THE ADAPTIVE DESIGN STRATEGY OF VACATION-TYPE RETIREMENT COMMUNITIES IN GUANGDONG

By

Mr. Bing HUANG

A Thesis Submitted in Partial Fulfillment of the Requirements

for Doctor of Philosophy DESIGN

Silpakorn University

Academic Year 2023

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โดย
Mr.Bing HUANG

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปรัชญาดุษฎีบัณฑิต
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By	Mr. Bing HUANG
Field of Study	DESIGN
Advisor	Assistant Professor Dr. Vanvipha Suneta

Faculty of Decorative Arts, Silpakorn University in Partial Fulfillment of the Requirements for the Doctor of Philosophy

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Mr. Bing HUANG : THE ADAPTIVE DESIGN STRATEGY OF VACATION-TYPE RETIREMENT COMMUNITIES IN GUANGDONG Thesis advisor : Assistant Professor Dr. Vanvipha Suneta

The research on retirement community design is becoming increasingly popular in the context of an aging global population. The objectives of this thesis were threefold: First, create a theoretical framework for Building Adaptive Design. Second, construct design strategies and methods for Building Adaptive Design for Vacation-Type Retirement Communities. Third, complete a design practice to transform a Natural Village into a Vacation-Type Retirement Community in Guangdong.

Research Methodology: First, through bibliometrics and fieldwork, the researcher found the research gap. Second, through literature research and expert interviews, the researcher created a theoretical framework for Building Adaptive Design. Again, through logical induction and deduction, the researcher explored the relationship between Building Adaptive Design and stakeholders, environment, and buildings; the researcher constructed design strategies and methods for transforming Natural Villages into Vacation-Type Retirement Communities. Finally, the researcher conducted design practice to verify and improve the design strategies and design methods of Building Adaptive Design.

Research Conclusions: Building Adaptive Design can transform Natural Villages into Vacation-Type Retirement Communities. The critical elements of Building Adaptive Design include stakeholders, environment, and buildings. The key stakeholders include users, operators, investors, and government. The environment consists of the natural environment and human environment. The user needs of a Vacation-Type Retirement Community had five levels: Living space, medical space, social and leisure space, children's space and farm space, and spiritual space. Depending on the degree of destruction of the original building, Building Adaptive Design strategies are divided into four categories: New construction, expansion and conversion, renovation, and maintenance. Building Adaptive Design methods include five levels: Light, furniture and furnishings, skin, house type, and structure.

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Bing HUANG

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Chapter 1 Introduction

1.1 Research background

1.1.1 Global population aging

Population aging refers to the gradual increase in the proportion of older persons in the total population. (Wu, C. P., 1999). Currently, two criteria are used to define aging societies around the world: The first one, the number of people aged 65 and over reached 7% of the total population; the second one, the number of people aged 60 and over reached 10% of the total population (Zhou, Y. M., 2018b). The United Nations set the first criterion in 1956 in the document *Population Aging and its Socioeconomic Consequences*(United Nations, 1956). The second criterion was set by the Vienna Assembly on Aging in 1982 (United Nations, 1982a). This research mainly adopts the first standard. The seniors population that appears in the following refers to people 65 and above. According to the United Nations: The population aged 65 and above reached 14% of the total population, entering a deeply aging society; the population aged 65 and above reached 21% of the total population, entering a super-aging society. (United Nations, 2015). Since the 20th century, population aging has gradually become a global problem (Hou, K. M., 2020).

Figure 1 shows the process and trend of global population aging. According to the United Nations (United Nations, 2022): In 1950, Europe, North America, and Oceania entered aging societies. Percentage of elderly population in the total population: 8% in Europe, 8.2% in North America, and 7.3% in Oceania. In 1970, the percentage of the population aged 65 and over in the total population changed: 10.5% in Europe, 9.9% in North America, and 7.1% in Oceania. In 2000, Europe's proportion of elderly population reached 14.8 % of the total population. Most European countries entered deeply aging societies. Population aging is deepening in North and Latin America. 12.3% in the United States, 12.6% in Canada, 9.7% in Argentina, and 13.1% in Uruguay. Population aging is also deepening in Asia: 7% in China, 17% in Japan, and 9.8% in Oceania. Oceania as a whole is 9.8%. In 2020, the world had 727,606,000 elderly population, accounting for 9.3% of the total population, and the world entered an

aging society. By 2050, the global elderly population will be 1,548,852,000, accounting for 15.9% of the total population, and the world will enter a deeply aged society. By 2100, the world's elderly population will reach 2,456,663,000, representing 22.6% of the total population, and the world will enter a super-aging society.

The data and charts make it easy to find that population aging is becoming faster and faster, and the aging population is increasing, gradually becoming a global problem that needs to be solved urgently.

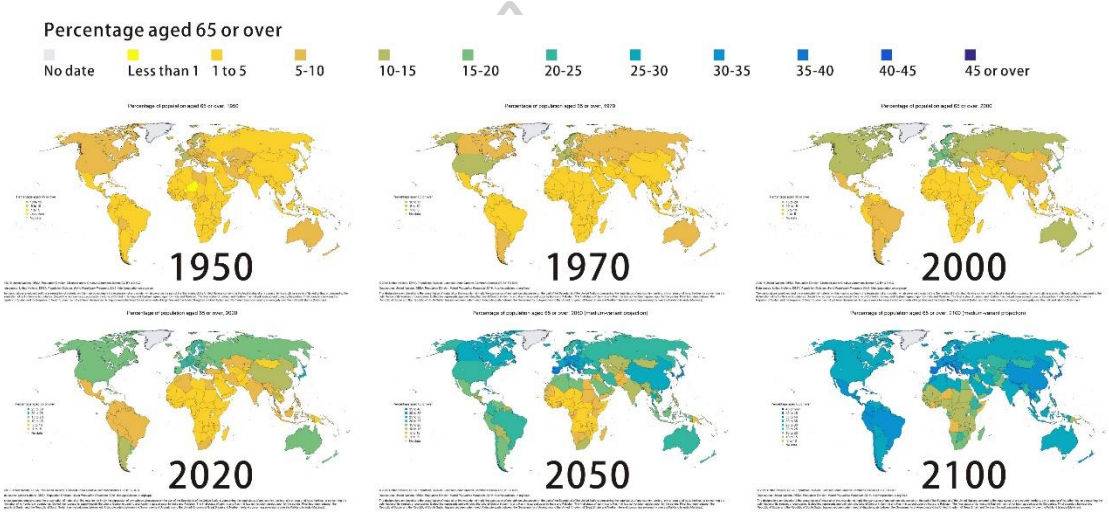

Figure 1. Global Aging Process

Source: Author Adapted From the United Nations (2019)

1.1.2 Population Aging in China

There are two views on the time when China entered an aging society. The first view is from 1999. In 1999, China's population aged 60 and above accounted for more than 10% of the total population (Liu, H. L., 2021). The second view is that it was 2000. Because in 2000 China's population aged 65 and over accounted for 7% of the total population (Dang, J. W., 2012). The two views differ because scholars have adopted different criteria for judging aging.

Figure 2 shows the number and percentage changes in the population aged 65 and over in China from 1999 to 2021. According to China's 7th National Census, on November 1, 2020, China had 190,640,000 elderly population, accounting for 13.5 % of the total population (National Bureau of Statistics of China, 2021). According to the National Bureau of Statistics of China, in 2021, the seniors population reached

210,350,000, representing 14.9% of the total population. (National Bureau of Statistics of China, 2022a). China has entered a deeply aging society. In 2000, data from China's fifth population census showed that there were 88,210,000 elderly population, accounting for 7 % of the total population. (National Bureau of Statistics of China, 2001). In 2011, data from China's sixth population census showed that there were 118,927,158 elderly population, accounting for 8.9% of the total population(National Bureau of Statistics of China, 2011). The aging of China is deepening.

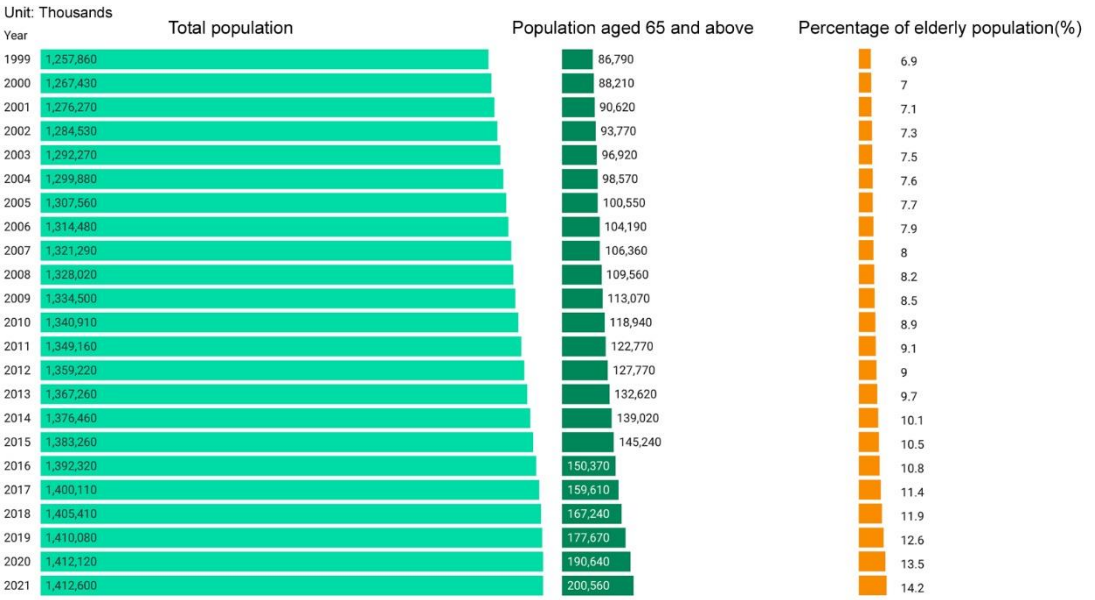

Figure 2. 1999--2021 Population Data in China

Source: Author's Drawing, Data Source: National Bureau of Statistics of China (2022)

The following conclusions could be drawn from the data on China's elderly population from 1999 to 2050: First, China's elderly population was enormous. The seniors population had increased from 86,790,000 in 1999 to 200,560,000 in 2021 (National Bureau of Statistics of China, 2022a). According to the United Nations Population Division, China's elderly population will reach 365,636,000 by 2050 (United Nations, 2022). Second, China was aging very fast. The elderly population will rise from 6.9% in 1999 to 14.9% in 2022(National Bureau of Statistics of China, 2022a). By 2050, the elderly population will account for 26.1% of the total population (United Nations, 2022).

China's aging has some other characteristics: First, Against the backdrop of not being rich, China has entered an aging society. France, Britain, Germany, Japan, and the United States are all in the background of developed countries entering the population aging. The per capita GDP was between 5,000 and 10,000 USD when developed countries entered an aging society. In contrast, when China entered an aging society, the per capita income was only 959 USD (National Bureau of Statistics of China, 2000). Premier Li, Keqiang emphasized that until 2021, China would still have 600 million people earning around 1,000 RMB monthly. Second, the degree of aging varied considerably. in 2020, the highest degree of aging was in Liaoning, with 17.42% of the elderly population; the lowest degree of aging was in Tibet, with 5.67% of the elderly population; the degree of population aging varied greatly among different provinces and regions (National Bureau of Statistics of China, 2022a). Third, there is a huge difference in the number of older adults. In 2020, Tibet, which had the smallest elderly population, had only 210,000 elderly population; Shandong, which had the largest elderly population, had 15,360,000 elderly population (National Bureau of Statistics of China, 2022a). Shandong's elderly population was 73.14 times that of Tibet. Fourth, China has a high proportion of low-aged older adults. By looking at the population pyramid, China has a higher proportion of younger older people compared to European and American countries as well as Japan (Figure 3).

