buildings

Article

Assessing Accessible Travel Satisfaction in Old Communities: A SEM Study

Liya Fan [1,2,*], Yingqing Xiong [2] and Yizhan Peng [2]

1 School of Architecture and Urban Planning, Shenyang Jianzhu University, Shenyang 110168, China
2 School of Architecture and Design, Nanchang University, Nanchang 330031, China; yq.xiong@email.ncu.edu.cn (Y.X.); yz.peng@email.ncu.edu.cn (Y.P.)
* Correspondence: mjfnn@ncu.edu.cn

Abstract: China faces a significant population of individuals with disabilities, and the aging demographic exacerbates this challenge. There is an urgent need for accessible environments for vulnerable groups such as persons with disabilities, the elderly, and pregnant women. Consequently, this study aimed to explore the factors influencing satisfaction with accessible travel in old communities in Nanchang City. Adopting a perspective encompassing vulnerabilities across all age groups, we employed interviews, on-site surveys, questionnaires, and literature reviews to construct a model of satisfaction with accessible travel. This model comprises five evaluation dimensions: pedestrian pathways, public spaces, signage guidance, social support, and software provision, encompassing twenty-seven influencing factors. Structural equation modeling (SEM) was utilized to validate the model. The research findings indicated that social support (0.697), pedestrian pathways (0.480), and public spaces (0.291) exerted a significant overall effect on satisfaction within the model, whereas the influence of software provision (0.225) and signage guidance (0.249) was comparatively smaller. Vulnerable groups within the community prioritized operational maintenance (0.818) and cultural advocacy (0.791) within social support. They also emphasized aspects of pedestrian pathways such as elevation treatment (0.809) and pavement design (0.803), as well as rest facilities (0.804) and service facilities (0.790) within public spaces. Finally, based on the weighted ranking of factors among latent variables, we propose corresponding optimization strategies and development proposals. This paper contributes to providing theoretical, practical, and technical support for the design of community accessibility that caters to socially vulnerable groups across "universal and all-ages" groups. It plays a proactive role in enhancing the quality of life for these vulnerable groups and promoting the improvement of accessibility environments in old communities.

Keywords: structure equation modelling (SEM); old communities; vulnerable groups; universal and all-ages; satisfaction with accessible travel

Citation: Fan, L.; Xiong, Y.; Peng, Y. Assessing Accessible Travel Satisfaction in Old Communities: A SEM Study. *Buildings* **2024**, *14*, 1273. https://doi.org/10.3390/buildings14051273

Academic Editor: Nikos A. Salingaros

Received: 22 March 2024
Revised: 25 April 2024
Accepted: 28 April 2024
Published: 1 May 2024

1. Introduction

Statistics show that more than one billion individuals worldwide were living with a limitation in 2010. The number of people with disabilities has been rising continuously due to population aging and the rising frequency of chronic health disorders, including diabetes and cardiovascular diseases, among other conditions [1]. The 20th National Congress of the Communist Party of China in 2022 proposed a series of policies aimed at addressing the needs of vulnerable groups of society, including "implementing proactive strategies to cope with population aging", "improving the social security system and care service framework for persons with disabilities", and "ensuring the legitimate rights and interests of women and children". These directives underscored the Party and the nation's unwavering commitment to a people-centered development ideology, emphasizing the fulfillment of basic needs and the safeguarding of the rights and interests of the populace.

In 2023, the enactment of the "Law of the People's Republic of China on Barrier-free Environment Construction" provided comprehensive legal safeguards for developing accessible environments, which signified a significant shift in China's accessible environment construction, transitioning from policy guidance and governmental impetus to a collaborative effort involving societal stakeholders. This transition marked a progression from a focus on quantity to an emphasis on quality in the development of a barrier-free environment. However, whether in communities or cities, it is rare to see vulnerable groups utilizing these facilities [2], which indirectly reflects potential shortcomings in the construction of accessible environments in urban areas in meeting the daily-living needs of vulnerable groups such as persons with disabilities [3].

Vulnerable groups in old communities may primarily encounter obstacles in the forms of mobility, usability, and informational access. Diverse physiological and psychological differences among these groups result in distinct behavioral patterns. For instance, older adults, due to changes in economic status and social relationships, strongly desire a sense of belonging and security, preferring social gatherings in familiar environments. However, due to age-related declines in physical and sensory functions, they may face challenges in accessing information, leading to difficulties in mobility. This, in turn, elevates the risk of social isolation and diminishes their quality of life [4]. Due to physical limitations and societal stereotypes, individuals with disabilities are highly susceptible to psychological issues. They commonly experience feelings of loneliness, low self-esteem, strong self-respect, a certain degree of resentment, and a heightened sense of dependency, highlighting their increased need for social support [5]. Individuals carrying heavy loads or pushing baby strollers may experience temporary mobility impairments, when encountering obstacles with road level differences [6]. Pregnant women, unable to walk or stand for extended periods, require additional street seating [7]. Young children typically exhibit abundant energy, have a low line of sight, and demonstrate unpredictable movement trajectories, often lacking awareness of potential hazards. Therefore, they typically require supervision from caregivers during outdoor play [8]. Accordingly, this study aimed to explore the factors influencing satisfaction with accessible travel in old communities in Nanchang City.

Research on the factors influencing accessible urban mobility and satisfaction is of significant importance for improving the quality of life for vulnerable groups across universal and all-ages groups, safeguarding their social rights and interests, and promoting social equity and justice, as well as enhancing their autonomy and social participation. The remainder of this study is structured into four sections. Section 2 provides a literature review of relevant research progress, laying the foundation for constructing the theoretical framework. Section 3 outlines the research methodology, elucidating the principles of the indicator system construction and questionnaire design. Section 4 discusses the findings based on data analysis and survey results. Section 5 draws conclusions and transformation strategies along with corresponding development recommendations for the five dimensions influencing satisfaction.

2. Literature Review

2.1. Research on the Expansion of Accessibility Services Users

The issue of mobility hindrances often subjects vulnerable groups in the community to profound social exclusion [9]. Moreover, higher levels of social exclusion were associated with lower well-being [10]. In the 1930s, European nations initiated urban planning and construction projects for barrier-free cities, initially targeting persons with disabilities as the primary beneficiaries of such facilities. Since the 1970s, with the global increase in the aging population, efforts have expanded to include not only persons with disabilities but also elderly individuals, children, pregnant women, and others with mobility limitations, aiming to reduce the dependency on society among older adults. Present-day initiatives for accessible environment construction have evolved to encompass a broader spectrum of society, advocating for inclusion across "universal and all-ages" groups and vulnerable demographics [11,12].

Consequently, the concept of barrier-free planning has shifted from exclusively serving persons with disabilities towards embracing universal design principles, catering to the needs of all individuals, known as “design for all ”. However, the built environment of old communities is closely intertwined with issues of mobility for vulnerable groups. Presently, inadequate community infrastructure often exacerbates mobility challenges for vulnerable groups such as the disabled and elderly, leading to feelings of alienation and oppression [13,14]. As a cornerstone of ensuring the inclusion of vulnerable groups within urban settings, enhancing accessible amenities tailored to their needs within communities is imperative for addressing shifts in societal demographics and achieving a people-centric agenda. Current research on accessibility often focuses solely on persons with disabilities and the elderly, which contradicts contemporary progressive societal ideologies. Therefore, this study aimed to broaden its scope by examining the “universal and all-ages” groups approach, which encompasses all members of society, including vulnerable groups across universal and all-ages groups.

2.2. Research on Accessible Travel

Numerous experimental studies have confirmed that intricate road infrastructure within old communities significantly reduces the walking speed and travel frequency of individuals from vulnerable groups [15]. Therefore, current research on accessibility predominantly focuses on the material aspects of environmental construction. This includes studies on the systematic establishment of spatial hierarchies for accessible transportation networks [16,17], optimization research on the spatial configuration of accessibility facilities in public space [18–20], and quantitative investigations into the color and scale of accessibility signage [21,22]. The relevant research in this section is limited to quantitative studies on barrier-free built environments, which inherently has limitations. It fails to consider the impact of social environments and software provisions on the mobility obstacles faced by vulnerable groups.

