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Study on the spatial design of transportation linkage of elderly facilities in developed countries

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Abstract: *Although the legal system of senior care facilities in China has been improved and new policies have been introduced, there are still problems such as single design form and unreasonable functional arrangement in the transportation space of senior care facilities. In this paper, we find the laws and regulations and typical cases of senior care facilities in Japan, Germany, France, Spain and other developed countries, and conduct an in-depth research and analysis from the perspective of the design of transportation space of senior care facilities, and come up with the design ideas of transportation space of senior care buildings in each country for the reference and understanding of colleagues.*

Keywords: *elderly care facilities, transportation connection space design, laws and regulations*

1. Introduction

Although China is still in the primary stage of population aging, significant development trends have emerged in some aspects, such as the large number of low-age elderly population and the rapid growth of the elderly population, among other issues, are obvious. According to the Statistical Bulletin on the Development of Civil Affairs in 2021 published by the Ministry of Civil Affairs of China, by the end of 2021, there were 267.36 million elderly people aged 60 and above, accounting for 18.90% of the total population, including 200.56 million elderly people aged 65 and above, accounting for 14.20% of the total population. It is expected that in 2050, China's elderly population will account for one-third of the total population.

In recent years, with the rapid increase in the number of elderly people, the state has introduced a large number of policies related to elderly care and formulated design specifications for elderly care facilities in order to vigorously promote the construction of elderly care facilities. Even so, there are problems such as single spatial form and unreasonable arrangement of functional space in the existing design of transportation connection space of senior care facilities, which meet the design requirements of relevant codes but have obvious shortage in applicability[1].

2. Methodology

Through reading literature, case analysis and generalization, the author has searched for laws and regulations and typical cases of elderly facilities in various developed countries, and conducted in-depth research and analysis from the perspective of the design of transportation linkage space of elderly facilities, and come up with design ideas and realization methods of transportation linkage space of elderly buildings abroad, so as to broaden the ideas for Chinese architects.

3. Transportation Link Space

As an important part of the building space, the traffic link space is the link that connects each single use space together. It is also an important guarantee for the function of each part of the building. In the transportation space, it can be divided into three kinds according to the basic space form, namely, horizontal transportation space, vertical transportation space and hub transportation space [2]. In conservation-type elderly facilities, stairs, elevators, foyers, corridors and other transportation spaces are mainly installed (Table 1). Therefore, this paper takes this as the research direction.

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Table 1: Transportation link space classification table.

Name	Classification	Related Types
Transportation Link Space	Horizontal traffic space	Corridors/walkways, exterior corridors, elevated connecting corridors
	Vertical Traffic Space	Stairs, elevators, ramps, steps
	Hub Transportation Space	Foyer, hallway, vestibule, front room, elevator hall

In this study, we have researched and analyzed the above-mentioned aspects through a large number of laws and regulations of foreign conservation-type senior care facilities (Table 2), and have supported the design ideas and realization methods of foreign senior care buildings in terms of public space with the analysis of typical cases.

Table 2: Table of regulations and related cases of elderly facilities in developed countries.

Country	Laws and Regulations	Typical cases
Japan	<Welfare for the Elderly Act>	Mishima City Conservatory
	<Health Care Law for the Elderly>	
	<Senior Citizen Residency Act>	
	<Social Welfare Workers and Nursing Welfare Workers Act>	
	<Intervention Insurance Act>	
Germany	<Statutory pension insurance>	Karlsruhe St. Anna Integrated Pension Project
	<Social long-term care insurance> <Care Enhancement Method>	
	<Law on Pension Institutions>	
	<Housing and Care Contracts Act>	
France	<Social Action and Family Code>	Orbec's Dependent Homes for the Elderly and Nursing Homes
	<Building and housing regulations>	
	<About RT2012 Public Project Management>	
Spain	<Orden de 18 de abril 1996>	Oleiros Sanatorium
	<Disposiciones generalves vicepresidencia de la igualdad ydel bienestar>	
	<DB-SI-3>	

3.1. Hub traffic space design

In the hub transportation space of senior care facilities, the foyer, as one of the important functional spaces, not only plays the role of dispersing and guiding the flow of people, but also has to meet the needs of various types of people for the space, for example, the service desk plays the role of staff to provide consultation, check-in and check-out matters for the elderly and visitors, and provide them with convenient services; the waiting area is for the elderly and outsiders to rest[3].

3.1.1. Research on foreign related regulations

Among the laws and regulations related to conservation-type elderly facilities in developed countries, the relevant French norms for the foyer space, on the other hand, stipulate that it serves as an important area. It naturally becomes a place of entertainment and meetings. Therefore, it must be carefully laid out (color, brightness, management, etc.). It remains a traffic area and must comply with safety rules. The sanitary facilities (male and female) are different from those of the residents, with toilets suitable for people with reduced mobility.