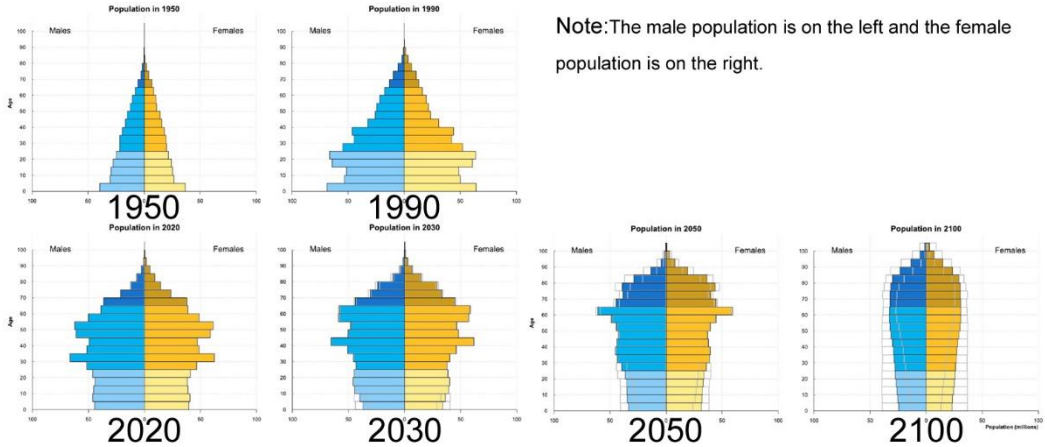

Figure 3. Changes in China's Population Pyramid

Source: Author Adapted From the United Nations (2019)

1.1.3 Vacation-Type Retirement Communities in China

Due to China's vast area, large population, and huge differences in natural and human environments in different regions led to a very complex vacation-oriented retirement community in China. Chinese Vacation-Type Retirement Communities present the following characteristics: First, the market is in the initial stage, with a highly fragmented market and lacking leaders. Secondly, many projects only pursue scale and do not pay enough attention to planning, architecture, landscape, and interior design, with obvious design flaws and high vacancy rates. Third, the scale is growing steadily. In 1999, the number of beds for the elderly in China was 1,024,000; in 2005, the number of beds for the elderly was 1,581,000; in 2010, the number was 3,161,000; in 2015, the number was 3,582,000; in 2020, the number was 4,882,000 (National Bureau of Statistics of China, 2022b). In 1999, the figure was 11.8; from 2001, it grew steadily; in 2005, it was 11.7; in 2012, it peaked at 32.6; and in 2020, it fell to 25.6 (National Bureau of Statistics of China, 2022b). The main reason for the fall was that the construction of elderly beds had been declining since 2014.

1.1.4 China's Rural Dilemma

Due to the urban-rural dichotomy in China, labor prices in urban areas are significantly higher than in rural areas. Many young people are attracted to urban employment, and large-scale population migration has occurred, with the rural population continuing to decline (Figure 4). This has given rise to a series of problems: 1) the demographic imbalance in rural areas, where most of those left behind are elderly people and children, giving rise to the issues of old age and children left behind in rural areas; 2) the number of Natural Villages has declined sharply, and they are seriously hollowed out. Due to rapid urbanization, many farmers, especially young farmers, have moved to towns and cities, leading to the decay of rural areas. According to the Ministry of Housing and Urban-Rural Development of China (Ministry of Housing and Urban-Rural Development of China, 1990-2020), only 2, 362, 908 Natural Villages remained in China in 2020, compared to 27, 229, 820 Natural Villages in 2010, a decrease of 366, 912 in 10 years, with an average of about 100 Natural Villages disappearing every day (Figure 5). Due to the lack of scientific village planning, rural China has seen the construction of new residences on the outskirts of former villages

to form new villages. In contrast, former villages' residences and land resources are left unused, causing massive waste.

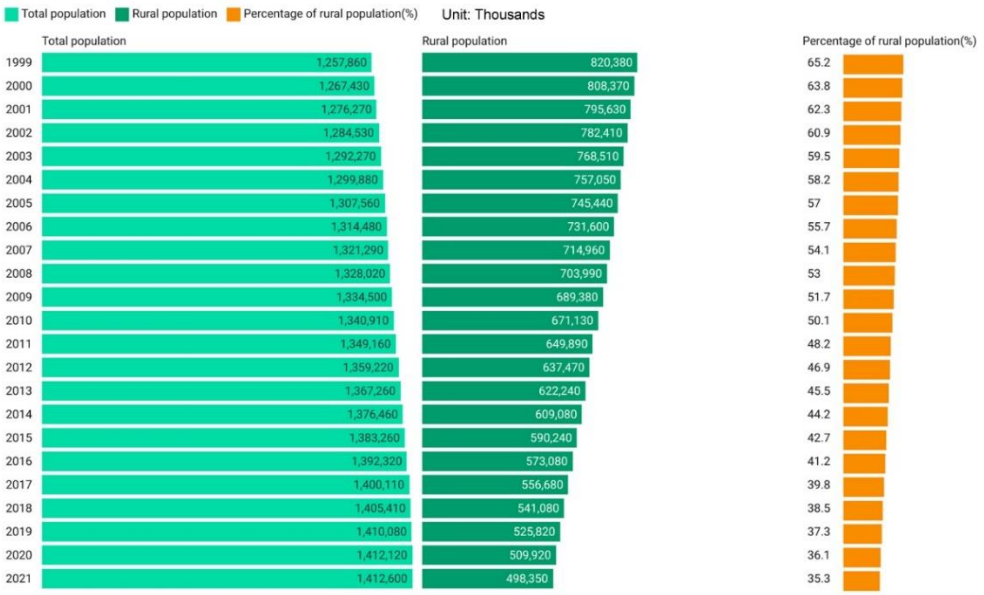

Figure 4 Population Change in Rural China

Source: Author's Drawing, Data Source: National Bureau of Statistics of China (2022)

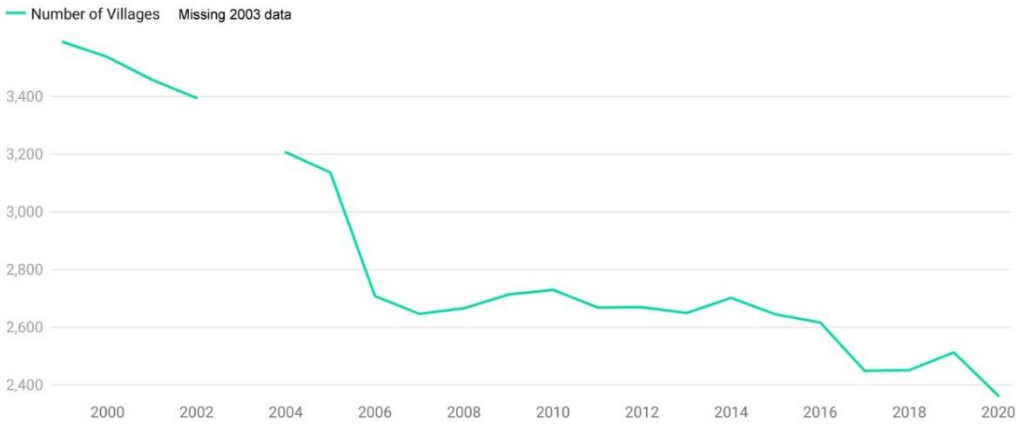

Figure 5. Changes in the Number of Natural Villages in China

Source: Author's Drawing, Data Source: Ministry of Housing and Urban-Rural Development of China (2022)

1.2 Significant of Problem

There are two types of problems discussed in this research: Real-world problems and research problems.

The real-world problems contain two areas.

There are severe problems with Vacation-Type Retirement Communities: 1) Strong user needs for Vacation-Type Retirement Communities and an insufficient supply of quality programs. For example, membership fees for Taikang communities are as high as RMB 2 million, and it is still hard to find a bed. 2) Vacation-Type Retirement Communities are costly and overcharged, with typical membership fees exceeding RMB 1 million, making them unaffordable for the general public. 3) Some Vacation-Type Retirement Communities are vacant, resulting in a massive waste of resources and money.

The reality of Natural Villages is even more severe. 1) Natural villages are dying out rapidly. According to the Ministry of Housing and Urban-Rural Development of China (Ministry of Housing and Urban-Rural Development of China, 1990-2020) only 2,362,908 Natural Villages will be left in China in 2020, compared to 3,773,162 Natural Villages in 1990. In just 30 years, 1,410,254 villages have disappeared. These villages are the carriers of culture and the spiritual homes of villagers. It is difficult to measure the loss of these disappearing villages in economic terms. Regrettably, the demise of villages continues to this day. The necessary conservation development of the villages must be carried out. 2) Natural Villages are seriously hollowed out. Even the Natural Villages that have survived have lost their appeal to young people, leaving only a few older adults and children.

The research questions are divided into three areas: Research on Vacation-Type Retirement Communities, Building Adaptive Design, and village preservation and revitalization research.

Vacation-Type Retirement Community research is still relatively rare, and related research mainly focuses on business models, planning and design, and architectural design. Building Adaptive Design research is among the popular research areas. Through the analysis of 4,660 documents in the Web of Science core library in the last 20 years, we found that: Research focuses on building energy efficiency retrofits, such as the application of adaptive design to enhance the methods and technologies of building energy retrofitting; the improvement of air quality through adaptive design; and the improvement of seismic effect through Building Adaptive Design. The research area on village retrofitting is mainly biased toward research on design applications. For example:

transforming old village buildings into B&Bs, libraries, and village centers. Few studies focus on design theory.

The researcher reviewed the mainstream literature databases and has not found any research on transforming Natural Villages into Vacation-Type Retirement Communities using Natural Villages as the object and Building Adaptive Design as the strategy, forming a Gap in the research field. This study combines Vacation-Type Retirement Communities, Natural Villages, and adaptive design, expecting to establish a theoretical framework and design methodology that can be used to guide the transformation of Natural Villages into Vacation-Type Retirement Communities, thus realizing the vision of Improving the life quality of older adults and revitalizing Natural Villages.

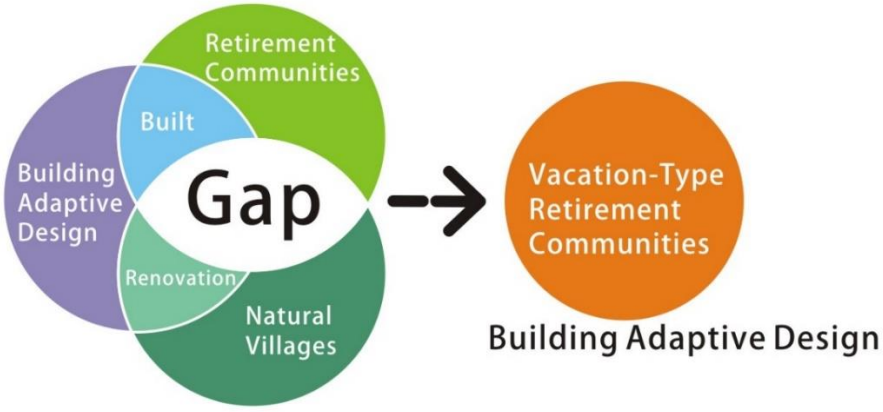

Figure 6. Research Gap
Source: Author (2023)

1.3 Hypothesis

This study hypothesized applying the Building Adaptive Design approach to transform vacant villages into Vacation-Type Retirement Communities. Natural Villages are often located in suburban areas with good natural landscapes, fresh air, beautiful fields, and rich biological resources. With the government's continuous construction of villages over the years, many villages have convenient transportation and good infrastructure. These are exactly the basic conditions that Vacation-Type Retirement Community should have, with only certain additional medical resources needed.

Therefore, the hypothesis of converting Natural Villages into Vacation-Type Retirement Communities is feasible.

Figure 7. Hypothesis

Source: Author (2023)

1.4 Questions and Objectives

1.4.1 Research Questions

The research questions can be subdivided into three (Figure 8).

1. What are the key elements of Building Adaptive Design for Vacation-Type Retirement Communities?

2. How to transform Natural Villages into Vacation-Type Retirement Communities with Building Adaptive Design?

3. How to carry out the design practice of transforming Natural Villages into Vacation-Type Retirement Communities in Guangdong through Building Adaptive Design?

1.4.2 Research Objectives

The research objectives corresponding to the research questions are also subdivided into three (Figure 8).

1. Create a theoretical framework for Building Adaptive Design for Vacation-Type Retirement Communities.

2. Create a set of Building Adaptive Design design strategies and design methodologies for Vacation-Type Retirement Communities.

3. Complete a design practice in Guangdong to transform a Natural Village into a Vacation-Type Retirement Community through Building Adaptive Design.