According to social cognitive theory, individual behavior is influenced by both social environments and personal factors [23]. Xia et al. contended that the daily travel patterns of vulnerable groups are influenced not only by the built environment factors within the community but also significantly by external social environmental factors [24].

Therefore, as the current disparity between the quantity of constructed accessibility facilities and their actual utility becomes apparent, the research focus has shifted away from solely the built environment towards investigating the influence factors of the external social environment on material spatial development. Scholars such as Ohnmacht, Cheng, and Annear et al. have argued that social culture factors may significantly impact individuals’ lifestyles, habits, and attitudes, leading to diverse travel patterns that affect satisfaction with accessible transportation [25,26]. Wang et al. revealed deficiencies in accessible regulation and maintenance, as well as urgent needs, through a study on the current status of sidewalk accessibility construction in Shanghai [27]. Azevedo et al. argued that the reformation of appropriate public policies can establish a safer accessible travel system for vulnerable groups [28]. Xia et al. suggested that socioeconomic and behavioral factors influence the frequency of vulnerable groups’ use of accessibility facilities [29]. Qiao et al. suggested that social and community support affect the travel behavior of vulnerable groups [30]. Zhao et al. demonstrated that subjective norms, attitudes toward behavior, and information acquisition collectively influence the public’s willingness to maintain accessibility facilities [31]. Diener et al. posited that individual personality traits can significantly influence the level of subjective satisfaction [32]. Tao et al., through a questionnaire survey conducted among disabled survivors of the Sichuan earthquake, identified social demographic variables, travel frequency, expenditure, motivation, time, and companionship as factors influencing the perception of mobility constraints among individuals with mobility impairments [33]. According to Hanna et al., enhanced accessibility legislation enacted by the government can increase older people’s overall satisfaction with their mobility [3].

Furthermore, with the continuous development and dissemination of information technology, scholars have also turned their attention to the construction of accessible software provision. They have advocated for the integration of digital assistive technologies into urban environments, to enhance the mobility of persons with disabilities [34]. Kamaldin presented SmartBFA (smart barrier free access and accessible facilities), which is designed to fill the interconnectivity gap between the first and last mile of accessible pathways for individuals with accessibility requirements (e.g., wheelchair users and seniors who use mobility aids), and it is intended to create a scalable, sustainable system [35]. Ugalde et al. utilized geographic information systems in conjunction with routing algorithms to design wheelchair navigation systems, facilitating users in finding the shortest obstruction-free routes [36]. Bergner et al. utilized sensor wristbands and GPS loggers to detect the time and location of negative emotions experienced by interviewees, thus achieving a "bottom-up" precise tagging, and employing this method for the objective assessment of urban spatial obstacles [37]. Wang et al. explored several methods of the spatialization of accessibility facility data systems and empowering urban accessibility facility management and services through GIS, with validation through applied case studies [38].

In summary, the built environment, social support, and software provision are critical factors influencing satisfaction with accessible travel. This study comprehensively considers domestic and international research, national policies, and standards. It adopts a holistic perspective, focusing on vulnerable groups across universal and all-ages groups, to establish a comprehensive indicator system for the renovation of accessible environments. Furthermore, employing the structural equation modeling (SEM) method, this study aims to validate the theoretical model of community satisfaction with accessible travel.

3. Research Method

3.1. Conceptual Model and Research Hypothesis

Traditional research has failed to unveil the underlying logic of the interrelations among factors affecting community satisfaction with accessible travel. Structural equation modeling, with its capability of simultaneously handling multiple variables and accounting for measurement errors, serves to effectively address the shortcomings of traditional methods [39].

This study employs structural equation modeling, combined with an assessment of the current state of community accessibility in Nanchang City, to explore the intricate relationships among the built environment, social support, software provision, and satisfaction with accessible travel. Given the broad scope of the built environment, it is decomposed into three systems: pedestrian pathways, public spaces, and signage guidance [40]. These are then integrated with the influences of participants' sociodemographic characteristics to construct a conceptual model of the structural equation model (Figure 1). Drawing upon the conceptual model, the following research hypotheses are proposed:

Hypothesis 1 (H1). *Pedestrian pathway accessibility positively affects satisfaction with accessible travel.*

Hypothesis 2 (H2). *Public space accessibility positively affects satisfaction with accessible travel.*

Hypothesis 3 (H3). *Signage guidance accessible positively affects satisfaction with accessible travel.*

Hypothesis 4 (H4). *Social support positively affects satisfaction with accessible travel.*

Hypothesis 5 (H5). *Software provision accessibility positively affects satisfaction with accessible travel.*

Hypothesis 6 (H6). *Pedestrian pathway accessibility positively affects accessible software provision.*

Hypothesis 7 (H7). *Pedestrian pathway accessibility positively affects accessible signage guidance.*

Hypothesis 8 (H8). *Pedestrian pathway accessibility positively affects accessible public space.*

Hypothesis 9 (H9). *Public space accessibility positively affects accessible software provision.*

Hypothesis 10 (H10). *Signage guidance accessibility positively affects accessible software provision.*

Hypothesis 11 (H11). *Social support positively affects pedestrian pathway accessibility.*

Hypothesis 12 (H12). *Social support positively affects accessible public space.*

Hypothesis 13 (H13). *Social support positively affects accessible signage guidance.*

Hypothesis 14 (H14). *Social support positively affects accessible software provision.*

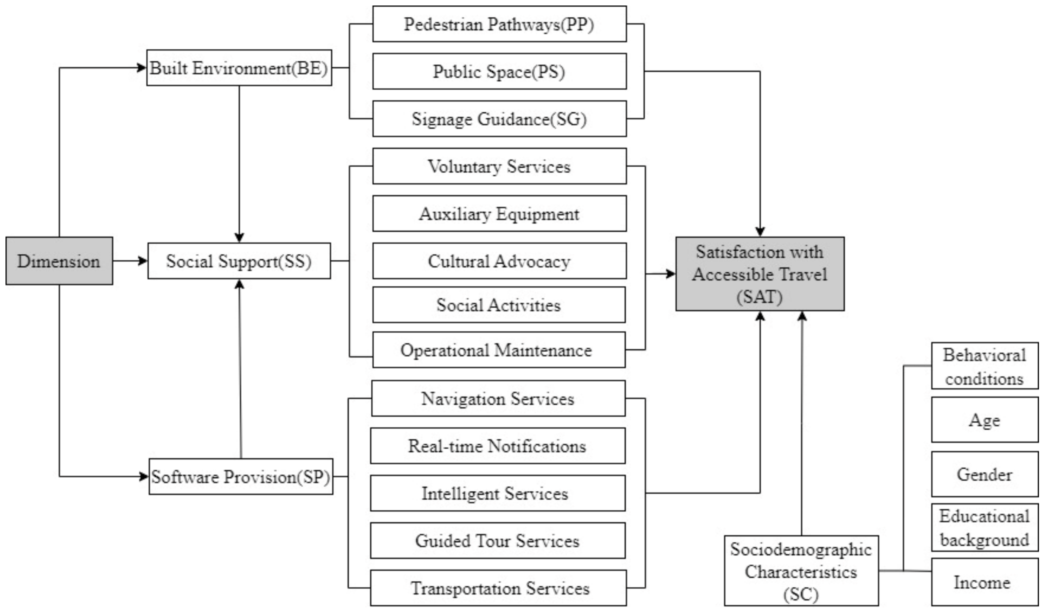

Figure 1. Conceptual model of the structural equation model.

