with the requirements identified in several studies. Bus stops: The location and facilities of Nanning's public bus stops support accessibility. These stops are strategically placed near residential areas and essential destinations, such as fresh markets. They are equipped with adequate nighttime lighting, cleanliness, clear signage for all bus routes, and convenient connections to other transportation systems. Most bus stops are sheltered with sunshades, providing protection from sun and rain, and offer sufficient seating. The surrounding sidewalks are shaded by green trees, flat, and feature stepless entryways, making them more accessible. However, challenges remain, such as the parking and operation of electric bicycles on sidewalks, which can impede the movement of elderly passengers. Bus Conditions: The physical features, both inside and outside, as well as the necessary facilities installed on the buses, align with the requirements of acceptability. All buses are clean both inside and outside, provide clear route signage, air conditioning, and priority seating with adequate space for people in need, such as the elderly. Real-time information with audio announcements is provided when the bus reaches and departs from each stop. The bus interiors are well-lit, and stanchions or handrails are appropriately installed. Additionally, the tops of the seat backrests are designed as handles for easy gripping. For the safety of passengers' lives and property, all buses are equipped with at least two CCTV cameras. Most buses are also low-floor, ensuring easier access for elderly passengers. Services and Drivers: The services of Nanning public buses reflect both availability and acceptability. Public bus services cover the entire Nanning municipality, with service frequency varying based on the population density in each area. Drivers are courteous and attentive to the needs of elderly passengers, ensuring a smooth and safe ride. They drive at appropriate speeds, reducing the risk of accidents, and park the bus with an optimal gap between the bus door and the sidewalk, making it easier for elderly passengers to board and disembark. Additionally, drivers ensure a smooth acceleration and deceleration, and they wait for elderly passengers to be seated or safely disembarked before closing the doors and continuing the journey. Affordability: The public bus fare in Nanning municipality is a flat rate of two RMB for the entire journey, which is very affordable compared to the cost of living in larger cities. As a result, Nanning's public bus system is increasingly becoming a reliable means of transportation for the elderly which is expanding every year. It serves as a potential model for public transportation designed with the elderly in mind. However, there are still areas for improvement, such as increasing the number of low-floor buses and reducing barriers caused by electric bikes on walkways. The focus on elderly passenger satisfaction is a standout feature of Nanning's public bus system.

The public transportation system in Nanning is well-integrated, including trains, subways, public buses, and

intercity buses. The city has five subway lines that cover the entire urban area, particularly commercial districts and residential communities. The subway system is fast, punctual, and cost-effective, contributing to its growing popularity. According to researchers' observations, the number of people using public buses is decreasing. Some buses carry fewer than ten passengers along the entire service route. Consequently, the public bus system in Nanning may need to rely more on government budget support. It is necessary to conduct research on potential solutions to reduce the cost of public bus services while maintaining the same quality of service that meets the needs and satisfaction of elderly passengers.

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