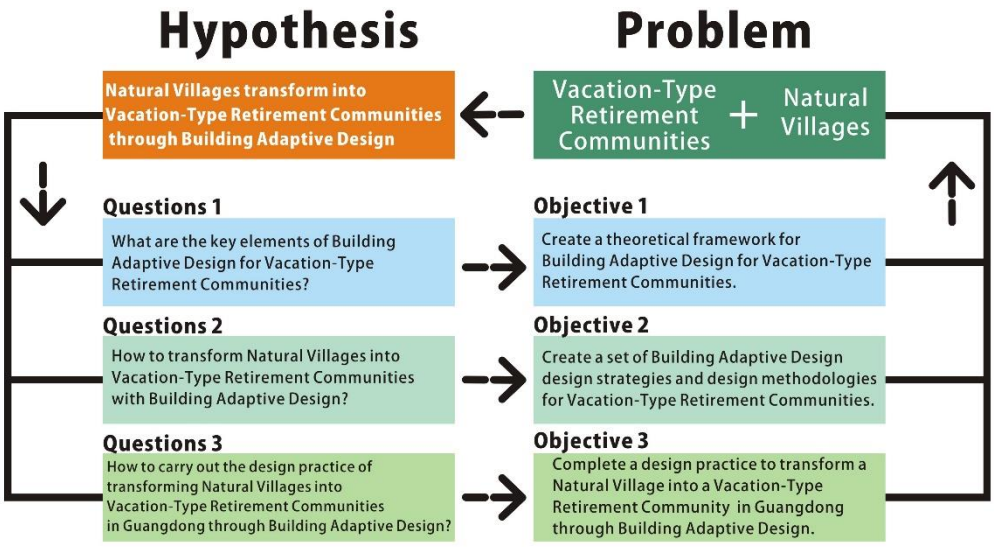

Figure 8. Questions and Objectives

Source: Author (2023)

1.5 Scope of the Research

The scope of the research is divided into three aspects: the geographical scope, the research subject's scope, and the research object's scope.

1. Geographical scope: Guangdong Province, China.

2. The scope of the research subject: Users, operators, investors, and government. User research is the main focus, the age of the young elderly 60-69 years old, taking into account 70-79 years old.

3. Object scope: Space design, including architectural design, interior design, and landscape design.

1.6 Definition of Terms

1. Vacation-Type Retirement Communities.

Vacation-Type Retirement Communities provide retirees with a full range of services and amenities to enhance their quality of life and promote social interaction. Such communities are typically located in pleasant climates and rich landscapes, have numerous resort facilities, and provide appropriate medical, nursing, and health services. Later in the thesis, Vacation-Type Retirement Community indicates Vacation-Type Retirement Community, and Vacation-Type Retirement Communities indicates Vacation-Type Retirement Communities.

2. Building Adaptive Design.

Building Adaptive Design refers to designing and constructing buildings that consider possible future changes and needs and employs various design strategies and techniques to enable buildings to adapt to different future environmental conditions and user needs. This design considers the impact of population growth, urbanization, technological development, and climate change on the use of buildings, as well as the individual needs of users and diverse usage patterns, and provides sustainable and long-term use value for buildings through flexible and variable design. The aim of Building Adaptive Design is to improve the effectiveness and sustainability of buildings while meeting the needs and expectations of users, Reduce the damage to the environment and waste of resources, and promote sustainable building development.

3. Natural Village

A natural village is a settlement of residents formed naturally by one or more families, households, clans, or other factors, whose origin is a village formed spontaneously by villagers after a long time in a natural environment where people naturally gather to live together; in general, it has only one family name, is the descendant of the same ancestor and has the same blood relationship.

1.7 Thesis Framework

The thesis is divided into six chapters: Chapter 1, Introduction. The researcher focused on the research background, the significance of the problem, hypothesis, questions and objectives, the scope of the research, and the definition of terms. Chapter 2, Literature Review and related research. The researcher reviewed and discussed the literature on retirement communities, Building Adaptive Design, Architectural Typology, and the Guangdong context to discover the research lineage of retirement communities and Building Adaptive Design, insight into the research trends in the related fields, and found the GAP of the research. Chapter 3, Research Methodology. The researcher focused on the methodology suitable for this research. 1) Qualitative research, including literature research, policy research, fieldwork, case study, and interview analysis; 2) Quantitative research, including literature research, case study, and questionnaire; 3) Comprehensive research, including Mutually Exclusive Collectively Exhaustive (MECE) rule and 80/20 principles. Chapter 4, Research

Results, were divided into three subsections: 1) Stakeholder research, including user research, operator research, investor research, and government research. 2) Environmental research, which contains both natural and human environments. 3) Building research, including Guangdong traditional houses, Guangdong natural villages, buildings, and adaptive design strategies for buildings. Chapter 5, Design Practices. The design practices were divided into three subsections: 1) Design workshop. 2) Design Practice in Chiu Chow. 3) Design feedback. Chapter 6, Conclusions, Discussion and Recommendations. Summarized the thesis, discussed new knowledge, and recommended further research. Figure 9 shows the thesis framework.

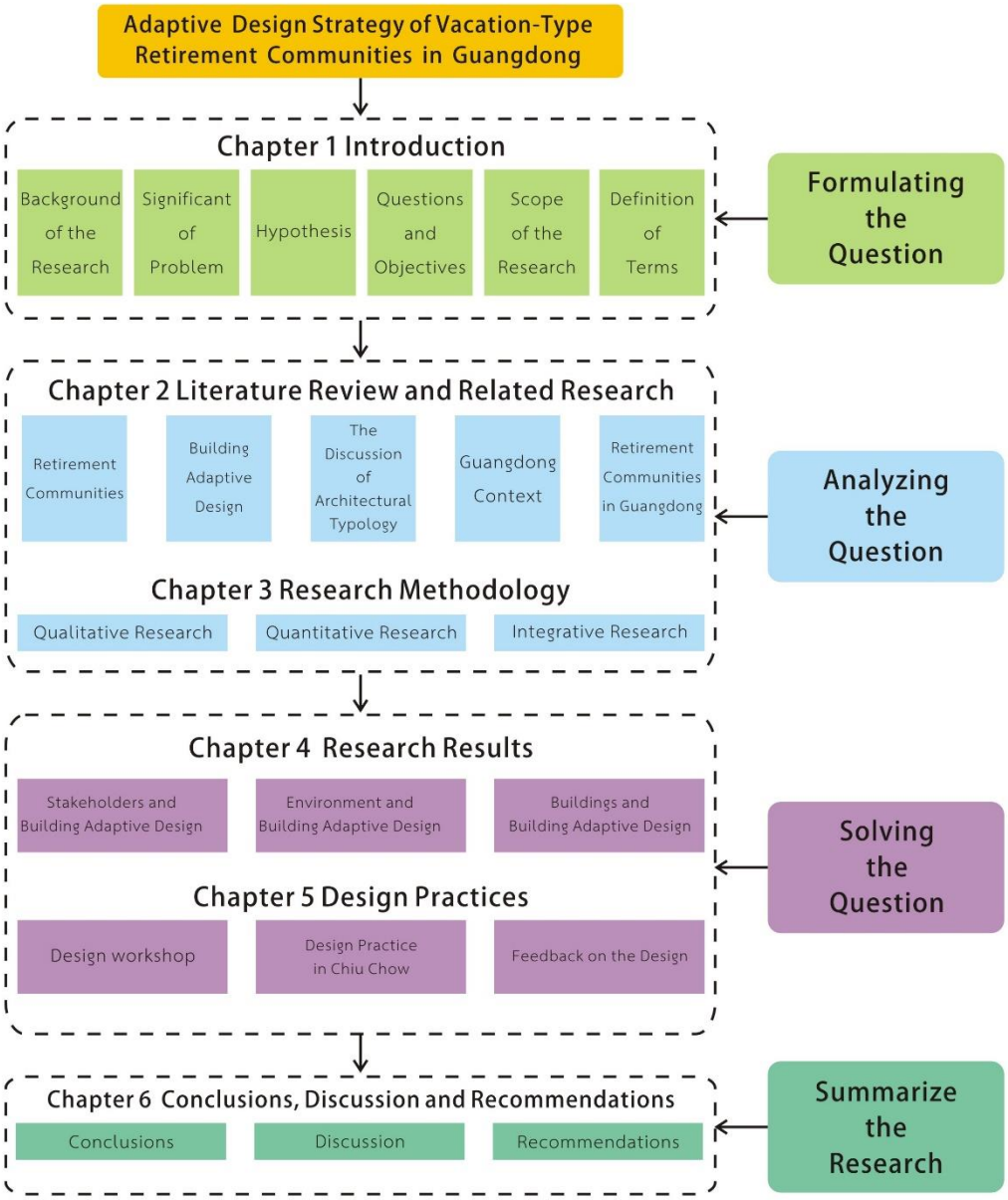

Figure 9. Thesis Framework

Source: Author (2023)

Chapter 2 Literature Review and Related Research

The literature review and related research were divided into six sections: 1. Retirement Communities; 2. Building Adaptive Design; 3. Discussion of Architectural Typology; 4. Guangdong Context; 5. Retirement Communities in Guangdong, 6. Summary.

The literature of this research contained English literature and Chinese literature. The primary source of English literature was the Web of Science Core Collection (WoSCC), and some English literature came from dissertations and books. The primary source of Chinese literature was the core academic journals and dissertations in China National Knowledge Infrastructure (CNKI), and some Chinese literature was also from books. Traditional literature review writing had subjective elements and lacked quantitative research. The critical literature in this research adopted a bibliometric approach to avoid this defect. First, data from the WoSCC were used for quantitative analysis to compile an overview of the research in this field. Second, the research collaboration network was analyzed using VOSviewer. Finally, the co-occurrence of keywords in the reference literature was analyzed using VOSviewer to derive research hotspots and trends and find the Research Gap.

2.1 Retirement Communities

2.1.1 Overview of Retirement Communities Research

1. Data Sources

In WoSCC, we searched Topic "Retirement Communit*" or "Senior Communit*" or "Old-age Communit*," and Document Type: Article, Review, and Language: English, and Index Date: 1900-01-01 to 2021-12-31. Seven hundred ninety documents were found. The search time was 2022-04-04. The retrieved documents were exported as plain text files containing the full record and cited references. The file type included title, abstract, keywords, authors, institution, country (region), year of publication, and contacts. Since the information is comprehensive, generating a visual knowledge graph will be easy.

2. Quantitative Analysis

With the development of global aging, scholars in developed countries began to pay attention to the search for retirement communities. The research on WoSCC retirement communities could be divided into three stages (Figure 10). The first phase: 1969-1991. 1969 was the first time that papers related to retirement communities were published. In the first phase, no more than ten articles were published per year. In the second phase: 1992-2010, the research in this phase gradually stabilized, and the number of cited articles related to retirement communities also steadily increased. The third phase: The time was from 2011 to present. During this phase, the number of articles published per year remained steady at 30 or more, except for 2014, when there were 24 articles, and the number of cited essays related to retirement communities increased dramatically. WoSCC had a relatively small literature on retirement communities from 1969 to 2021, with 790 articles, averaging about 15 per year. However, these 790 papers were cited 26,297 times, with an average of about 33 citations per paper and an H-index of 79. The quality of the articles was generally good.