3.2. Indicator System Selection

Presently, China's population aged 60 and above has reached 264 million, with a significant acceleration in aging trends, while the population of persons with disabilities stands at a staggering 85.02 million. Additionally, the implementation of the three-child policy has led to a notable increase in the number of pregnant women, children, and other demographic groups, contributing to a surge in the size of the population requiring accessibility across universal and all-ages within society.

To prevent and address the array of issues stemming from the mobility barriers faced by vulnerable groups, governmental entities have proactively responded by introducing multiple relevant policies, laws, and industry standards. These measures aim to guide the high-quality development of accessible environments within communities (Table 1). In constructing a model indicator system, this paper referred to relevant indicators from certain normative standards, synthesizing and organizing them into the content of the indicator system. Through a combination of theoretical research, practical investigations, and expert consultations, this paper has identified five evaluation dimensions for the research model: pedestrian pathways, public spaces, signage guidance, software provision, and social support, along with 27 influencing factors (Table 2).

Table 1. Selected norms, standards, and legislation.

Number	Name	Code	Type	Implementation
1	"Law of the People's Republic of China on Barrier-free Environment Construction"		National Law	1 September 2023
2	"General codes for accessibility of buildings and municipal engineering projects"	GB 55019-2021 [41]	National Standard	1 April 2022
3	"Public information graphical symbols—Part 9: Symbols for accessible facilities"	GB/T 10001.9-2021 [42]	National Standard	1 October 2021
4	"Specification for Barrier-free Design"	GB 50763-2012 [43]	National Standard	1 September 2012
5	"Construction acceptance and maintenance standards of the barrier-free facilities"	GB 50642-2011 [44]	National Standard	1 June 2011

Table 2. Relevant variables and indicators of accessible travel satisfaction.

Dimension	Number	Observed Variables	Indicators
Pedestrian pathways	PP1	Elevation Treatment	Curb ramps, wheelchair ramps, accessible entrances, etc.
	PP2	Connection Functionality	Interchange facilities for buses, taxis, subway, etc.
	PP3	Pathway Design	Pavement materials (smooth, non-slip, non-water-retaining), passage dimensions, turning space design, etc.
	PP4	Streamline Design	Convenience and accessibility of routes, etc.
Public space	PS1	Sanitary Facilities	Washbasins, toilets, urinals, safety grab bars, emergency facilities, etc.
	PS2	Vertical Transportation	Elevators, stairs, escalators, steps, etc.
	PS3	Horizontal Transportation	Barrier-free passages, door design, tactile paving, etc.
	PS4	Safety Protection	Stair handrails, non-slip strips, warning strips, tactile paving warning strips, etc.
	PS5	Low-Level Services	Inquiry counters, cashiers, water dispensers, access control, barrier-free elevators, etc.
	PS6	Wheelchair Seating	Unobstructed sightlines, easy evacuation, appropriate size, sufficient quantity, etc.
	PS7	Parking Systems	Convenient route design, wheelchair access design, connectivity design, signage and guidance design, etc.
	PS8	Rest Facilities	Enclosure design for seats, shading and rain shelter facilities, comfortable seat materials, appropriate backrest and armrest design, etc.
	PS9	Service Facilities	Wheelchair parking spaces, baby stroller parking spaces, facilities for the elderly and lower limb disabled to place crutches, storage racks, tactile paving, etc.
Signage guidance	SG1	Guidance Connection	Interruption at intersections, etc.
	SG2	Installation Location	Location away from sidewalks, installation positions too high, etc.
	SG3	Graphic Symbols	Color, contrast, scale, spacing, etc.
	SG4	Signage Configuration	Crosswalk speakers, buzzers, touch maps, accessibility facility guides, accessible road guides, safety warning lines, etc.
Software provision	SP1	Navigation Services	Query of positions and detailed information on public transportation, roads, bridges, tunnels, stations, airports, etc., and accessibility route planning functions, etc.
	SP2	Real-time Notifications	Information push services for road conditions, traffic flow, traffic incidents, etc.
	SP3	Intelligent Services	Vehicle reservations, automatic navigation, safety warnings, etc.
	SP4	Software-guided Tour	Introduction to scenic spots, travel guides, cultural backgrounds, etc.
	SP5	Public Transit Services	Vehicle schedules, station locations, etc.
Social support	SS1	Voluntary Services	Accompanying services, psychological services, etc.
	SS2	Auxiliary Equipment	Rental wheelchairs, baby strollers, white canes, hearing aids, etc.
	SS3	Cultural Advocacy	Universal design concepts, concepts of inclusive society, etc.
	SS4	Social Activities	Neighborhood, relatives, friends interactions, etc.
	SS5	Operational Maintenance	Road cleaning, pavement updates, supervision of voice prompt devices, maintenance and repair of accessibility signage, etc.

3.3. Questionnaire Design and Data Collection

Drawing from domestic and international research and relevant policy standards, the questionnaire design comprises two main sections. First, the foundational section encompasses the sociodemographic characteristics of the sample, including gender, age, education level, income, and other demographic attributes. Second, the scale section comprises items aimed at measuring observed variables, thereby assessing the latent variables influencing community satisfaction with accessible travel. Employing a 5-point Likert scale for grading, the questionnaire represents the satisfaction levels of vulnerable groups towards the questionnaire items. The overall development of accessible environments in Nanchang City lags behind the norm, making it difficult for certain vulnerable groups such as persons with disabilities, the elderly, and others with restricted physical mobility to benefit from the developments in barrier-free environment construction in Nanchang City.

This study employed a simple random sampling method to survey residents from typical old communities in Nanchang City, encompassing diverse age groups of vulnerable populations and those who have experienced accessible travel. The primary data collection methods included on-site visits and both online and offline questionnaire surveys. A total of 255 questionnaires were distributed, yielding 237 valid responses.

The demographic analysis of the questionnaire sample was as follows (Table 3): The gender distribution of the sample was relatively balanced, with 56.96% male and 43.04% female respondents. The age structure of the sample population tended to be younger, with the majority falling between 19 and 45 years old, accounting for 69.2% of the sample. The educational attainment level of the sample population was fairly evenly distributed, with 52.74% holding a bachelor's degree or higher, and 47.26% having a high school diploma or below. Among the sample population, 69.20% had used accessible facilities due to temporary injuries, 54.85% had utilized such facilities for carrying luggage, 61.60% had assisted others in using accessible facilities, 31.65% had used them for pushing strollers, 3.38% had used them due to pregnancy-related mobility issues, and 8.02% were individuals with disabilities or elderly individuals.

Table 3. Demographic data of respondents.

Category	Items	No.	Percentage	Category	Items	No.	Percentage
Behavioral conditions	Disabled group	9	3.80%	Gender	Male	135	56.96%
	Elderly group	10	4.22%		Female	102	43.04%
	Stroller-pushing groups	75	31.65%	Educational background	Primary school or below	11	4.64%
	Temporary injured groups	164	69.20%		Junior high school	23	9.70%
	Groups carrying luggage	130	54.85%		Higher school	78	32.91%
	Groups assisting others	146	61.60%		College degree	108	45.57%
	Pregnant groups	8	3.38%		Bachelor's or above	17	7.17%
	Unused groups	8	3.38%				
Age	≤18 years old	22	9.28%	Income	≤1000 RMB	66	27.85%
	19–22 years old	56	23.63%		1001–3000 RMB	33	13.92%
	23–30 years old	59	24.89%		3001–5000 RMB	43	18.14%
	31–45 years old	49	20.68%		5001–7000 RMB	39	16.46%
	46–60 years old	32	13.50%		7001–10,000 RMB	37	15.61%
	≥60 years old	19	8.02%		≥10,000 RMB	19	8.02%

It is noteworthy that among all survey participants, only 3.38% reported never having used accessible facilities. This indicates that in the old communities of Nanchang City, only a very small minority of residents do not need accessible access, further underscoring the imperative for optimizing the development of accessible infrastructure within these communities.

