Research on Design Optimization of Barrier-Free Public Facilities

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Abstract. With the change in the development of civilization, China has paid more and more attention to the people-oriented concept, and the degree of care for special groups such as the disabled has gradually increased. However, due to the increase of the population base and the expansion of urbanization areas, the demand for infrastructure is expanding, and some facilities such as barrier-free facilities are difficult to perfect in the specific application of details. This means that it is difficult to provide proper physical and psychological services for special people, and it also lays hidden dangers for later use and maintenance. Because the existing barrier-free public facilities have a certain time lag in theoretical design, they have exposed some inconvenient problems in practical application, and there are many places that can be improved and optimized. At the same time, the development of science and technology has provided many emerging techniques that can be applied in the field of research. This paper lists some problems existing in the operation of barrier-free public facilities and puts forward some optimization and improvement schemes based on the existing technology and the expected development of technology in the near future.

Keywords: Barrier-free renovation, public facilities, disabled people, technology integration.

1. Introduction

As an important place for people to gather, public space, taking squares, streets, parks, and libraries as examples, satisfy people's physiological needs for normal contact with the same kind of people and basic psychological social needs, and plays a pivotal role in people's community life [1]. The purpose of building barrier-free facilities in the community is to narrow the gap between the disabled and the physically able-bodied and achieve a relatively equitable role. However, the process of eliminating differences is not simple, and separating ideas from practice cannot achieve value. In daily life have seen the unreasonable existence of many barrier-free facilities: Immovable barriers to normal wheelchair access, multiple gates with only one entry size for accessibility, easily consumed blind blocks that provide insufficient information, blind blocks cut off by new bus stops or other facilities, easily overlooked or too hidden sign placement locations, accessibility signs that are not immediately identifiable or have unclear directions, etc. How should barrier-free facilities in public Spaces be designed to avoid these problems and new ones? This is the question that people have been thinking about on the way to the truth of fairness.

2. Barrier-Free Access Design for Public Places

Obstacles coexist with human society, but it is not until modern times that the rights and interests of the disabled have been paid attention to by the public [1]. Barrier-free facilities refer to the physical environment built to ensure that persons with disabilities, the elderly, children and other persons with mobility difficulties can freely, safely, and conveniently access and use the material environment when living, traveling, working, recreational, and participating in other social activities. Barrier-free facilities are the inevitable product of fair service for citizens in the development of modern civilization, and they are also one of the measurement standards of a country's humanitarian care. People build barrier-free facilities in the community to narrow the gap between the disabled and the able-bodied to achieve relative equity. However, in life, many barrier-free facilities do not play the expected role because of design and other problems. In real life, for aesthetic or economic

considerations, some public places do not take into account the needs of disabled people in the design of entrances and exits, which hinders their daily actions. Such as buying supplies in the supermarket, relaxing in the square and other actions. This paper will discuss the existing problems and how to improve and optimize the design from barrier-free access design, blind path design, barrier-free sign design and guidance.

2.1. Roadblock Scale Formulation and Intelligent Roadblock Prospect

To prevent motor vehicles and non-motor vehicles from entering public places such as commercial squares and parks, immovable barricades will be set up at the entrance to shorten the passable width. However, the width of the new national standard electric vehicle in line with the "*Safety Technical Specifications for Electric Vehicles*" is 0.45 meters, and the total width of the conventional wheelchair is within 65 centimeters. As shown in the practice report in Fig. 1, it can be seen that the average width of the electric vehicle in actual use is less than the standard width of the wheelchair, while the spacing of the barricades is often one man wide (about 0.5 meters). When small motor vehicles led by electric vehicles can enter, wheelchairs are still unable to enter.

With the development of The Times, people with disabilities are increasingly concerned about the establishment of roadblocks should not only consider stopping motor vehicles but should consider how to stop motor vehicles while allowing people with disabilities to pass normally. The current rise of AI recognition technology may be one of the ways to solve this contradiction. Intelligent roadblocks controlled by AI can separate motor vehicles and people in wheelchairs and selectively release them, or will become a new trend in future development.