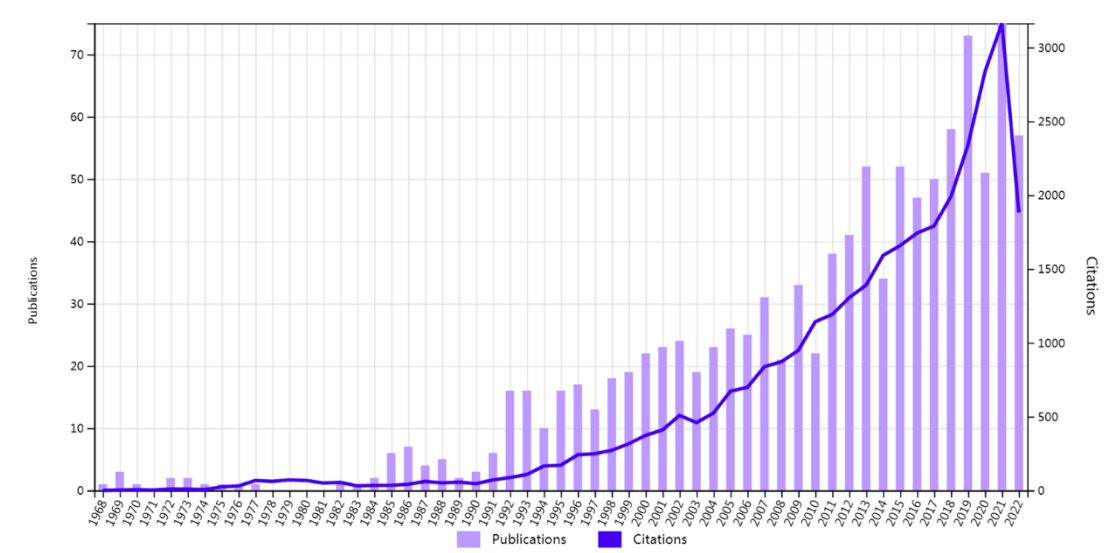

Figure 10. Number of Publications and Citations in Retirement Communities in the WoSCC Database

Source: Author (2022)

3. Research Collaboration Network Analysis

The author collaboration network was plotted by VOSviewer (Figure 11). Figure 11 shows three author collaboration networks in this domain: the author collaboration network in the red area had nine authors, including Kerra, J., Krist, K., Natarajan, L., Rosenberg, D., Moran, K., Godbole, S., Marshall, S. The author collaboration network in the blue region had seven authors, including Carlson, J.A., Rosenberg, D., and five others. The author's collaboration network in the green region had Bolling, K., Nebeker, C., Kim, H.C., Jeste, D.V., Reichstadt, J., Depp, C.A., and Palinkas, L.A. Among them, Kerra, J., Krist, K. in the red region was an essential node with extensive collaboration with authors in the red and blue regions. Bolling, K. in the green region was also a crucial central node, and Bolling, K. has extensive collaborations with authors in the red, blue, and green regions. Significantly, Bolling, K. served as a bridge between authors in the green area and those in other areas. In general, the collaborative network of retirement community research authors in the WoSCC database is loose, with only a few authors collaborating. There is much room for improvement in author collaboration.

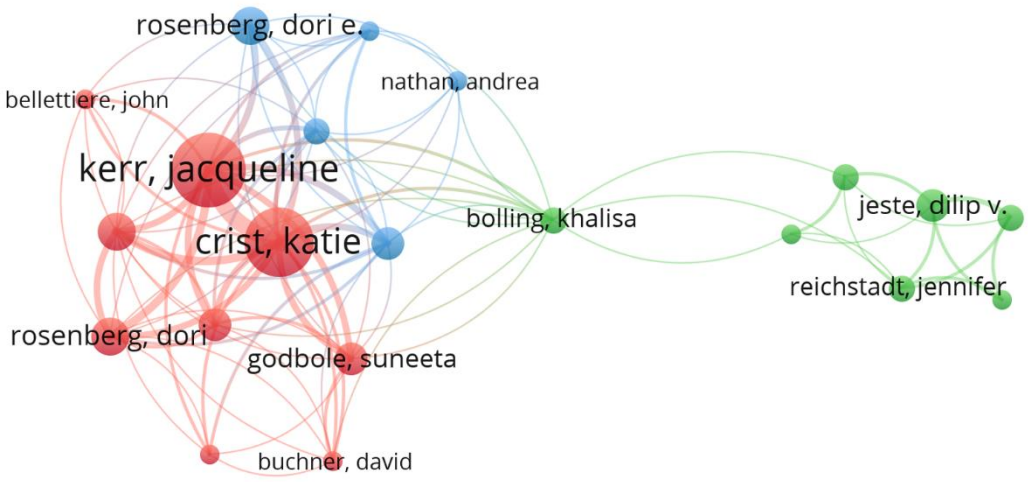

Figure 11. Author Collaboration Network of WoSCC

Source: Author (2022)

2.1.2 Evolution of Retirement Communities Research

Retirement communities are currently defined differently by different scholars. Retirement communities were collections of housing units and at least a minimum level of services planned primarily for healthy and retired seniors (Hunt, M. E. et al.,

1984). Retirement communities were planned, low-density, age-restricted developments built with private capital that provided a wide range of recreational services and relatively low-cost housing (Tsao, T. C., 2003). Retirement communities referred to residential areas where older adults live in their old age (Zhang, W. G., 2012).

According to factors such as community size, population characteristics, the types and quantities of the services provided, and the initiator of the establishment of the community, the retired community could be divided into five types: 1) Retirement New Towns, 2) Retirement Villages, 3) Retirement Communities, 4) Retirement Residences, 5) Continuing Care Retirement Communities (Tsao, T. C., 2003). Historically, Retirement Communities first appeared in the USA. The earliest Retirement Communities in the USA could be traced back to the Kearsley Retirement Community, established in 1772. Labor unions and religious groups developed supportive living environments for their past members in Florida in the 1920s, including the Moosehaven Community for retired members in 1922 and the Lakeland Carpenters' Home, a prototype Retirement Community established in 1928 (Hunt, M. E. et al., 1984). In 1954, Youngtown was built in Maricopa County, Arizona. Youngtown was the first Age-Restricted Retirement Community in the USA. Sun City, built in the 1960s and completed in the 1980s, was a model for Retirement Communities in the USA and worldwide. The Retirement Community has gone through different stages of development, including Continuing Care Retirement Communities (CCRCs), Naturally Occurring Retirement Communities (NORCs), University-Based Retirement Communities (UBRCs), and other stages of development (Figure 12).

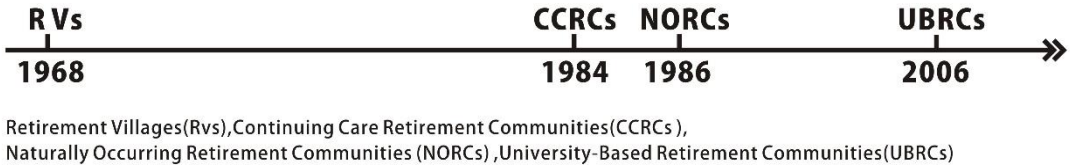

Figure 12. Evolution of Retirement Communities Research

Source: Author (2022)

1. Continuing Care Retirement Communities (CCRCs)

Continuing Care Retirement Community (CCRC) was an organization that provided housing, services, and health care for retirees (Winklevoss, H. E. & Powell, A. V., 1984). CCRCs originated in the USA and were an essential senior living model. CCRCs include Independent Living, Assisted Living, Nursing houses, Memory Care, and various living facilities to achieve aging in place for seniors (Tang, R., 2019). Krout, J. A. et al. (2002) studied the reasons seniors move into CCRCs and found that common reasons were: anticipation of future needs, continuity of care, reputation of the organization, management style, and proximity to family and friends. Shippee, T. P. (2009) studied the transitions between levels of care for residents of CCRCs and concluded that these transitions were stressful for residents, particularly regarding reduced social networks. Chaulagain, S. et al. (2022) studied the resident satisfaction of CCRCs, and the research showed that 10 CCRC factors significantly influenced resident satisfaction. Of these, psychosocial factors significantly impacted resident satisfaction, followed by cost and value, medical services, availability of activities, food service, design, rooms, management and staff, location, and mental environment. Zhang, X. Z. et al. (2022) proposed embedded CCRCs through case research with a facility unit-resilient organization-integrated implantation framework to provide new ideas for urban aging community construction. Ding, Y. J. (2020) studied the rehabilitation landscape of CCRCs and proposed eight design principles: Safety, comfort, locality, recognizability, accessibility, viewability, spatial diversity, and sustainability. Hu, X. et al. (2019) studied the impediments to the development of CCRCs in China by analyzing news reports from 14 major Chinese portals. The research results showed that 21 barriers hinder the development of CCRCs in China. These barriers were related to 3 categories: Development and management, government policy and industry regulation, and potential and current customers. Among the barriers with a frequency higher than 50% were: 1) Low return on investment and high risk due to high investment, long development and operation cycles of CCRC projects (67.27%); 2) Immature business models (55.36%); 3) Customer affordability issues (51.79%). These barriers required close cooperation among CCRCs stakeholders to ensure the healthy development of the CCRCs industry in China.

2. Naturally Occurring Retirement Communities (NORCs)

Hunt, M. and Gunter-Hunt, G. (1986) first introduced the concept of Naturally Occurring Retirement Communities (NORCs), "*a housing development that is not planned or designed for older people, but which over time comes to house largely older people*". The criteria for NORCs were mainly based on the proportion of the elderly population. Hunt, M. and Gunter-Hunt, G. (1986) considered the criterion of NORCs to be 50% of the elderly population. Hunt, M. (1988) considered the criterion of NORCs to be more than 50% of residents over 65 years of age. Hunt, M. and Ross, L. (1990) considered NORCs more than 50% of residents over 60. Lanspery, S. (1995) considered NORCs 50% of residents over 60. The size of NORCs varied widely, from a small apartment building to an entire community (Hunt, M. & Gunter-Hunt, G., 1986).

Greenfield, E. A. et al. (2012) proposed a conceptual framework for NORCs: First, the resources of NORCs contained external and internal resources. External resources refer to service providers, while internal resources include employees, volunteers, and the organization's mission. Second, the activities and services of NORCs consisted of three categories: 1) Civic engagement and empowerment activities, 2) Social activities, and 3) Services for accessing resources. Third, NORCs' goals were divided into three categories: 1) Initial goals, which specifically included self-efficacy, collective efficacy, and a greater sense of community; increased social support and reduced isolation; reduced unmet needs. 2) Intermediate goals, specifically physical and psychosocial health enhancement. 3) Long-term goals promote aging in place. Masotti, P. J. et al. (2006) proposed the concept of Healthy NORCs. They argued that the political, social, and physical environment of Healthy NORCs was more friendly to older adults and was a low-cost way to promote healthy aging. Parniak, S. et al. (2022) suggest that NORCs have the potential to leverage existing resources and partnerships to support older adults to lead happy lives in the community and that NORCs hold great promise. Currently, Naturally Occurring Retirement Community (NORC) study is focused on North America, and global NORC research needs to be developed due to the need for a standardized approach to identifying NORC and the lack of uniform terminology.

3. University-Based Retirement Communities (UBRCs)

UBRCs originated in the United States, a concept first proposed by Andrew Carle, Assistant Professor at George Mason University, in 2006 (Cai, H. & Wang, Z., 2017). The pioneers of UBRCs were Meadowood and Green Hills (Carle, A., 2006). In 1961, Dr. Herman, B. W. proposed developing exclusive retirement facilities for faculty and staff. 1981 saw the opening of Indiana University's retirement community "Meadowood," and the first residents moved in. The idea for Green Hills came from the Iowa State University Alumni Association in 1976, and Green Hills was completed and opened in 1986. George Mason University had identified five criteria for successful UBRCs: 1) Location within one mile of core campus facilities; 2) Integration of residents with university employees and students; 3) Providing a full range of senior housing services; 4) A written financial relationship between the retirement community and the university; 5) At least 10% of the residents were affiliated with the University or a University employee or alumnus (Carle, A., 2006). Smith, E. K. et al. (2014) used the Social-Physical Place Over Time theory to improve the definition of UBRCs by adding two supporting criteria: Transportation support and facilitation activities. UBRCs could provide residents with college facilities such as libraries, classrooms, gymnasiums, sports fields, concert halls, art galleries, and more. These facilities help enrich the lives of seniors and provide convenience for those who wish to pursue lifelong learning. Some of the residents of UBRCs were professors or employees of the university themselves, and living in UBRCs made it easier for them to continue their service to the university. In addition, some universities had strong hospital affiliations, and residents of UBRCs enjoyed green access to university hospitals. Although immature, UBRCs were favored by many experts and scholars and were one of the most promising models of aging communities in the United States (Hou, S. I. & Cao, X., 2021). It was estimated that there were over 100 UBRCs in the USA and that there would be nearly 400 similar retirement communities in the next 20 years (Carle, A., 2006). In addition to scholars in the USA researching UBRCs, some scholars in China and South Korea have also started to explore this field in recent years. The concept of UBRCs has only been around for 17 years since it was proposed in 2006. There were only 12 research papers on UBRCs in the WoSCC and very few research papers. The research on UBRCs

was still immature. Still, there was great potential for research on UBRCs because the number of practical cases of UBRCs was growing fast, and it was a promising way to age in place.

As early as 1968, the concept of Retirement Villages was introduced. Subsequently, this form has been developing steadily. However, a trend of accelerated development in recent years was worthy of attention (Osei-Kyei, R. et al., 2020).