4. Data Analyses and Results

4.1. Reliability and Validity Test

Reliability is a crucial step in examining the consistency and dependability of data results, to eliminate invalid data and ensure the accuracy of conclusions. This study utilized Cronbach's alpha reliability coefficient to assess the questionnaire's reliability, where higher coefficient values indicated greater internal consistency of the questionnaire. Using SPSS software, a reliability analysis was conducted on indicators such as satisfaction with accessible travel and pedestrian pathways. The results indicated that the overall questionnaire reliability and Cronbach's alpha coefficient for each dimension fell within the range of 0.8 to 1, suggesting excellent internal consistency of the scales used in this study (Table 4).

Table 4. Reliability test.

Latent Variables	Cronbach Alpha	Number of Items
Pedestrian pathways	0.867	4
Public space	0.925	9
Signage guidance	0.867	4
Software provision	0.906	5
Social support	0.887	5
Satisfaction	0.882	3

Validity refers to the effectiveness of a measurement tool, specifically the extent to which a questionnaire or scale as a measurement tool accurately assesses the target variable. Validity testing includes tests for convergent validity and discriminant validity.

The convergent validity assessment model examines whether the relationships among variables align with theoretical hypotheses. If a model demonstrates strong convergent validity, indicating that causal relationships within the model are consistent with theoretical expectations, the research findings will be more persuasive.

Discriminant validity evaluates the independence of variables within a model, assessing whether they measure distinct concepts. Strong discriminant validity implies clear differentiation of variables within the model. Low discriminant validity between two variables may result in multicollinearity or confusion in the model, thereby affecting the interpretation of the true relationships between variables.

Convergent validity is confirmed when the average variance extracted (AVE) values for each dimension of the scale are greater than 0.5, and the composite reliability (CR) values are greater than 0.7, indicating good convergent validity and internal consistency. Discriminant validity is established when the square root of the AVE value for each dimension exceeds the absolute value of the standardized regression weights between dimensions. Analysis of Tables 5 and 6 reveals that the AVE values for each dimension exceeded 0.5, CR values exceeded 0.7, and the standardized correlation coefficients between each pair of dimensions were less than the square root of the AVE value for the corresponding dimension, indicating good convergent and discriminant validity across all dimensions.

Table 5. Convergent validity analysis.

Dimension	Item	Significance Estimation				Std.	SMC	CR	AVE
		UnStd.	S.E.	t-Value	*p*				
Pedestrian pathways	PP1	1.000				0.809	0.654	0.866	0.618
	PP2	0.911	0.076	12.008	***	0.743	0.552		
	PP3	1.009	0.077	13.190	***	0.803	0.645		
	PP4	1.011	0.078	12.893	***	0.788	0.621		
Public space	PS1	1.000				0.789	0.623	0.926	0.581
	PS2	0.928	0.078	11.892	***	0.722	0.521		
	PS3	1.032	0.081	12.783	***	0.765	0.585		
	PS4	0.908	0.074	12.279	***	0.740	0.548		
	PS5	0.894	0.080	11.154	***	0.685	0.469		
	PS6	1.092	0.083	13.111	***	0.780	0.608		
	PS7	0.957	0.073	13.025	***	0.776	0.602		
	PS8	1.082	0.079	13.630	***	0.804	0.646		
	PS9	1.015	0.076	13.327	***	0.790	0.624		
Signage guidance	SG4	1.000				0.770	0.593	0.868	0.623
	SG3	1.086	0.086	12.624	***	0.816	0.666		
	SG2	1.056	0.091	11.572	***	0.752	0.566		
	SG1	1.115	0.088	12.622	***	0.816	0.666		
Software provision	SP5	1.000				0.779	0.607	0.905	0.657
	SP4	1.016	0.076	13.381	***	0.812	0.659		
	SP3	0.997	0.073	13.641	***	0.825	0.681		
	SP2	1.098	0.082	13.320	***	0.809	0.654		
	SP1	1.062	0.078	13.687	***	0.827	0.684		
Social support	SS5	1.000				0.818	0.669	0.887	0.611
	SS4	0.955	0.071	13.401	***	0.787	0.619		
	SS3	0.987	0.073	13.488	***	0.791	0.626		
	SS2	0.904	0.074	12.148	***	0.730	0.533		
	SS1	0.961	0.073	13.203	***	0.778	0.605		
Satisfaction	SAT1	1.000				0.864	0.746	0.883	0.717
	SAT2	1.009	0.059	17.192	***	0.870	0.757		
	SAT3	0.885	0.058	15.138	***	0.804	0.646		

Note: *** Significance level is $p < 0.001$.

Table 6. Discriminant validity analysis.

	AVE	SS	PP	SG	PS	SP	SAT
SS	0.611	0.782					
PP	0.618	0.522	0.786				
SG	0.623	0.471	0.523	0.789			
PS	0.581	0.513	0.472	0.319	0.762		
SP	0.657	0.625	0.618	0.558	0.558	0.811	
SAT	0.717	0.697	0.713	0.629	0.653	0.754	0.847

Note: The items on the diagonal in bold represent the square roots of the AVE, while the values below the diagonal indicate the Pearson correlation coefficients among latent variables.

4.2. Model Fitting Test

Confirmatory factor analysis (CFA) can assess the rationality of model construction. In this study, AMOS 26 software was employed to conduct CFA on the variables of the model, using various commonly used indicators to assess the model fit. According to the model fit test results in Table 7, it can be observed that the CMIN/DF (Chi-Square/degrees of freedom) ratio was 1.250, falling within the range of 1–3, and the root mean square error of approximation (RMSEA) was 0.033, which is within the excellent range of <0.05. Furthermore, the examination results for the comparative fit index (CFI) and Tucker–Lewis index (TLI) both exceeded the excellent threshold of 0.9.

Table 7. Model fit indices.

Fit Indices	Acceptable Range	Estimation	Model Fit Assessment
Chi-square	-	488.861	Accept
Degree of freedom	-	391	Accept
x^2/df	<3.00	1.250	Accept
GFI	>0.80	0.885	Accept
AGFI	>0.80	0.863	Accept
CFI	>0.80	0.978	Accept
TLI(NNFI)	>0.80	0.976	Accept
RMSEA	<0.08	0.033	Accept
SRMR	<0.08	0.050	Accept

Therefore, based on the comprehensive analysis results, it can be concluded that the CFA model of accessible travel satisfaction demonstrated a good fit, accurately depicting the relationships among observed variables.

4.3. Path Analysis Verification

Based on the research hypotheses proposed earlier, the standardized path coefficients between latent variables were computed (Table 8). It was found that pedestrian pathways, public spaces, signage guidance, social support, and software provision all exhibited significant positive effects on community satisfaction with accessible travel, thereby confirming hypotheses H1 to H5. Similar patterns were observed for the remaining paths of influence, indicating no need for the removal of any paths. Finally, a structural model path diagram was generated, as illustrated in Figure 2.

Table 8. Path coefficients for hypothesis testing.

Hypothesis		Std.(β)	S.E.	t-Value	*p*	Decision
H1	PP→SAT	0.247	0.065	3.816	***	Supported
H2	PS→SAT	0.240	0.065	4.188	***	Supported
H3	SG→SAT	0.198	0.063	3.335	***	Supported
H4	SS→SAT	0.211	0.067	3.347	***	Supported
H5	SP→SAT	0.225	0.072	3.107	**	Supported
H6	PP→SP	0.251	0.075	3.372	***	Supported
H7	PP→SG	0.380	0.079	4.535	***	Supported
H8	PP→PS	0.281	0.070	3.566	***	Supported
H9	PS→SP	0.229	0.075	3.494	***	Supported
H10	SG→SP	0.227	0.073	3.302	***	Supported
H11	SS→PP	0.522	0.079	6.962	***	Supported
H12	SS→PS	0.366	0.075	4.570	***	Supported
H13	SS→SG	0.273	0.081	3.383	***	Supported
H14	SS→SP	0.269	0.078	3.699	***	Supported

Note: Refers to the effect of the construct before the symbol on the construct after the symbol, *** Significance level is $p < 0.001$. ** Significance level is $p < 0.01$.