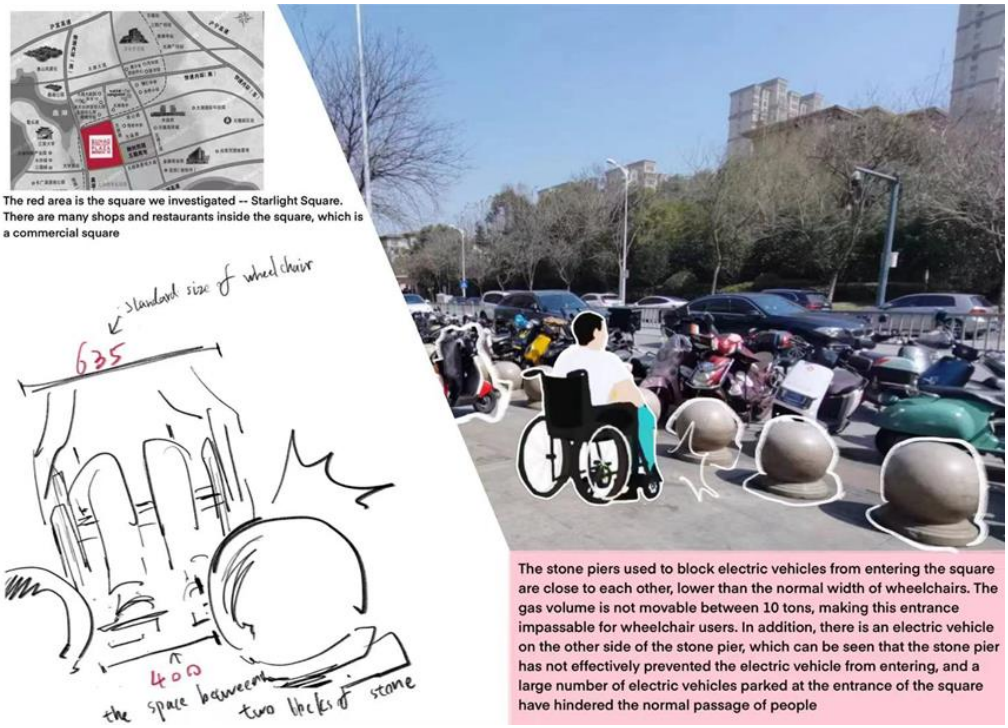


Fig. 1 Practice report on research on barriers preventing Wheelchair Movement

2.2. Loss of Directional Identification and Application of Electronic Map

Perimeter signage indicates that public Spaces will not have barrier-free access at every entrance and exit for aesthetic or topographical design purposes. The map generally does not indicate accessibility, which makes it difficult for people who need to use wheelchairs to get in and out.

As shown in the practice report in Fig. 2, some entrances do not meet the barrier-free specifications and there are no signs directing to barrier-free access. Some entrances will set up barricades at the passage in order to prevent motor vehicles from entering, and the actual setting up of "bicycles, electric vehicles, motorcycles are prohibited" signs will be a more direct and effective way. According

to the "*Urban Appearance Standards of the People's Republic of China - Announcement No. 129 of the Ministry of Housing and Urban-Rural Development*", public facilities are defined as having the characteristics of publicity, openness, applicability, artistry, and unfair use, that is, mainly providing convenience and services for urban residents in the local area. Therefore, the design of public areas should set up directional facilities or patterns such as road signs and ground guidance graphics to facilitate the passage of disabled people.

In addition to traditional pointing facilities (including paper maps, road signs, and landmarks), electronic maps can also be used as a way to solve problems. Two-dimensional code is a common form of electronic map information storage. Scanning two-dimensional code through mobile facilities to obtain information is not only convenient to operate, but also low cost. The introduction of barrier-free paths into the electronic map as a separate topic allows guidance in a more intuitive and flexible manner than paper maps and street sign instructions. In addition, as a part of the public space, the directional facility is the subject, the user is the object, and the use of people depends on the facility itself. The user is the main body of the electronic map, and the map is the object of operation [2]. The guide of the electronic map can guide and correct according to different behaviors of people, which is more convenient for serving special groups.



Fig. 2 Practice report on guiding road signs instead of roadblocks

3. Blind Track Design

The design of blind roads, ramps, and other auxiliary facilities is included in the outdoor barrier-free design. The role of blind path establishment is to inform the specific location of the disability facility and assist the disabled in understanding the surrounding situation [3]. However, the current blind channel design has disadvantages in many aspects, such as blind channel specifications and blind channel location.