3.1.2. Foreign case studies

Among the foyer space design of each developed country's senior care facility cases, the foyer space of Mishima City Nursing Home mainly includes reception, office and other functional spaces, and is arranged in a corner, with a foyer area of 35.31m^2 and a reception area of 11.8m^2, which is a suitable area and space scale[4].

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The foyer space of Karlsruhe St. Anna integrated senior living project is arranged between the two building blocks, the senior apartment building and the care center share the foyer, in order to ensure the smooth flow of people in the two areas, the service desk is set up separately and equipped with a waiting room, so that the dynamic flow of people going to the senior apartment building and the care center in the foyer and the static flow of people handling business at the service desk are separated, so that the foyer as a hub space can complement the flow of people. Cross-talk and maintain the flow.

The foyer space of Orbec's dependent elderly home and nursing home is concisely arranged, mainly including functional spaces such as service desk, waiting area, door hopper, and bathroom. According to the different functional spaces on both sides of the foyer, the people are divided into different streams, thus reducing mutual interference. The geographic location is set in the concave corner of the building form, and an open courtyard space is set outside the lobby, thus playing the role of gathering people, making it easy for the elderly to have a sense of belonging and security psychologically, and making it easy for the elderly to identify in terms of sight.

The foyer space of Oleiros Nursing Home is set at the intersection of the public space and the elderly's living space area, and plays a transitional role between the two. It includes 34.51m^2 of foyer, 9.18m^2 of door hopper and 10.78m^2 of service desk, without waiting area, wheelchair and travel tool storage area, etc. Although the function of foyer space is simplified, the space scale is appropriate.

3.2. Vertical traffic space design

In the vertical traffic space of the building, stairs and elevators are used as vertical traffic elements between floors. They are mainly used for the traffic connection between floors and when the height difference is large. Although most buildings use elevators as the main vertical transportation, stairs are still reserved for people to evacuate and escape in case of fire. In elderly facilities, elevators mainly use three types of elevators, namely stretcher elevators, passenger elevators and food elevators, and stairs mainly use straight-running stairs, double-running stairs and triple-running stairs[5].

3.2.1. Research on foreign related regulations

In developed countries conservation-type elderly facilities and elevators and stairs-related laws and regulations, the relevant regulations in North Rhine-Westphalia, Germany, for example, stipulate that stairs must have at least 1.25 m width, both sides must have no gaps in the handrail, the necessary stairs cannot be spiral. In Japanese regulations, the inspection items for facility elevators come from the "Architectural Design Standards for Taking into Account the Smooth Travel of the Elderly, Disabled, etc.

3.2.2. Foreign case studies

Two double-run evacuation staircases are set up in the closed stairwell in the building plan of Mishima City Nursing Home, and two stretcher elevators are equipped for the use of the elderly machine staff. The setting of staircases and elevators is not only relevant to the code requirements, but also provides great convenience for the passage of all kinds of elderly people.

Karlsruhe St. Anna integrated senior living project consists of a senior apartment building and a group care area, both of which are equipped with two evacuation staircases, and the evacuation stairwell of each functional area consists of an enclosed stairwell and an open stairwell, thus meeting the requirements of evacuation regulations. There are three elevators in the group care area, one passenger elevator and two stretcher elevators, and the building elevators are scattered.

In Orbec's home for the dependent elderly and nursing home project (Figure 1), three elevators, four evacuation staircases and several evacuation exits and corridors leading to the outdoors are set up to form the public transportation system of the whole building, among which the elevators mainly include two stretcher elevators and one passenger elevator, which are evenly dispersed throughout the building plan.The staircases mainly include one double-run staircase, one scissor staircase and two outdoor straight-run staircases, thus meeting the fire evacuation requirements of the whole building.

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Figure 1: Orbec's dependent homes for the elderly and nursing home stairs and lifts.

Oleiros Nursing Home has one straight-run staircase and two three-run staircases (Figure 2), a total of three evacuation staircases, all of which are enclosed stairwells, evenly dispersed in each building block to meet the evacuation requirements. Two passenger elevators are arranged side by side near the foyer and one stretcher elevator is installed in the nursing unit area to facilitate barrier-free access for all kinds of elderly people.

Figure 2: Oleiros Nursing Home stairs, lifts.

3.3. Horizontal traffic space design

The corridor in the horizontal traffic space of the elderly facilities, which plays the role of connecting the various functional spaces in the building, so that it constitutes a complete and orderly body block as a whole. Corridor is generally divided into internal corridor type and external corridor type[6]. Different types of buildings have corresponding requirements for the form, length, width, height and other conditions of the corridor, in the conservation-type elderly facilities, the corridor space must be equipped with barrier-free handrails, the corridor space is spacious and bright and other basic requirements, the higher the requirements of high-end elderly facilities for the corridor[7].

3.3.1. Research on foreign related regulations

The laws and regulations regarding horizontal traffic space in each country are shown in the table (Table 3).