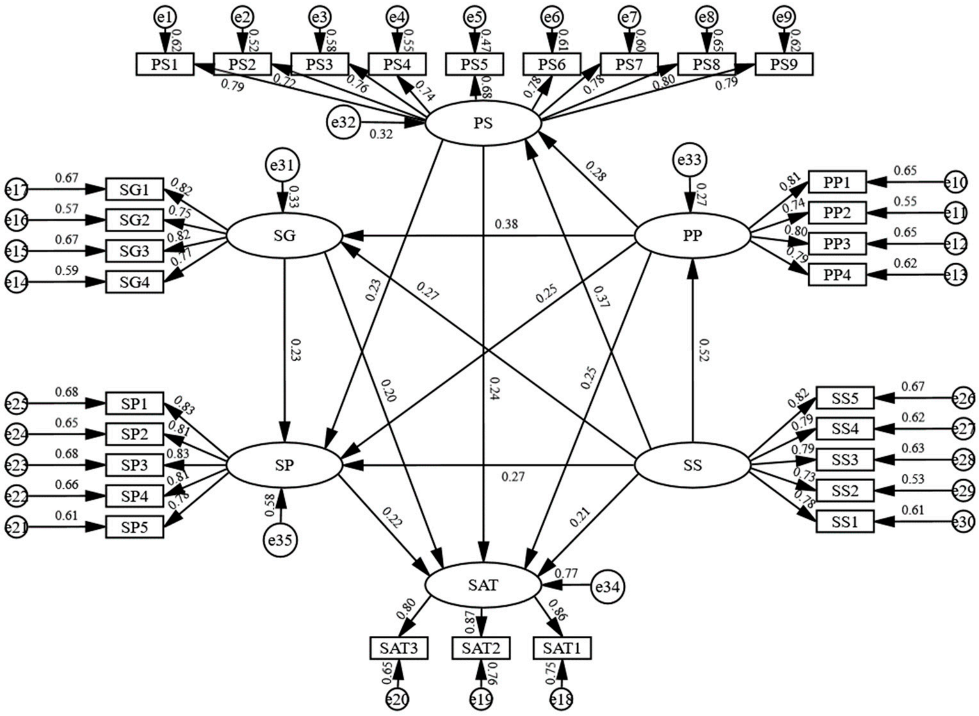

Figure 2. SEM statistical model. Note: pedestrian pathways = PP; public space = PS; signage guidance = SG; software provision = SP; social support = SS; satisfaction with accessible travel = SAT.

4.4. Indicator Weighting Coefficients

Upon obtaining the path diagram of the structural model, attention was directed toward both the direct and indirect effects of its latent variables. Direct effects refer to the immediate impact of the independent variables on the dependent variable, typically quantified by their respective path coefficients, while indirect effects pertain to the impact of independent variables on the dependent variable through intermediary variables. Table 9 provides insights into the direct, indirect, and overall effects of exogenous variables on endogenous variables within the model of satisfaction with accessible travel in old communities.

Table 9. Effect relationships between latent variables.

Path	Direct Effects	Indirect Effects	Rank
SS→SAT	0.211	0.486	1
PP→SAT	0.247	0.233	2
SG→SAT	0.198	0.051	4
PS→SAT	0.240	0.051	3
SP→SAT	0.225	0.000	5

To ascertain the relative importance of each accessible indicator in the model, factor analysis was employed to compute the weights of these indicators, measuring their influence on community satisfaction with accessible travel. By normalizing the overall effects of latent variables and the loadings of observed variables, as outlined in Equations (1) and (2), the weights of all latent and observed variables in the evaluation system of accessible travel satisfaction could be determined. The summarized findings are presented in Table 10.

$$W_i = \frac{t_i}{\sum_{i=1}^{n} t_i} \quad (1)$$

$$W_{ij} = \frac{t_{ij}}{\sum_{i=1}^{n} t_{ij}} \quad (2)$$

where W_i represents the weight of the ith latent variable, t_i denotes the standardized overall effect of the ith latent variable on satisfaction with accessible travel, W_{ij} signifies the weight of the jth observed variable under the ith latent variable, and t_{ij} indicates the factor loading coefficient of the ith latent variable on the jth observed variable. The variable n represents the number of indicators.

Table 10. Weights of indicators in the accessible travel satisfaction model.

Latent Variables	Total Effects	Primary Weights	Primary Rank	Observation Variables	Factor Loadings	Secondary Weights	Secondary Rank
SS	0.697	0.359	1	SS1	0.778	0.199	4
				SS2	0.730	0.187	5
				SS3	0.791	0.203	2
				SS4	0.787	0.202	3
				SS5	0.818	0.210	1
PP	0.480	0.247	2	PP1	0.809	0.257	1
				PP2	0.743	0.236	4
				PP3	0.803	0.255	2
				PP4	0.788	0.251	3
SG	0.249	0.128	4	SG1	0.816	0.259	1
				SG2	0.752	0.238	4
				SG3	0.816	0.259	2
				SG4	0.770	0.244	3
PS	0.291	0.150	3	PS1	0.789	0.115	3
				PS2	0.722	0.105	8
				PS3	0.765	0.112	6
				PS4	0.740	0.108	7
				PS5	0.685	0.100	9
				PS6	0.780	0.114	4
				PS7	0.776	0.113	5
				PS8	0.804	0.117	1
				PS9	0.790	0.115	2
SP	0.225	0.116	5	SP1	0.827	0.204	2
				SP2	0.809	0.200	3
				SP3	0.825	0.204	1
				SP4	0.812	0.200	4
				SP5	0.779	0.192	5

4.5. Result

Based on the results of the model presented earlier, it is evident that the outer loading coefficients of each latent variable were relatively high, indicating significant impacts of the observed variables on the latent variables. Consequently, the evaluation dimensions established for the satisfaction model were considered reasonable. The decomposition of the effects of community satisfaction with accessible travel and the quantified weights of evaluation indicators revealed the following ranking of factors based on their overall effects: social support (0.697), pedestrian pathways (0.480), public space (0.291), signage guidance (0.249), and software provision (0.225). Among these, social support and pedestrian pathways were the most crucial, while public space, signage guidance, and software provision exhibited relatively similar overall effects. This finding is consistent with the current situation in old communities, where there is a lack of government oversight and supervision in the construction and maintenance of accessible facilities, non-compliance with standards in pedestrian pathway construction leading to frequent occupation and damage, inadequate facilities and safety measures in public activity space, incoherent placement of accessible signage, and limited awareness among residents regarding software engineering.

In terms of the direct effects on the satisfaction model, the factors ranked in descending order of their direct effects as follows: pedestrian pathways (0.247), public space (0.240), software provision (0.225), social support (0.211), and signage guidance (0.198). Notably, pedestrian pathways had the most significant direct influence, suggesting that improving the accessibility design of pedestrian pathways in older communities could maximize travel opportunities and frequencies for vulnerable groups.

Regarding indirect effects on the satisfaction model, the factors ranked as follows: social support (0.486), pedestrian pathways (0.233), public space (0.051), signage guidance (0.051), and software provision (0.000). This indicates that social support and pedestrian pathways exerted a substantial indirect impact on other variables within the model, thus indirectly influencing accessible travel satisfaction. Conversely, public spaces, signage guidance, and software provision minimally influenced the other variables within the model, indicating that they primarily affected satisfaction directly. Therefore, to improve the frequency and efficiency of accessible travel for vulnerable groups within the community, it is imperative to prioritize addressing accessibility factors concerning pedestrian pathways and social support.