3.1. Blind Channel Specification Design

Blind track is mainly divided into moving blind path and prompt blind channel. The former has a strip surface, which can help blind people better use the touch of feet and the touch of blind staff to effectively find the right way, and guide blind people directly ahead. The latter shows the shape of dots, which are generally set at the corner of blind roads, the destination position and the position of service facilities can effectively remind blind people [4]. Due to the single form of blind channel

commonly used at present, the indicator information is not clear enough, and blind people will have misunderstand blind channel information and difficulty in dealing with complex road conditions when using it, so the blind channel can be pointed to the brick surface figure size and shape differently, and the design indicator has a more rich and clear blind channel meaning. For example, by changing the pattern, dot density, and dot size of the prompt pattern of the blind trace pattern, the prompt blind channel is divided into turning and turning brick, blocking brick, and upper and lower stairs, etc. more specific information is transmitted [5].

3.2. Environmental Treatment of Blind Path

Although the blind path should be maintained continuously in the design concept and will not overlap with other functional areas, the blind path will be unable to be used normally due to various internal or external factors in practical application, such as blocking and disconnecting by facilities established in the later stage, road damage, bicycle occupation and other situations. Therefore, in the design, the surrounding environment of the blind channel should be considered, the transition and connection of the blind channel are located on the side of the sidewalk, and the separation and connection with the adjacent functional partition.

Blind lane and bike stop point setting locations should not be too close. It is a common phenomenon that when the traffic of people exceeds the expected value, the bicycle stop point will be difficult to accommodate all the bikes parked, and the extra bikes will occupy the areas of other functional partitions. When some parts of a bicycle occupy the space of a blind path walking, it may only be a detour problem for normal people, which can become a safety hazard for blind people or people with lazy eyes who need blind paths. New facilities may be built, such as bus stations and signs, in the post-renewal and optimization of roads, which should be considered to be blocked or affected by blind roads. Therefore, in the design of blind lanes, it must reserve extra space for other functional partitions and future planning partitions, and when roads change (adding functional partitions and public facilities), blind roads should also make appropriate adjustments.

4. Barrier-Free Identification Design and Guidance

The identification guidance system has the function of guiding and guiding people to move freely in the space environment, which is an important part of urban construction [6]. The advantages of electronic maps over traditional guidance facilities in the case of difficulty to operate properly are discussed in the above article. However, due to their independence from space, electronic maps are special, and for the elderly group led by people who will not use or are inconvenient to use electronic facilities, the design and guidance of barrier-free identification of the field landscape are still irreplaceable, and electronic maps are used as its supplement and extension.

4.1. Location Placement

Sign locations should not be confined to barrier-free access. Because the elderly and disabled people in wheelchairs and other special groups are slightly lower than ordinary people, the visibility of the field of vision is smaller than ordinary people's, so the installation height of the sign guide plate should be adjusted accordingly. According to the survey data, when people observe the surrounding environment, the Angle between the Angle of looking up and the horizon is 10°, which is the most comfortable observation Angle. The height of the sign is 2.5 meters above the ground, and the field of vision of ordinary pedestrians will not be affected [6]. To ensure the normal reception of information within a certain range, the best distance between the center of the sign and the ground is 1.35 meters [7]. In a crowded crowd, it is necessary to ensure that the vision of special people is not blocked or increased by pasted road leads and hanging street signs, which hardly occupy too much space and can also take care of the needs of special people [8].

Too much information will distract people's attention, and the surrounding barrier-free signs should reduce the nearby advertising, and limit the advertising area. Reduce the installation of devices

near the accessibility signs, and do a line of sight guidance to make the signs more eye-catching. When accessibility signs are placed in the vicinity of a mass placement such as a plaza store, the placement of the signs should be different from general placement, such as specific colored fluorescent or individual signage.

4.2. Color and Font Design

The service facilities of barrier-free facilities should not only conform to the ease of use and comfort of special groups but also consider the psychological feelings of special groups when using them [9]. Therefore, the color of barrier-free identification should not be limited to the high saturation of the three primary colors, but also consider the surrounding bad environment, avoiding too abrupt to cause psychological discomfort. Traditional barrier-free marks include national standards barrier-free signs, guide signs, and warning signs [10]. Information that cannot be clearly expressed by patterns will be supplemented by text. Considering that the number of people with different education degrees and different cultural backgrounds of logos is large, the text of barrier-free logos needs to reduce the use of artistic effect and achieve the purpose of simplicity, clarity, and clarity.

5. Conclusion

At present, most of the accessible public facilities have some defects in function and design, and there is a lot of room for improvement and development. The solution and improvement plan mentioned in this paper are mostly theoretical, and the specific application effect needs to be further studied and improved in practical application. With the development of new technology and the change in people's way of travel and living habits, the design of barrier-free public facilities will also change and improve with The Times, which tends to be complex, diversified, scientific, intelligent and humanized transformation, and more closely fits the people-oriented social service concept.

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