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Table 3: Corridor space related regulations table

Serial number	Country	Content of the law
1	Spain	The minimum width of the corridor in the nursing group should be 1.80m.
2	Germany (North Rhine-Wes tphalia)	Two structural escape routes per group of rooms are sufficient.
		Both escape routes within the floor are available through the same corridor.
		There are up to 8 room groups in a building with common escape routes.
		The necessary corridor must be at least 1.50m wide and the corridor over the stretcher bed must be at least 2.25m.
		Doors from necessary stairwells to necessary corridors should have openings that are smoke proof, flame retardant, and able to close automatically.
		Doors on the escape route must be open in the direction of escape.

3.3.2. Foreign case studies

Spanish regulations stipulate that the minimum width of the corridor in the care group should be 1.80m. The care areas of the Mishima City Nursing Home (Figure 3) and Karlsruhe St. Anna Integrated Retirement Project Cluster (Figure 4) have a "return" building plan, and the corridor is of the outer corridor type and partially of the inner corridor type. The corridor of Oleiros Nursing Home is a public corridor linking all care units (Figure 5), with a net width of about 2.20m, which meets the requirements of the relevant codes, and light windows are set at the end of the corridor or on both sides to increase the brightness of the corridor and facilitate the passage of all kinds of elderly people. The corridors in Orbec's Dependent Care Homes for the Elderly and Nursing Homes are of the inner corridor type, with light spaces at the nodes of the corridors providing light to the inner corridors (Figure 6). The corridor is combined with service space and building form, which is not only spacious and bright, but also satisfies the passage needs of the elderly and provides them with convenient space for leisure activities, enriches the corridor space and building appearance effect, and greatly reflects the design sense of building form and the practicality of building space.

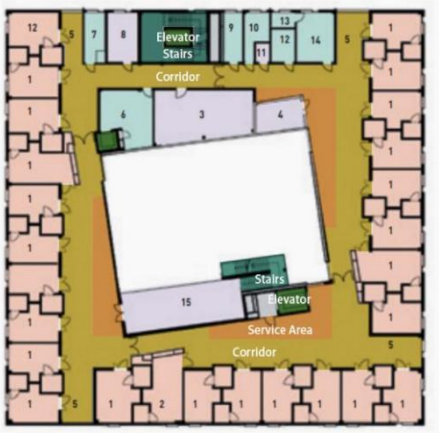

Figure 3: Mishima City Conservation Home Corridor.

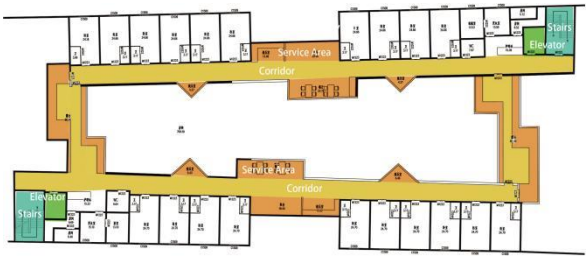

Figure 4: Corridor of the St. Anna integratedretirement project in Karlsruhe.

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Figure 5: Corridor of Oleiros Nursing Home.

Figure 6: Orbec's Dependency Home for the Elderly and Nursing Home Corridor.

4. Conclusion

Through the above-mentioned analysis and research of the policies and regulations related to the design of public transportation space in care-oriented elderly facilities in developed countries and comprehensive comparison, the following design ideas are summarized in terms of elevators, staircases, foyers and corridors.

In the care-oriented elderly facilities, the arrangement of stairs and elevators should be evenly scattered throughout the building plan at locations where the flow of people is dense and does not interfere with the passage, provided that the code requirements are met. For example, the stretcher elevator is set in the care unit area to meet the daily needs of the elderly; the passenger elevator is set near the foyer to facilitate the passage of nursing staff, self-care elderly and foreigners; the food elevator is set near the kitchen to facilitate the staff to deliver meals to the elderly in each care group. A suitable area of elevator lobby should be set in front of the elevator door, which can be combined with other spaces. As one of the main vertical traffic spaces, the usage rate of staircase is relatively low compared with that of elevator, but it plays a key role in emergency evacuation of people, therefore, the staircase and elevator should be combined. The staircase should be set in the closed stairwell, and the curved staircase is prohibited as the evacuation staircase[8].

The foyer, as the most complex place for the elderly, should be equipped with perfect functional space and suitable space scale, and should be arranged in a position with high identification and convenient access to each functional area, so that the elderly can easily identify and improve the efficiency of access to each functional area. Simple but not simple.

The corridor should be set at a net width of 2.2m and above, and both sides should be equipped with barrier-free handrails, provided that it meets the requirements of the code. The layout should have the characteristics of convenience and orientation, and the corridor should have sufficient light and age-appropriate space-oriented signs to improve the efficiency of the elderly and caregivers and create a comfortable and bright indoor living environment. In order to meet the needs of elderly, the corridor space should be combined with other service spaces, such as rest area, daylight room and activity area, which can not only meet the needs of elderly for recreational activities and enrich the narrow and

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monotonous corridor space, but also enrich the architectural shape and enhance the aesthetic appearance and recognition of the building.

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