In the realm of social support factors, the ranking of secondary weights for each factor was as follows: operational maintenance (0.818), cultural advocacy (0.791), social activities (0.787), voluntary services (0.778), and auxiliary equipment (0.730). This suggests that, in comparison to the provision of community social activities, voluntary services, and auxiliary equipment, vulnerable groups are more concerned about issues related to the operational maintenance of accessible facilities and the promotion of accessible culture.

In the domain of pedestrian pathways, the ranking of secondary weights for each factor was as follows: elevation treatment (0.809), pavement design (0.803), streamline design (0.788), and connection functionality (0.743). This indicates that, compared to the accessibility connectivity features of pedestrian pathways, vulnerable groups are more concerned about elevation differentials, pavement design, and ease of passage along accessible routes.

In the realm of public space, the secondary weights of each factor ranked as follows: rest facilities (0.804), service facilities (0.790), sanitary facilities (0.789), wheelchair seating (0.780), parking systems (0.776), horizontal transportation (0.765), safety protection (0.740), vertical transportation (0.722), and low-level services (0.685). The first four factors all exhibited spatial inclusiveness characteristics, suggesting that, in contrast to community accessibility in transportation and safety provisions, the vulnerable groups prioritized the need for inclusive spatial accommodations.

In the aspect of signage guidance, the secondary weights of each factor ranked as follows: guidance connection (0.816), graphic symbols (0.816), signage configuration (0.770), and installation location (0.752). Notably, guidance coherence and graphic symbols were of utmost importance, indicating significant deficiencies in the current community signage in terms of coherence in flow lines and textual display.

In the realm of software provision, the secondary weights of each factor ranked as follows: navigation services (0.827), intelligent services (0.825), software-guided tour (0.812), real-time notifications (0.809), and public transit services (0.779). The weights of these five factors were relatively close, indicating that various information technology components significantly influence the mobility of vulnerable groups.

5. Conclusions and Proposals

Based on the field research and the summary of various accessibility indicators in the old communities of Nanchang City outlined previously, a structural equation model was constructed and analyzed, along with indicator weights calculated based on data gathered from surveys of vulnerable groups across the community's "universal and all-ages" vulnerable groups.

The study revealed that pedestrian pathways, public space, and signage guidance are crucial factors influencing satisfaction levels within the built environment. Regarding social support factors, vulnerable groups expressed greater concern over the level of oversight and maintenance of accessibility infrastructure and the intensity of cultural advocacy, as opposed to the emphasis placed by the community on volunteer services and auxiliary equipment provision. While software provision had the least overall impact on satisfaction levels, the sub-factors exhibited relatively high secondary weights, reflecting the current paradox of underutilized accessibility software engineering amid substantial demand.

Accordingly, research on the factors affecting accessible urban mobility and satisfaction is crucial for enhancing the quality of life for vulnerable groups, protecting their social rights and interests, promoting social equity and justice, and empowering their autonomy and social engagement. Drawing on the current status of old communities in Nanchang City, this paper proposes corresponding implementation recommendations targeting the indicators with higher-ranking weights in each factor.

5.1. Pedestrian Pathway Optimization Strategies

The research findings indicated that the direct impact of pedestrian pathways on the satisfaction model was most significant, with elevation treatment and pathway design emerging as significant sub-factors influencing pedestrian pathways, which underscores the prioritization of curb ramps at road junctions of accessible travel pathways. At community road intersections and building entrances, it is advisable to install curb ramps that comply with accessibility standards, featuring moderate inclines and slip-resistant surfaces, along with handrails for additional support. Furthermore, for streets with low motor vehicle traffic within the community, a method of removing curb height differences and fully paving the road surface could be employed, designating them as shared streets. This approach would not only eliminate mobility barriers for vulnerable groups, but also expand their public space.

Similarly, stemming from the safety concerns of vulnerable groups, pathway design significantly impacts pedestrian pathways. It is advisable to avoid using materials such as cobblestones that create uneven surfaces, opting instead for smooth, slip-resistant, and water-resistant materials for road paving. Additionally, the design should include widened pedestrian passages within the community and incorporate standardized turning spaces to meet the needs of wheelchair users. We contend that increasing the construction of curb ramps within communities and employing durable, damage-resistant pavement would significantly enhance the satisfaction of vulnerable groups with accessible pedestrian pathways.

Furthermore, according to the questionnaire and interview findings, it is evident that vulnerable groups residing on the urban margin often face greater mobility barriers. Therefore, enhancing the satisfaction of vulnerable groups with accessible pedestrian pathways requires more than just localized road optimizations. We should adopt a broader perspective in future urban planning, drawing inspiration from Carlos Moreno's "15-min city" theory [45,46], which shifts urban planning emphasis from community accessibility to the proximity of urban functions within communities and encourages the development of polycentric cities, where people can reach major facilities within a 15-minute walk or bike ride [47], aiming to improve the satisfaction of accessible travel for vulnerable groups across universal and all-ages groups.

5.2. Public Space Optimization Strategies

The direct impact of public spaces on the satisfaction model was highly significant, and second only to pathways. Subfactors significantly influencing public spaces include rest facilities, service facilities, and sanitary facilities. Consequently, the prioritization of adding and renovating rest and service amenities suitable for the majority of users' needs should be a primary consideration in the design of accessible public spaces. Due to the aging population structure in the old communities of Nanchang, public spaces in these communities are mainly frequented by elderly individuals and parents with strollers. Therefore, it is imperative to increase the number of wheelchair parking spaces and stroller parking spaces.

Furthermore, it is essential to emphasize the independence and integration of spaces for the elderly and children, ensuring that they are adequately separated, while also meeting the elderly's caregiving needs for children within designated zones for different activities. Taking into account social interactions among people, it is advisable to avoid placing individual seats in a single layout. Instead, enclosed seating areas with sunshades and armrests should be installed, accompanied by designated wheelchair resting spaces adjacent to the seating.

Similarly, sanitary facilities have a significant impact on public spaces, which may be attributed to the frequent lack of compliance with accessibility standards in community restroom facilities. To address this, we advocate for the use of ramps instead of steps at restroom entrances, along with the strategic placement of safety grab bars and emergency call devices within the stalls, to ensure the safety of vulnerable groups. Moreover, it is essential to emphasize the provision of third-person restrooms alongside traditional male and female facilities to accommodate families with opposite-sex children and individuals with mobility impairments.

5.3. Signage Guidance Optimization Strategies

The analysis results indicated that the most significant sub-factor influencing directional signage was guidance connectivity. Within communities, signage facilities often experience interruptions at road intersections and turns, leading to unclear directions and ineffective guidance. It is imperative to undertake comprehensive planning for signage in old communities, ensuring the placement of continuous signage at road intersections and primary activity spaces. Additionally, for complex intersections and lengthy pathways, signage should be appropriately spaced. Furthermore, for roads inaccessible to individuals with disabilities and the elderly, warning signs can be installed to prevent them from experiencing the inconvenience of repetitive detours.

Likewise, graphic symbols, signage configuration, and installation locations significantly influence signage guidance. Therefore, emphasizing the scale of signage text and its contrast relationship with the background is essential, as a strong contrast can enhance travel efficiency for some elderly and vulnerable individuals. Additionally, community signage predominantly consists of visual cues, neglecting the needs of the visually impaired. We recommend that communities, where economically feasible, should incorporate auditory and tactile devices as much as possible. It is worth noting that the placement and height of signage should also be carefully considered. To ensure that pedestrians can quickly access signage information, installations should avoid being distant from sidewalks and positioned at excessive heights.

5.4. Software Provision Development Proposals

The field investigations revealed that the comprehensive dissemination of accessible software engineering in Nanchang is lacking. However, research indicates that software provision significantly impacts satisfaction models, second only to thoroughfares and public spaces. Consequently, it can be inferred that there is substantial demand among vulnerable groups for accessible software engineering. Based on data analysis, it is evident that various information technology services, such as navigation services, intelligent services, software-guided tours, and real-time notifications, significantly impact the mobility of vulnerable groups.