2.1.3 Trends in Retirement Communities Research

VOSviewer was used to analysis the keyword co-occurrence of retired community literature in the WoSCC database, obtaining 42 keywords, deleting words such as people, older- adults, older adults, life, home, age, women, etc., which were not significant for the analysis, and finally, 35 keywords were obtained (Figure 13).

Figure 13 shows that: Earlier studies focused on population, disability, disease, Alzheimer's disease, exercise, and mortality. More recent studies focused on performance, risk, validation, depression, caregiving, retirement community, and social support. Recent studies have focused on Aging in Place, satisfaction, long-term care, loneliness, interventions, and falls.

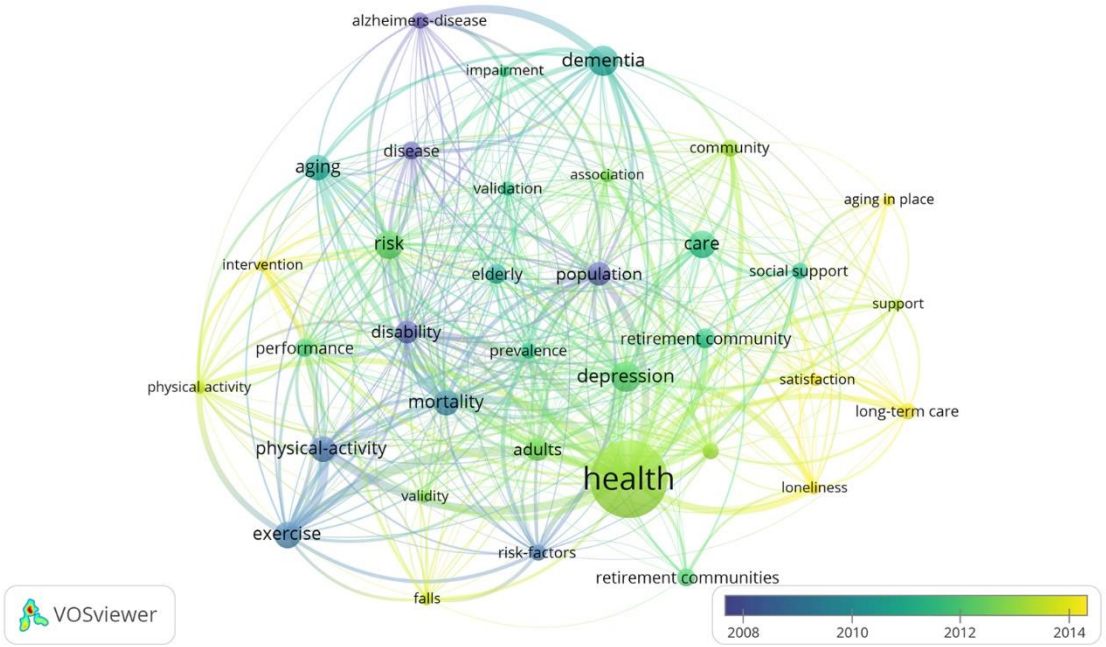

Figure 13. Keywords Co-occurrence Overlay Visualization of WoSCC

Source: Author (2022)

1. Aging in Place

Aging in Place is an initiative launched by the United Nations in response to the global population aging. Aging in Place maintains older adults' original social networks, increases independence, and is inexpensive. According to WoSCC, the earliest literature on Aging in Place was published in 1988, examining Aging in Place as one of two factors in the growth of regional elderly populations (Rogers, A. & Woodward, J., 1988). Aging in Place means maintaining independence and quality of life in one's home and community (Kim, K. I. et al., 2017). The "Aging in Place" program aimed to prevent or delay the traumatic relocation of the seniors to dependent facilities such as nursing homes (WHO, 2004). Aging in Place was the ability to live safely, independently, and comfortably in one's home and community, regardless of age, income, or ability level (American Planning Association & National Association of County and City Health Officials, 2009). The shift from institutional to Aging in Place would require a combination of science and technology, behavioral science, policy, community design, and significant innovation (Kim, K. I. et al., 2017). Aging in Place had four related topics: Health and well-being, social relationships, sense of self and autonomy, and activity participation (Chum, K. et al., 2022). Wiles, J. L. et al. (2012) investigated older adults' understanding of Aging in Place, for whom Aging in Place extended beyond the home or housing to the community. Communities are the physical places where communal aging occurs, networks are the social places where communal living occurs, and communities and networks influence the lived experience of Aging in Place (Gardner, P. J., 2011). There were six categories of factors that influence technology acceptance in Aging in Place: 1) Concerns about technology; 2) expected benefits of technology; 3) demand for technology; 4) alternatives to technology; 5) social influences; 6) characteristics of older adults (Peek, S. T. M. et al., 2014).

2. Satisfaction

Satisfaction is a popular keyword in retirement community research. Resident satisfaction was an essential indicator of market competition in CCRCs, and ten factors such as psychosocial factors, cost and value, medical services, food services, and design influence resident satisfaction in CCRCs, and resident satisfaction had a positive effect on life satisfaction and word of mouth (Chaulagain, S. et al., 2022). With the

rapid growth of the seniors population and the shortage of medical staff, telemedicine robots might improve older adults' life satisfaction (Bakas, T. et al., 2018). Older adults' participation in social activities, especially with friends, enhances life satisfaction, and the loss of social roles in older adults decreases life satisfaction (Lemon, B. W. et al., 1972).

3. Long-Term Care

Long-Term Care is also a popular keyword in retirement community research. Socially assistive robots help older adults maintain independence, provide social companionship, and improve working conditions for caregivers, thereby improving long-term care (McGinn, C. et al., 2019). By controlling 1/3 of senior housing ownership and then raising rents and health care costs, financial companies have disadvantaged older people in Long-Term Care homes and retirement communities (August, M., 2022). During the COVID-19 outbreak, closure measures by Israeli CCRCs brought about painful emotional reactions in older adults in Long-Term Care (Ayalon, L. & Avidor, S., 2021).

4. Loneliness

In recent years, Loneliness has also been a high-frequency keyword in retirement community research. Loneliness is a subjective experience of missing social relationships. Ayalon, L. (2018) found Loneliness pervasive, distressing, and detrimental to health and well-being. During the COVID-19 epidemic, segregation limited some social activities, leading to isolation and negative emotions, such as anxiety, among older people (Badal, V. D. et al., 2022). Health and physical deterioration, loss of close relationships, and lack of physical contact contribute to Loneliness in older adults (Carr, S. & Fang, C., 2022). Video-assisted leisure education increased leisure knowledge, maintained leisure satisfaction, and significantly reduced Loneliness in older adults with CCRCs (Dattilo, J. et al., 2022).

2.1.4 Vacation-Type Retirement Communities

1. Concepts related to Vacation-Type Retirement Communities

Concepts related to Vacation-Type Retirement Communities have not been studied in sufficient depth, and there is still no single definition. Zhou, G. (2009) put forward the concept of sojourn retirement: Sojourn retirement was a general term for travel, temporary residence, excursions, and other activities that take place in the form

of off-site retirement for elderly tourists, including vacation, sightseeing, convalescence, health care, and other forms. Rowles, G. D. and Watkins, J. F. (1993) built a model of a "small community of elderly immigrants" but did not give a clear definition. Based on the research of Rowles, G. D. and Watkins, J. F., Stallmann, J. I. and Siegel, P. B. (1995) proposed the concept of a "Seasonal Retirement Community."

2. Overview of research on Vacation-Type Retirement Communities

Research on Vacation-Type Retirement Communities could be broadly divided into three categories.

The first type of research is approached from a sociological perspective. Vacation-Type Retirement Communities are often accompanied by retired immigrants; therefore, many scholars have studied them from the perspective of retired immigrants. Savas, E. B. et al. (2023) reviewed 90 pieces of literature between 1998 and 2021. The study aimed to gain a comprehensive understanding of the field by assessing the strengths and weaknesses of the literature's methodological approach, reviewing the results of empirical studies, and discussing future research directions. Gustafson, P. (2008) studied retired immigrants from Western Europe in Spain and found that retired immigrants have strong transnational characteristics in terms of their mobility, identities, social networks, and cultural practices and do not have political transnational characteristics. Hoonaard, V. D. and Kestin, D. (2002), in a survey of retirement communities in Florida, found that there were Native Americans were somewhat at odds with each other.

The second type of research cuts across geography. Ono, M. (2015) examined the lifestyles of Japanese retired migrants in Malaysia. The study argued that lifestyle migration as a form of consumption leads to self-actualization, which is culturally specific to Japanese retirees. Hayes, M. (2015) examined North American retired migrants relocating to Ecuador through qualitative interviews with migrants, and the results showed that economic motivation was the main reason for their relocation. King, R. et al. (2019) studied international retired migrants in the Marche region of Italy and found that most international retired migrants grew their produce, participated in local community life, and appreciated the beautiful hilly landscape. However,

language and cultural barriers hindered integration into local life, and they complained of local bureaucracy.

The third category of research is approached from a planning and architectural perspective. Using the Alicante region of Spain as a case study, Zasada, I. et al. (2010) examined the relationship between the migration process, landscape change, and environmental impacts of retirement migrants through an interdisciplinary approach. Unique spatial patterns of migration and landscape archetypes were revealed. Lee, J. H. and Tan, T. H. (2023) examined the impact of community walkability and third places on the social connectedness of older adults. The study results showed that the third place has a positive significance in enhancing the social connection of older adults, and planners and developers should prioritize the third space in the design. Xu, J. (2015) took landscape design as an entry point and proposed to build a landscape system of Vacation-Type Retirement Communities with the "trinity" of the landscape of the natural environment, the landscape of the economic production, and the cultural environment. Lei, T. (2016) Analyzed and researched the existing travel and retirement bases in Hainan, conducted functional and market positioning of the project, and carried out planning and design based on the positioning.

3. Review of Research on Vacation-Type Retirement Communities

First, there is a tiny amount of research literature on Vacation-Type Retirement Communities. As of April 10, 2023, there were only two pieces of literature on Vacation-Type Retirement Communities in the WoSSCC database and only 303 related literature. The CNKI database has only 17 works of literature on Vacation-Type Retirement Communities.

Second, the research on Vacation-Type Retirement Communities mainly starts from sociology, geography, and other disciplines, and the overall examination needed to be more macroscopic and deeper. Once again, a few studies on Vacation-Type Retirement Communities approach from the perspective of planning and architecture to study micro issues. The previous research mainly focuses on the planning and design of specific projects, architectural or landscape design, which have a particular application value. Still, the theoretical depth needs to be improved, and there needs to be more building a systematic academic system.

2.1.5 Retirement Community Design

1. Data Sources

The English literature data was obtained from the WoSCC database. The search type was "Topic," and the keywords were "retirement community*" and "design"; the document type was limited to "article " and "review"; the language of the documents was limited to "English"; the search period was from January 1, 1991, to December 31, 2021. The search was conducted on April 15, 2022. After the search, a total of 211 helpful articles were obtained.

2. Quantitative Analysis

Figure 14 shows the characteristics of the year distribution of Retirement Community Design related articles in WoSCC. Based on the temporal distribution and changes in the number of papers, this paper attempted to divide them into two phases: The first phase was the start-up phase, from 1991 to 2006. The number of papers published in this period was small and unstable. Among them, the least number was in 1991, with only one paper; the most were in 1992 and 1996, with eight papers. The second phase was the development phase, from 2007 to 2021. The number of articles in this phase increased dramatically. Among them, the number of articles reached 12 in 2015 and 2018. Overall, from 1991 to 2021, the WoSCC had 211 pieces of literature related to Retirement Community Design, a small amount of literature. However, these 211 papers were cited 9209 times, with an average of about 44 citations per paper and an H-Index of 50.