However, establishing a database for urban community accessibility facilities and constructing an information system is a prerequisite for realizing digital accessibility in urban communities and a necessary condition for facilitating the provision of accessibility software provision. Therefore, in future community planning, we should utilize the Internet of Things (IoT) and data collection devices (such as the Trimble MX7 Real-time Image mobile mapping system) to establish a real-time database of accessibility facilities in Nanchang City [48]. Subsequently, developing applications for accessible navigation, guided tours, real-time notifications, etc., can facilitate smooth mobility for vulnerable groups. Specifically, we can leverage artificial intelligence (AI) technology to offer personalized services based on users' mobility and preferences, such as vehicle reservation, automatic navigation, and voice recognition. Additionally, the development of virtual tourism applications could enable users to explore historical and cultural landmarks, public facilities, and community information, thereby enhancing opportunities for inclusive cultural experiences for vulnerable groups.

5.5. Social Support Development Proposals

The research findings indicated that social support exerted the most significant indirect impact on the satisfaction model, suggesting its notable positive influence on the other four latent variables. Subfactors notably influenced by social support included operational maintenance and cultural advocacy. Therefore, there is a need to establish a robust management mechanism and maintenance system, conducting regular inspections, upkeep, and repairs of community accessibility facilities to ensure their proper functioning and safety performance.

It is worth noting that relying solely on governmental planning and management for the construction of accessible environments within communities is insufficient. Through a "bottom-up" approach, community residents and users can actively engage in community renewal and transformation, providing effective implementation pathways for constructing accessible environments. Addressing accessibility planning issues tailored to specific local conditions fosters neighborhood interactions among residents [49], thereby promoting community co-construction, co-governance, and resource-sharing.

Similarly, cultural advocacy significantly influences social support. Community workers should utilize channels such as bulletin boards and social media to conduct accessibility cultural propaganda activities, enhancing community residents' awareness and understanding of accessibility, which fosters social inclusion and respect for vulnerable groups within society.

In summary, in the process of revitalizing accessibility in the old communities of Nanchang, it is imperative to comprehensively consider five aspects: accessibility of pedestrian pathways, public space, signage guidance, software provision, and social support. The government should take the lead in mobilizing the various sectors of society to foster a social atmosphere that values and protects accessibility initiatives in communities. By harnessing societal efforts, community accessibility construction can be prioritized and safeguarded, ensuring the practical realization of accessibility functions. This transition from formality to substantive value will enhance the satisfaction of "universal and all-ages" vulnerable groups with accessibility in the community.

5.6. Limitations and Future Directions

The quantitative analysis of factors impacting satisfaction with accessible travel, conducted through structural equation modeling, offers theoretical, practical, and technical support for the development of "inclusive" community accessible space design catering to socially vulnerable groups across "universal and all-ages" groups. It plays a proactive role in improving the quality of accessibility environments in old communities. However, due to certain limitations, this study was confined to investigating old communities in Nanchang, which may limit the generalizability of the findings, due to geographical constraints and local economic development rates. Future research endeavors by our team will expand on this groundwork, undertaking comparative assessments of accessible environment statuses and factors influencing satisfaction with accessible travel across various regions. This pursuit aims to foster a more comprehensive understanding of the topic.

Author Contributions: Conceptualization, L.F. and Y.X.; methodology, L.F., Y.X. and Y.P.; investigation, Y.X. and Y.P.; data curation, Y.X.; writing—original draft preparation, Y.X.; writing—review and editing, L.F., Y.X. and Y.P.; supervision, L.F.; funding acquisition, L.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the 2020 Science and Technology Project of the Ministry of Housing and Urban-Rural Development (Project No. 2020-K-009).

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: The authors would like to thank all participants in the survey process.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. World Health Organization. World Report on Disability. In *World Report on Disability*; World Health Organization: Geneva, Switzerland, 2011; p. 24.
2. Ma, H.; Peng, Z. *Study on Law of Barrier-Free Environmental Construction in China*; Atlantis Press: Amsterdam, The Netherlands, 2017; pp. 220–223.
3. Wennberg, H.; Hydén, C.; Ståhl, A. Barrier-Free Outdoor Environments: Older Peoples' Perceptions before and after Implementation of Legislative Directives. *Transp. Policy* **2010**, *17*, 464–474. [CrossRef]
4. Dabelko-Schoeny, H.; Maleku, A.; Cao, Q.; White, K.; Ozbilen, B. "We Want to Go, but There Are No Options": Exploring Barriers and Facilitators of Transportation among Diverse Older Adults. *J. Transp. Health* **2021**, *20*, 100994. [CrossRef]
5. Mushtaq, S.; Akhouri, D. Self Esteem, Anxiety, Depression and Stress among Physically Disabled People. *Int. J. Indian Psychol.* **2016**, *3*, 64.
6. Oh, S.; Lee, S.-M.; Park, S.-J. Spatial Factors on Satisfaction Level of Baby Stroller's and Parenting Stress. *J. Archit. Inst. Korea Plan. Des.* **2015**, *31*, 75–82. [CrossRef]
7. Fernando, M.L.; Giles, M.; Krishnaswamy, S.; Cole, S. The Pregnant Traveller: An Overview of General Travel Advice. *Aust. N. Z. J. Obstet. Gynaecol.* **2023**, *63*, 638–642. [CrossRef] [PubMed]
8. Gemmell, E.; Ramsden, R.; Brussoni, M.; Brauer, M. Influence of Neighborhood Built Environments on the Outdoor Free Play of Young Children: A Systematic, Mixed-Studies Review and Thematic Synthesis. *J. Urban Health* **2023**, *100*, 118–150. [CrossRef] [PubMed]
9. Church, A.; Frost, M.; Sullivan, K. Transport and Social Exclusion in London. *Transp. Policy* **2000**, *7*, 195–205. [CrossRef]
10. Dahlberg, L.; McKee, K.J. Social Exclusion and Well-Being among Older Adults in Rural and Urban Areas. *Arch. Gerontol. Geriatr.* **2018**, *79*, 176–184. [CrossRef] [PubMed]
11. Dolmage, J. From Steep Steps to Retrofit to Universal Design, from Collapse to Austerity: Neo-Liberal Spaces of Disability. In *Disability, Space, Architecture: A Reader*; Routledge: London, UK, 2017.
12. Imrie, R.; Kullman, K. Designing with Care and Caring with Design. In *Care and Design*; John Wiley & Sons, Ltd.: Hoboken, NJ, USA, 2016; pp. 1–17.
13. Clarke, P.; Ailshire, J.A.; Lantz, P. Urban Built Environments and Trajectories of Mobility Disability: Findings from a National Sample of Community-Dwelling American Adults (1986–2001). *Soc. Sci. Med.* **2009**, *69*, 964–970. [CrossRef]
14. Imrie, R.; Kumar, M. Focusing on Disability and Access in the Built Environment. *Disabil. Soc.* **1998**, *13*, 357–374. [CrossRef]
15. Sharifi, M.S.; Christensen, K.; Chen, A.; Stuart, D.; Kim, Y.S.; Chen, Y. A Large-Scale Controlled Experiment on Pedestrian Walking Behavior Involving Individuals with Disabilities. *Travel. Behav. Soc.* **2017**, *8*, 14–25. [CrossRef]
16. Oswald Beiler, M.; McGoff, R.; McLaughlin, S. Trail Network Accessibility: Analyzing Collector Pathways to Support Pedestrian and Cycling Mobility. *J. Urban Plan. Dev.* **2017**, *143*, 04016024. [CrossRef]
17. Palazzi, C.E.; Teodori, L.; Roccetti, M. Path 2.0: A Participatory System for the Generation of Accessible Routes. In Proceedings of the 2010 IEEE International Conference on Multimedia and Expo, Singapore, 19–23 July 2010; pp. 1707–1711.
18. Esfandfard, E.; Wahab, M.H.; Amat, R.C. Universal Design in Urban Public Spaces for People With Disability. Case Study of Tehran, Iran. *Plan. Malays.* **2018**, *16*, 2–12. [CrossRef]
19. Yılmaz, M. *Public Space and Accessibility*; Konya Technical University Faculty of Architecture and Design: Konya, Turkey, 2018. [CrossRef]
20. Chitrakar, R.M.; Baker, D.C.; Guaralda, M. How Accessible Are Neighbourhood Open Spaces? Control of Public Space and Its Management in Contemporary Cities. *Cities* **2022**, *131*, 103948. [CrossRef]
21. Wan, Y.K.P. Accessibility of Tourist Signage at Heritage Sites: An Application of the Universal Design Principles. *Tour. Recreat. Res.* **2022**, *1*, 1–15. [CrossRef]
22. Arditi, A. Rethinking ADA Signage Standards for Low-Vision Accessibility. *J. Vis.* **2017**, *17*, 8. [CrossRef] [PubMed]
23. Bandura, A. *Social Foundations of Thought and Action: A Social Cognitive Theory*; SAGE Publications: London, UK, 1986.
24. Xia, J. Research on Spatial Incarcerated Effect and Released Strategy of People with Disabilities. Ph.D. Thesis, Southeast University, Nanjing, China, 2020. [CrossRef]
25. Ohnmacht, T.; Götz, K.; Schad, H. Leisure Mobility Styles in Swiss Conurbations: Construction and Empirical Analysis. *Transportation* **2009**, *36*, 243–265. [CrossRef]
26. Cheng, L.; Chen, X.; Yang, S.; Cao, Z.; De Vos, J.; Witlox, F. Active Travel for Active Ageing in China: The Role of Built Environment. *J. Transp. Geogr.* **2019**, *76*, 142–152. [CrossRef]

27. Wang, C.; Lü, J.; Xie, H. Evaluation of Accessibility of Road Traffic Sidewalks Using the Codes for Accessibility Design in the Mega-city: A Case of Shanghai. *Chin. J. Rehabil. Theory Pract.* **2021**, *27*, 1225–1232.
28. Azevedo, G.A.; Sampaio, R.R.; Filho, A.S.N.; Moret, M.A.; Murari, T.B. Sustainable Urban Mobility Analysis for Elderly and Disabled People in São Paulo. *Sci. Rep.* **2021**, *11*, 791. [CrossRef]
29. Xia, J.; Cheng, H.; Wang, X. Study on the Low Utilization Frequency of Barrier-free Facilities is from the Perspective of People with Disabilities: With Nanjing City as an Example. *City Plan. Rev.* **2020**, *44*, 47–56.
30. Qiao, G.; Zhang, J.; Pabel, A. Understanding the Factors Influencing the Leisure Tourism Behavior of Visually Impaired Travelers: An Empirical Study in China. *Front. Psychol.* **2021**, *12*, 684285. [CrossRef]
31. Zhao, T.-F.; Zheng, S.-X.; Zheng, Q.-H.; Gu, H. Data-Driven Accessibility Public Welfare Communication and Mobile Crowdsourcing System. In Proceedings of the 2023 5th International Conference on Data-driven Optimization of Complex Systems (DOCS), Tianjin, China, 22 September 2023; pp. 1–8.
32. Diener, E.; Oishi, S.; Lucas, R.E. Personality, Culture, and Subjective Well-Being: Emotional and Cognitive Evaluations of Life. *Annu. Rev. Psychol.* **2003**, *54*, 403–425. [CrossRef]
33. Tao, B.C.; Goh, E.; Huang, S.; Moyle, B. Travel Constraint Perceptions of People with Mobility Disability: A Study of Sichuan Earthquake Survivors. *Tour. Recreat. Res.* **2019**, *44*, 203–216. [CrossRef]
34. Zhang, M.; Fu, J.; Liu, J.; Yan, M. Urban Public Transportation Services for People with Disabilities. *Packag. Eng.* **2022**, *43*, 199–207. [CrossRef]
35. Kamaldin, N.; Kee, S.; Kong, S.; Lee, C.; Liang, H.; Saini, A.; Tan, H.-P.; Tan, H. SmartBFA: A Passive Crowdsourcing System for Point-to-Point Barrier-Free Access. In Proceedings of the 2019 IEEE 44th Conference on Local Computer Networks (LCN), Osnabrueck, Germany, 14–17 October 2019; pp. 34–41.
36. Ugalde, B.H.; Maaliw, R.R.; Palarimath, S.; Al Mahri, M.B.; Vinluan, A.A.; Carpio, J.T.; Lagman, A.C.; Panergo, M.C. Barrier-Free Routes in a Geographic Information System for Mobility Impaired People. In Proceedings of the 2022 IEEE 13th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON), New York, NY, NY, USA, 26–29 October 2022; pp. 0119–0123.
37. Bergner, B.S.; Zeile, P.; Papastefanou, G.; Rech, W.; Streich, B. Emotional Barrier-GIS–a New Approach to Integrate Barrier-Free Planning in Urban Planning Processes. 2011. Available online: https://www.corp.at/archive/CORP2011_27.pdf (accessed on 22 March 2024).
38. Wang, S.; Wang, A.; Wu, Z. Application of GIS in the Digital Transformation of Urban Barrier-free Facilities Management Services. *Geospat. Inf.* **2023**, *21*, 35–39.
39. Hoe, S.L. Issues and Procedures in Adopting Structural Equation Modelling Technique. *J. Quant. Methods* **2008**, *3*, 76.
40. Zhu, Y. Research on the Design Method of the Accessibility in the Public Space of Shenzhen Residential Area. Master's Thesis, South China University of Technology, Guangzhou, China, 2023. [CrossRef]
41. *GB 55019-2021*; General Codes for Accessibility of Buildings and Municipal Engineering Projects. Ministry of Housing and Urban-Rural Development: Beijing, China, 2021.
42. *GB/T 10001.9-2021*; Public Information Graphical Symbols—Part 9: Symbols for Accessible Facilities. Standardization Administration of China: Beijing, China, 2021.
43. *GB 50763-2012*; Translated English of Chinese Standard. Ministry of Housing and Urban-Rural Development: Beijing, China, 2012.
44. *GB 50642-2011*; Construction Acceptance and Maintenance Standards of the Barrier-Free Facilities. Nanjing Construction Engineering Group Co., Ltd.: Nanjing, China, 2011.
45. Allam, Z.; Bibri, S.E.; Chabaud, D.; Moreno, C. The '15-Minute City' Concept Can Shape a Net-Zero Urban Future. *Humanit Soc Sci Commun* **2022**, *9*, 1–5. [CrossRef]
46. Moreno, C.; Allam, Z.; Chabaud, D.; Gall, C.; Pratlong, F. Introducing the "15-Minute City": Sustainability, Resilience and Place Identity in Future Post-Pandemic Cities. *Smart Cities* **2021**, *4*, 93–111. [CrossRef]
47. The Quarter-Hour City: For a New Chrono-Urban Planning. Available online: https://www.latribune.fr/regions/smart-cities/la-tribune-de-carlos-moreno/la-ville-du-quart-d-heure-pour-un-nouveau-chrono-urbanisme-604358.html (accessed on 18 April 2024).
48. Hennig, S.; Sattler, T.; Wasserburger, W.W.; Wasserburger, M. How to Improve Accessibility of Natural Areas: About the Relevance of Providing Information on Accessible Services and Facilities in Natural Areas. In *Real Corp 2015. Plan Together—Right Now—Overall. From Vision to Reality for Vibrant Cities and Regions*; CORP—Competence Center of Urban and Regional Planning: Ghent, Belgium, 2015; pp. 803–812.
49. Alexander, C. *A Pattern Language: Towns, Buildings, Construction*; Oxford University Press: Oxford, UK, 1977.