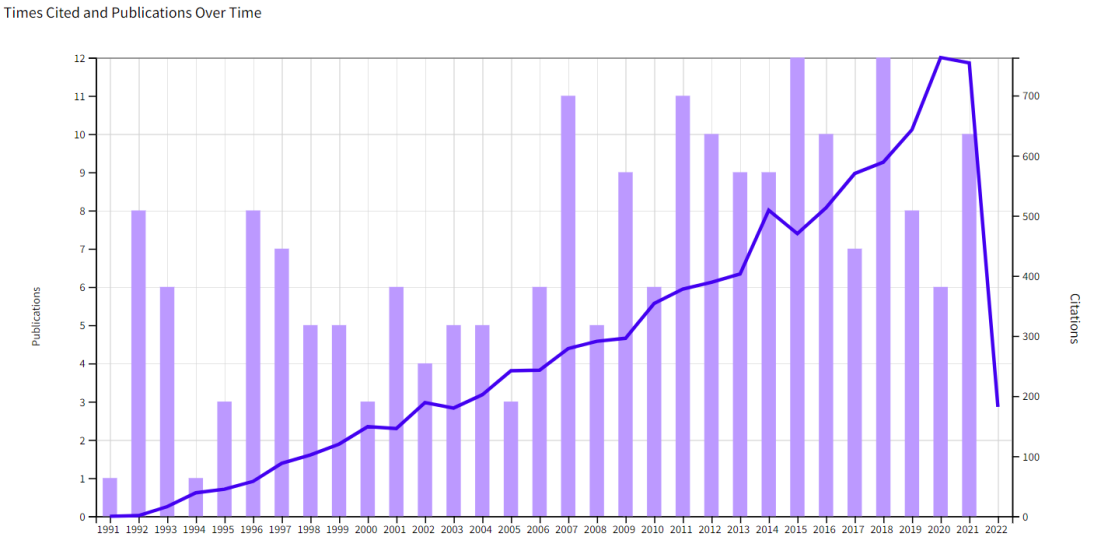

Figure 14. Number of Publications and Citations in Retirement Community Design in the WoSCC Database

Source: Author (2022)

3. Research Cooperation Network Analysis

Vosviewer was used to analyze the author collaboration network of the literature (Figure 15). The area of the circle indicates the number of published papers. The thickness of the connecting wires indicates the closeness of the cooperation. Looking at Figure 15, we could see three author collaboration networks in this area. The author collaboration network in the green area had seven authors, including Bennett, D.A., Buchman, A.S., Leurgans, S.E., and Barnes, L.I. The collaborative author network in the red area had ten authors, including Schneider, J.A., Larson, E.B., Trittschuh, E., and Crane, P.K. The collaborative network of authors in the blue region had six authors, including Gibbons, L.E., Manly, J., Jefferson, A.I., and Carvalho, J.O. Among them, the essential author was Bennett, D.A., who was from Rush University and was the central node of the author collaboration network, connecting most of the authors in Figure 15. Also, an influential scholar was Gibbons, L.E., who was from the University of Washington and focuses on measuring cognitive aging. Gibbons, L.E. was a regional network node that connected authors in the blue and red regions. The green regions had a high level of cooperation, while the red and blue regions had a relatively low level of cooperation. Overall, the collaborative network of Retirement Community

Design research authors was loose, with only a few authors collaborating, and there was much room for improvement in author collaboration.

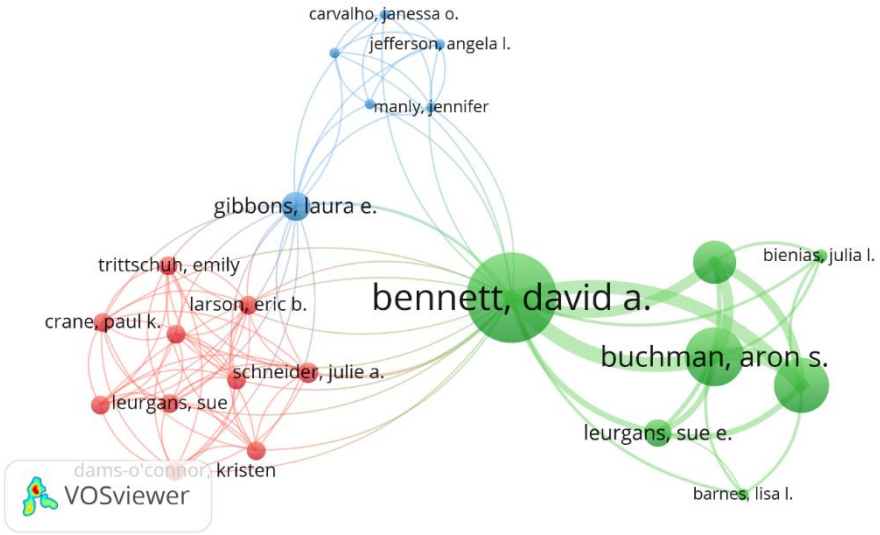

Figure 15. Author Collaboration Network of WoSCC

Source: Author (2022)

4. Keywords Co-occurrence Analysis

Keyword Co-occurrence Analysis of the Retirement Community Design related literature using Vosviewer. Two hundred eleven Keyword Co-occurrence were analyzed using Vosviewer to generate the Keyword Co-occurrence time series graph (Figure 16). The Keyword Co-occurrence time series graph analysis could present the research status and trends. The keywords in yellow were the research hotspots and trends in Retirement Community Design: 1) Long-Term Care; 2) Aging in Place. This conclusion was consistent with the analysis of retirement community literature.

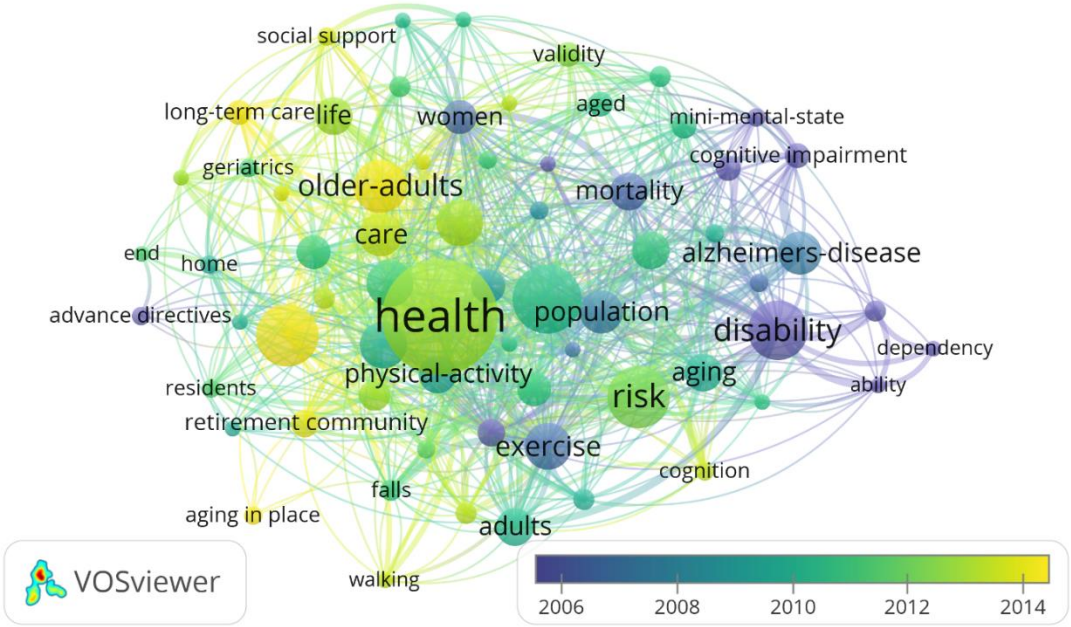

Figure 16. Keywords Co-occurrence Overlay Visualization of WoSCC

Source: Author (2022)

Conclusions of the Retirement Communities Research

1) Retirement Communities will be combined with Active Aging and Aging in Place, and NORCs, UBRCs, and Retirement Villages would be promising models.

2) Retirement Communities would be smaller and more home-based, and institutionalization would be eliminated.

Conclusions of the Retirement Community Design Research.

1) The research cooperation network of Retirement Community Design research showed small-scale cooperation, and the depth and breadth of cooperation were insufficient;

2) The scholars at the core of Retirement Community Design were Bennett, D.A., Royall, D. Buchman, A.S., Boyle, P.A., and Wilson, R.S.

3) The research hotspots and trends of Retirement Community Design: First, Aging in Place. Second, Smart Aging. Third, Rehabilitation Landscape.

4) Western scholars advocate the normalization integration of retirement communities, proposing that older adults return to the mainstream of society and integrate into the community; these ideas would become mainstream design concepts, and specialization and segregation would be eliminated (Li, Q. L. & Li, B., 2019).

2.2 Building Adaptive Design

2.2.1 Adaptive Design

Adaptation came from the Latin adaptations, which were meant initially to adjust or change (Wang, Z., 2008). Adaptation is a biological term by which organisms change their form and color to survive and adapt to environmental changes (He, J. Y. et al., 2017). Adaptation originates in the theory of evolution proposed by the British biologist Darwin. In 1859, Darwin advanced the concept of natural selection in *On the Origin of Species*, stating that organisms adapted to their natural environment reproduce better than those less adapted (Darwin, C. R., 2018). In 1864 the English philosopher Herbert Spencer summarized the idea of evolution as survival of the fittest in *Principles of Biology* (Pan, W., 2012). Herbert Spencer has been called the "father of social Darwinism." Subsequently, the concept of adaptation has been widely introduced into other disciplines, resulting in discipline-specific adaptation theories. In biogenetics, adaptation referred to the ability of biological populations to adapt to new environmental change conditions through genetics and variation (Pan, W., 2012). In the field of geography, adaptive design has also been defined by numerous scholars. In 1920, the British geographer Roxby, P.M. created the "adaptation theory." According to Roxby, P.M., the theory contained two layers: First, the limitations of the natural environment for various human behavioral activities, and second, the possibilities of various human social behaviors for using the natural environment (Huang, G. Y., 2006). In philosophy, the British philosopher Herbert Spencer argued that adaptation refers to the appropriate change of things in response to eternal external forces. In philosophy, adaptation referred to the continuous equilibrium-imbalance-new equilibrium experienced during which the equilibrium level between subject and object was increased through subject-object interaction (Pan, W., 2012).

In 1995, American scholar John Holland proposed Complex Adaptive Systems (CAS) in his book *Hidden Order: How Adaptation Builds Complexity*, a milestone of adaptive development. The agent consists of three primary mechanisms and four significant features: Aggregation, flows, diversity, nonlinearity, internal models, taggings, and building. The core concept of CAS theory: The adaptive or acting subject, the core idea of CAS, adaptation was an essential cause of complexity. John Holland argued

that subjects should be able to adapt, interact with the environment or other subjects, and modify their behavior rules according to the effects of their behavior in order to survive better afterward (Pan, W., 2012; Zhang, Q., 2011).

2.2.2 Building Adaptive Design

In architecture, adaptive design emerged late and needs a systematic approach, and so far, there has been no uniform definition, with different scholars offering different views. The definition made by James, D. (2006) in his book *Building Adaptability*: Building Adaptive Design was any work that changes the capacity, function, or performance of a building through maintenance or any intervention that was made to adapt, reuse or enhance a building to fit a new environment or need. Gorgolewski, M. (2005) considered building adaptability the ability to adapt a building to future changes and the ability to fulfill the owner's changing needs in the easiest way and at the lowest cost. According to Wang, Y. and Ye, W. H. (2002), Building Adaptive Design is a design idea, principle, and technique that examines the relationship between buildings and nature, society, history, culture, and economy from the perspective of human needs. According to Zhang, F. and Kuang, W. (2019), building adaptive refers to buildings that maximize building value throughout their life cycle by effectively regulating their ability to adapt to the changing needs of their users and environment. Adaptive design enhances the life cycle of buildings and is essential for the efficient use of resources and sustainable development; factors that influence buildings adaptability include the functional needs of the exterior of the building, the owner's wishes, and the designer's awareness, as well as the space, scale, and height of the interior of the building (Zhang, F. & Kuang, W., 2019). Due to the flexibility of adaptive design, some scholars also call the adaptive design a variable design. Many concepts were similar to adaptive design, such as remodeling, adaptive reuse, renovation, reinstatement, retrofitting, conversion, restoration, and so on (Zhang, F., 2018).

1. The Development of Building Adaptive Design

Building Adaptive Design was divided into three phases: Phase I, the 1910s to 1950s: Variable Design. Phase II, the 1960s to 1990s: Flexible Design. Phase III, the 1990s to present: Sustainable Design (Figure 17).

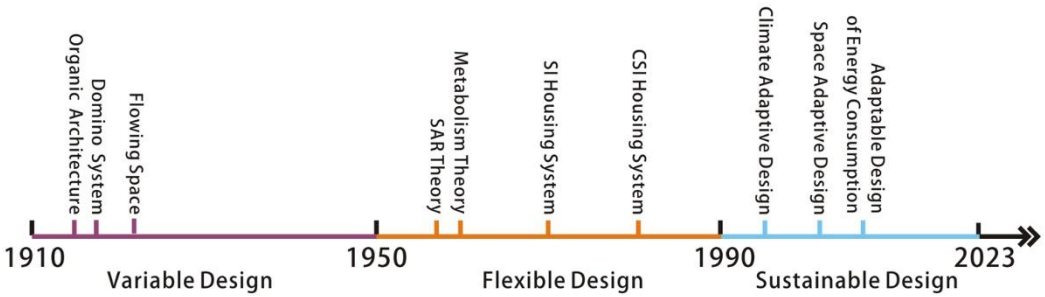

Figure 17. Research Development in Building Adaptive Design

Source: Author (2022)

Phase I, the 1910s to 1950s: Variable Design

Wright's theory of "Organic Architecture", an idea about the relationship between organisms and their environment, was proposed in 1914 in *For the Sake of Architecture ,* which refers to a building that develops from the inside out, by the conditions of its existence, rather than the kind of building that is formed from the outside(Zeng, B., 2014). This inside-out development is a natural structural principle by which architecture should be developed and serves as the basis for organizing architectural space. Wright treats architecture as a part of nature, and it should grow out of and in harmony with its environment, reflecting architecture's adaptability to nature.

The Domino system is the basic structural prototype of modernist architecture, and its buildings are found worldwide and have had a profound impact on the world. The Domino system originated in 1914-1915 when Le Corbusier built a series of reinforced concrete prefabricated skeletal houses, the Domino Houses. Domino is derived from the Latin word "Domus." In a narrow sense, the Domino system refers to the reinforced concrete-slab system; in a broader sense, the Domino system refers to the Skeleton frame structure (Han, Y. C., 2015). Since the Domino system adopts a frame structure, it brings excellent flexibility to the plan layout and façade division of the building, making it much more adaptable than the traditional load-bearing wall structure. The Domino system pioneered the design of adaptable buildings, and the Marseille apartment in France, completed in 1952, is undoubtedly a typical representative of the Domino system.

In 1928, Mies van der Rohe designed the German National Pavilion for the World's Fair by using the "flowing space" technique to increase the permeability and variability of the space, which naturally increased the adaptability of the space. The so-called flowing space is a flexible space enclosed by the changes in length, width, proportion, and distance of vertical and horizontal elements. In 1929, Mies van der Rohe continued the concept of "fluid space" in his design of the Tugendhat Villa by separating the living room and the research with stone slabs in an open space and the dining room with a wall. And the living room eventually forms an interconnected space with the other rooms (Jiao, M. F., 2019). The concept of "fluid space" was developed by Mies van der Rohe, resulting in the concept of "universal space." In a "fluid space," an ample space is divided into several small interconnected spaces. Removing the partition walls creates a whole ample space, the "universal space." The "universal space" can be transformed into smaller spaces of different sizes according to the user's needs. "Universal space" is also called "total space," which is an idea that reflects the adaptability of architecture.

Phase II, the 1960s to 1990s: Flexible Design

1) Stichting Architecten Researc (SAR) Theory

After the Second World War, large-scale residential construction was carried out in many countries to solve the housing shortage. Although this large-scale housing construction solved the housing shortage for a short period, it lacked adaptability and could not meet the individual needs of residents. By the 1960s, people were dissatisfied with the uniformity of the homes built during this period. Research by Stichting Architecten Research in the Netherlands has identified the root cause of the uniformity of housing: A loss of resident participation and decision-making power. In 1961, Professor Nicholas John Habraken published *Support - An Alternative To Mass Housing*, proposing the skeletal support theory, the prototype of the SAR theory. In 1965, Professor Habraken presented the idea of dividing housing design and construction into two parts - Support and Detachable Unite - for the first time at the Dutch Architects' Association. Since then, Stichting Architecten Research (SAR) has developed a set of theories and methods known as SAR theory.

Support refers to the basic structure of a building, which is designed by the architect and other professionals and decided by the project organizer. Its construction task is finished when the project is completed; Detachable Unite includes partition walls, equipment, decoration, general components, etc. The residents choose and implement Detachable Unite according to their own needs. The SAR theory is a reasonable consideration for the adaptability of the building and allows future space for the users to meet the changing needs of their families efficiently. Professor Habraken proposes that the user should be the main protagonist in the construction of the house and have the right to participate and decide in the building process of the house. SAR theory has been developed to produce a series of methods: 1) the most basic residential design method -SAR65; 2) the computer method of residential design -SAR70; 3) the group design method --SAR70 (Zhang, S. Y., 1981). In 1977, Dutch designers carried out SAR practice for the first time. SAR homes make homes humane, sustainable, and durable. SAR is a philosophical idea and methodology that prolongs the time families spend in housing and increases the stability of residents. Most traditional interior design is static and fixed. Residents cannot participate in short-term interior changes based on the phased changes in family size and do not have the opportunity to participate in the design process. The starting point of SAR theory is to adapt the living space to the diverse lifestyles and changing demographics of families so that there is a correspondence between families and living patterns (Jiao, M. F., 2019). The SAR theory has significantly impacted Japan, China, the United States, and other countries with far-reaching influence on variable housing. Japan introduced the SAR theory and developed the SI housing system based on it (Kawasaki, N. & Kim., Y., 2020). S refers to Skeleton, which is fixed, highly durable, designed by professionals, and generally use for more than 100 years; I refers to Infill, which is flexible and variable and can be flexibly adjusted according to users' needs (Kawasaki, N. & Kim., Y., 2020). The SI housing system is the mainstream housing design model in Japan. Subsequently, China introduced the SI residential system from Japan, and established the CSI housing system, which also significantly impacted the residential design in China (Shan, Q. et al., 2020).

2) Metabolic Theory

In the 1960s, under the influence of the famous Japanese architect Kenzo Tange, Masato Otaka, Kisho Kurokawa, Kiyonori Kikutake, and Fumihiko Maki founded the architectural creation organization "Metabolism". Metabolism emphasizes that architecture and cities should develop dynamically like living creatures, emphasizing the process of growth, renewal, and decline. This theory advocates the introduction of a temporal dimension in the practice of architectural design and urban planning, specifying the cycle of each element and forming buildings and cities based on the combination of different cyclic elements. In this view, there is a problem with the interaction of different parts of the building and the city based on the temporal factor and the coexistence of tissues and organs with different life cycles in a living organism. Based on the metabolism theory, Kisho Kurokawa proposed the idea of "symbiosis ", the coexistence and symbiosis of things such as architecture, based on the theory of biological adaptation. The BOC pod building designed in 1972 is one of the representative works of this school of thought, realizing the concept of plug-in, which can replace the interior decorative plug-in according to the changing needs of users, giving full play to the adaptability of living space and people (Pan, W., 2012).

Phase III, the 1990s to Present: Sustainable Design

Ahern, J. (2013), suggested that in order to achieve urban sustainability, planners, landscape ecologists, and architects should collaborate and adhere to five building strategies: adaptive design, connectivity of urban ecological networks, biodiversity, multifunctional design, and modular design. Mesaros, P. et al. (2021) proposed applying building information modeling (BIM) research adaptive design templates for construction renovation to enhance efficiency and sustainability. Van Ellen, L. A. et al. (2021) proposed the concept of rhythmic buildings, where adaptive architecture would address global environmental, social, and economic challenges. A systematic review of the development of adaptive architecture is presented. Senatore, G. et al. (2018) conducted a study of five case studies, which showed that across a range of space configurations and building costs, adaptive design resulted in an average of 70 percent whole-life energy savings.

Building Adaptive Design continued to develop after the 1990s, with the following main research categories in the WoSCC and CNKI literature: 1) Climate Adaptive Design, 2) Space Adaptive Design, and 3) Adaptive design for building energy consumption.

1) Climate Adaptive Design

Xia, G. P. (2010) studied the climate adaptation of Lingnan buildings and devised four matching design strategies: 1) Body shape selection, 2) Ventilation organization, 3) Heat release countermeasures, and 4) Shading design. Wang, Z. (2008) studied the adaptive design of urban neighborhoods in hot-summer and cold-winter regions, he applied numerical computation techniques to simulate and predict the daily microclimate processes in the neighborhood layer isthmus, and the simultaneous dynamic scouring of environmental parameters such as wind flow, heat flow, turbulence, and radiation is completed. Moreover, the comparison with the measured results confirms the reliability and applicability of the numerical calculation software, which provides new ideas and methods for urban outdoor microclimate and urban design research. Chen, L. (2020) used Guangzhou as a case research to set design goals based on the environment, form, and function of Guangzhou through green building and adaptive design strategies to achieve a building that matches the local climate and meets the requirements of energy efficiency and health. Liang, J. K. (2014) studied the climatic adaptation of Dai dwellings and summarized four characteristics of the climatic adaptation of Dai dwellings: 1) Rain protection, 2) Sun shading, 3) Ventilation, and 4) Climatic buffer zone. Moreover, these characteristics will guide the construction of new dwellings for the Dai people.

2) Space Adaptive Design

Based on the analysis of youth needs, Wan, Z. X. (2013) points out that the household type of Chinese houses is developing from large to small. By analyzing the values, lifestyles, and living needs of youth, he divides the needs of young people for living space into enjoyment, home, and work types. He proposes to realize adaptive design in horizontal as well as vertical directions. Huang, X. C. (2014) applied the investigation and analysis methods of architectural planning to search the adaptability of indoor activity space and derive design principles and methods, taking kindergartens

in Dalian City as the research object. Yu, L. Y. (2010) researched the teaching buildings in Xi'an, summarized the existing problems and students' behavior patterns and actual needs, and after studying a series of excellent cases, summarized the composition method of spatial adaptability design for single public teaching buildings. Xu, Z. Q. et al. (2015) studied the completed public housing in Beijing and found a need for more adaptability, proposing the SI housing system for public housing to improve adaptability to meet the needs of different households. By researching the relationship between family demographics and space, Jiao, M. F. (2019) points out that based on changes in family demographics, residential space needs to change simultaneously, and then proposes a search on the adaptive design of living space based on family demographics, resulting in three primary adaptive design methods: movement, replacement, and adaptation.

3) Adaptive Design for Building Energy Consumption

Castleton et al. reviewed cases of retrofitting existing buildings and found a high potential for green roof retrofits in the U.K. (Castleton, H. F. et al., 2010). Thomsen et al. studied the Danish apartment Traneparken after an energy retrofit, including renovation of the facade, windows, and insulation, and the addition of a rooftop photovoltaic installation; the study found a significant reduction in energy consumption and a significant improvement in indoor climate(Thomsen, K. E. et al., 2016). G.M. et al. propose a cost-optimal approach to building energy retrofitting using a sample of office buildings built in southern Italy between 1920 and 1970(Mauro, G. M. et al., 2015). A statistical data-based approach for applying building energy efficiency for cost optimization in urban renewal processes is proposed by Aguacil S. et al. for a case study of buildings constructed in Spain in 2001(Aguacil, S. et al., 2017).

2.2.3 Building Adaptive Design and Retirement Communities

Zhou, Y. M., Cheng, X. Q., et al. (2018) summarized several design points for making household types with aging-adaptive retrofitting potential through variability design in the book *Elderly Housing*. These include: using frame structures in buildings, using light partitions in sets, reserving door and window openings, designing flexible spaces, and centralizing pipelines. In "A research on the adaptive design of elderly facilities." Li, J. J. (2014) summarizes the key points of adaptive space design on the

standard floor of elderly facilities in terms of structural system, floor plan layout, building elevator location, tube well setting, living units, public space, and care support space. In "Research on the space adaptive design of care unit." Song, C. (2019) analyzes the adaptive design of care unit space in elderly care facility buildings, summarizes the adaptive design method of care units based on research, and proposes constructive suggestions, including the outline of adaptive configuration and adaptive space arrangement of living space and unit living room space. In "Research on space adaptability design of elderly apartments based on dynamic demand." Zhang, R. (2018) gives the adaptive design methods of elderly apartments from the problems of living room, public activity space, and floor plan organization mode of older adults. The first is the in-suite adaptation, which can be achieved through the conversion of functional space attributes, the setting of flexible space, and the adjustment of furniture; the second is the combination of suite type, which can be divided and combined and exchange space design to change the size of the suite type. Wang, Y. (2013), in "Application in suburban communities of the adaptive plan for Aged," found that communities consider the inadequacy of the adaptive planning and design for aged care in planning and design, and proposed adaptive principles and strategies for the planning and design of suburban aged care communities, starting from the psychological needs of the elderly, the satisfaction of the seniors living, and the sense of belonging of the seniors family.

2.3 The Discussion of Architectural Typology

2.3.1 The Concept of Architectural Typology

Marcus Vitruvius Pollio is an explorer of the transfer of typology to architecture, and in his classic work *Ten Books on Architecture*, Marcus Vitruvius Pollio focuses on the analysis of three temples and their specific practices that originated from the imitation of character types: Doric temples "reveal the rigidity and grace of the man's body proportions"; "Ionic temples "reveal a slender and decorated well-proportioned female pose"; Corinthian temples " imitates the slender posture of a maiden. Because of the young age of the maiden, her limbs are more slender, and when used as decoration, a more graceful effect is obtained" (Pollio, M. V., 2012). The basic framework of these three character types of temples is typical of architectural typology.

During the neoclassical period in the 18th century, some French architects studied classical architecture and compiled basic types of classical architectural plans and elevations to solve urban landscape problems (Yang, Y. H. & Wei, C. Y., 2008).

According to Wei, C. Y. (1990) in "Architectural typology research," architectural typology is a system of methods for categorizing and grouping buildings and a feasible solution for making buildings run along a trajectory in line with regional and cultural characteristics. According to Aldo Rossi, "Typology is the idea of architecture, which is closest to the essence of architecture." Wang L.J. proposed the concept of architectural typology in a broad sense. They concluded that as long as the concept of "archetype" is involved in the design or its "archetypal" characteristics can be analyzed, it should fall within the scope of architectural typology research (Wang, L. J., 2003).

2.3.2 The Development of the Architectural Typology

After more than one hundred years of development, modern architectural typology research has entirely influenced architectural activities at different levels. It has become a necessary dual tool of theoretical and practical nature. Architectural typology has gone through three stages of development: "archetypal architectural typology," "paradigmatic architectural typology," and "contemporary architectural typology" (Xin, Y., 2013).

1. The Typology of Prototypical Architecture

In the 18th century, during the French Enlightenment, a valid typology of architecture emerged: the "primitive hut" theory of Laugier M.A. Laugier believed that this shelter, made of natural materials such as branches and leaves, was the origin of all architecture, or the "prototype." The "prototype." This prototype contains all the necessary architectural elements, including columns, beams, walls, roofs, gables, etc. (Huang, J., 2016).

The founder of architectural typology was the French architect Jean Nicolas Louis Durand.He published the world's first treatise on architectural typology in 1800, The Typological Manual of Ancient and Modern Similar Buildings (Wang, L. J., 2003). in which Durand used a diagrammatic approach to introduce the classic architecture of various peoples and eras. By creating a diagrammatic system that incorporates buildings' basic structural and geometric arrangement, he illustrates the principle of

combining building types as "prototypes" of architectural solutions. He thus initiated a systematic approach to the research of architectural typology (Zhang, Y. A., 2017).

Laugier's archetypes are derived from nature, and Durand's from geometry, but both ideas lead architecture down the rational path of archetypes and derivations similarly (Huang, J., 2016). The purpose of architectural typology is to expect to discover principles of architecture from previous buildings that can guide architectural practice. The archetypal typology, which is the first stage of architectural typology, has been repeatedly explored by European scholars over a long period and has constructed a complete framework for architectural typology (Wang, L. J., 2003).

2. Paradigm Building Typology

1870s-early 1900s, Europe, the United States, and Japan completed the second industrial revolution, and humanity entered the electrical age. Industrialization influenced all areas of society, and architecture was also swept by the tide of industrialization. The standardization and mass production of products were the main concerns of this period. In response to this trend, Le Corbusier proposed the idea of "architecture as a machine for living." The modernist architects and scholars, represented by Le Corbusier, abandoned the view of archetypal typology and proposed that architectural typology return to the "human being." Le Corbusier believes that all architectural design should be based on "people" and that the building components must consider the human scale. He proposed the concept of "modulus" and developed two modulus systems: red and blue. Based on the human modulus, the building design follows the universal standard: the walls, stairs, windows, doors and floors should be human-referenced and meet the needs of people. Thus, the typology of architecture was transformed from "prototype" to "paradigm," and the typology of architecture in this period was called "paradigm typology" (Huang, J., 2016).

The emergence of paradigm typology is the inevitable result of historical development. The development of prototypical typology to paradigmatic typology results from a shift in the view of nature. The historical background of the emergence of prototypical typology was the dominance of nature (first nature) at that time. With the completion of the second industrial revolution, man's ability to transform nature was greatly enhanced. Artificial (second nature) increased in status and became the

primary source of architectural typology. Therefore, paradigm typology is also called the second typology. Paradigm typology is one of the essential manifestations of modernist architectural thought.

3. Contemporary Architectural Typology

In the 1960s, modernist architecture was heavily criticized for over-emphasizing functional and economic values and erasing the humanistic attributes of architecture, such as locality and diversity. In this context, a typology of architecture emerged, the contemporary typology, also known as the "third architectural typology." Contemporary architectural typology consisted of two main parts: A neo-rationalist architectural typology that looked to history for "archetypes." The second was a neo-regionalist architectural typology that looked for "archetypes" in the region (Wang, L. J. & Shu, P., 2005).

1) Neo-Rational

In the 1960s, a movement to reconceptualize classical architecture, the Neo-Rational movement, broke out in Italy. This movement was represented by Aldo Rossi, Giorgio Grassi, Leon Krier, Rob Krier, Mario Botta, and others. Neo-Rationalism, known as the Tendenza School, began with two original works: Aldo Rossi's 1966 book *Urban Architecture* and Giorgio Grassi's 1969 book *The Logical Structure of Architecture*. Aldo Rossi used the typological approach to architecture, arguing that architecture could also be divided into typologies of a typical nature, requiring architects to return to the original form of architecture in their designs. Rossi also advocates the principle of similarity, which, when extended to the urban scope, leads to the idea of the so-called "similar city. In his book, he emphasizes that architecture should be an integral part of the urban texture rather than a mutation or an invasion (Yan, K., 2005).

In *The Logical Structure of Architecture*, Giorgio Grassi attempts to develop some necessary combinatorial laws for architecture (Wang, L. J. & Shu, P., 2005). The Krier brothers (Leon Krier and Rob Krier) have built a whole set of theories about the morphological aspects of the city based on typology.

2) Neo-Regionalism

It referred to the architectural assimilation of local, folk, folkloric, and ethnic styles to reflect the local unique style in modern architecture. As a contemporary

genre, it is derived from the traditional localism or vernacularism, a dialect or folk style in architecture". (Wang, L. J. & Shu, P., 2005). Since the 1970s, it has had a vast influence in Northern Europe, Japan, and less developed countries in Asia. This style differs from the historical style but is also familiar to the public and more artistically intimate (Wang, L. J., 2003). Neo-regionalism is not a copy or imitation of local traditional architecture. Neo-regionalism is still a part of modern architecture, which follows current standards and needs regarding construction and function (Wang, L. J. & Shu, P., 2005). Neo-regionalism highlights tradition and sublimates local traditional culture after digestion and absorption.

Since Modernism erased local culture, New Regionalism reflects and revises Modernism. In the history of modern architecture, regionalism can be traced back to the famous Spanish architect Gaudi. Gaudi's works, such as the Mira Apartments, were highly accomplished in expressing the local traditions of Catalonia. The renowned Finnish architect Alvar Aalto greatly influenced Neo-Regionalism, and he was the first master to counteract Modernism by adopting the Neo-Regionalist design approach. In his design of Villa Maria, the Scandinavian enthusiasm, aggressive character, and romantic spirit are unmistakably revealed (Wang, L. J., 2003). Mexican architect Luis Barragan is also an icon of neo-regionalism; as a young man, Barragan participated in the Escuela Tapatia movement, which promoted the integration of architecture with regional traditions and culture; Barragan's work often uses regional elements such as traditional Mexican inward-facing courtyards, distinctive cast-iron grilles, mosaics, and bold colors, and bold colors. Chinese scholar and architect Wang Shu also represents the new regionalism. At a time when China is inundated with square boxes of Modernism, he remains committed to neo-regionalism. Wang Shu has always advocated the need for architecture to continue the local culture. When designing the Xiangshan Campus of the China Academy of Art, Wang Shu used old discarded bricks and tiles as the primary material and extracted the typical shapes of Jiangnan dwellings. The design concept came from the experience of Chinese garden design in Mr. Tong's *Jiangnan Garden History:* sparse and dense, zigzag, and with a view in front of the eyes (Tong, L., 1963). Wang Shu's insistence on new regionalism continued into his later renovation projects in the countryside.

It is worth noting that Neo-rationalism tends to find its cultural roots, while neo-regionalism tends to find its regional roots. The archetype of neo-rationalism is to restore the grand narrative of history, and the archetype of neo-territorialism is to restore the micro-narrative of a particular region (Wang, L. J. & Shu, P., 2005). The famous Swiss architect Mario Botta is both a neo-rationalist and a neo-territorialist architect (Wei, C. Y., 1990).

2.3.3 The Architectural Typology and Retirement Communities

1. Types of Retirement Communities

The building types of retirement communities can be divided into various types depending on the criteria. Depending on the characteristics, retirement communities are classified into CCRC, NORC, and UBRC. Depending on the size, retirement communities are divided into small, medium, large, and extra large. According to the location of retirement communities, retirement communities are classified into urban, suburban, distant suburban, and rural. According to the different resources and facilities in the location of retirement communities, retirement communities are divided into the general type and resort type. According to retirement communities' different supporting medical resources, retirement communities are divided into typical types and combined medical and healthcare types. According to retirement communities' different degrees of openness, retirement communities are divided into closed, semi-closed, and open. According to the different age structures of retirement communities, retirement communities are divided into the single type and all-age types.

2. Building Types of Retirement Communities

The buildings of retirement communities can be divided into residential, service, support, and Integrated categories according to their uses. Residential buildings can be divided into older adults housing, apartments, and living units. Service buildings include nursing care buildings and medical buildings. The supporting buildings include a multi-purpose hall, dining room, laundry room, recreation room, classroom, etc. Depending on the construction method, retirement community buildings can be divided into new, expanded, and renovated buildings. Depending on the construction cost, retirement community buildings can be divided into low-cost, medium-cost, and high-cost.

Retirement community buildings can be classified into low, medium, and high adaptability depending on the degree of adaptability.

2.4 Guangdong Context

2.4.1 Natural Environment of Guangdong

1. Location and Area

Guangdong is located in southern China. Jiangxi and Hunan border it to the north, Guangxi to the west, Fujian to the east, and the South China Sea to the south. The mouth of the Pearl River borders Hong Kong and Macau on the east and west. The whole province of Guangdong lies between 20° 09′ - 25° 31′ N latitude and 109° 45′ - 117° 20′ E longitude (Zeng, Y., 2016). Guangdong is about 800 kilometers long from east to west and 600 kilometers wide from north to south. Guangdong has a sea area of 419,000 square kilometers and a land area of 179,800 square meters (Zeng, Y., 2016).

2. Terrain and Landforms

Guangdong has complex and diverse landforms, including mountains, hills, plains, tablelands, rivers, and lakes. Among them, 33.7% are mountains, 24.9% are hills, and 21.7% are plains (Guangdong Yearbook Editorial Committee, 2021). The topography of Guangdong is high in the north and low in the south, with mountains and hills in the north and plains and tablelands in the south.

Mountains with an elevation below 500 meters are called hills. The hills in Guangdong are mainly distributed in the southeast (Zhang, Z. S., 2016). The tablelands in Guangdong are distributed primarily in the coastal areas, among which Chaoyang-Haifeng and Yangjiang-Dianbai-Leizhou peninsulas are more dispersed (Zhang, Z. S., 2016).

The plains in Guangdong are divided into three types: Delta plains, river valley impact plains, and coastal plains. The main delta plains in Guangdong include the Pearl River Delta Plain and the Han River Delta Plain. The river valley impact plains are all over Guangdong, mainly the Rongjiang Lianjiang Plain in eastern Guangdong, the Jianjiang Plain in western Guangdong, the Huiyang Plain in the Dongjiang River, and the Yingde Plain in the Beijiang River. The coastal plains of Guangdong are mainly the Lufeng Plain, Yangjiang Plain, and Zhanjiang Plain.

3. Water Resources

Guangdong has abundant rainfall and many rivers. The biggest river among them is the Pearl River, which has three major tributaries: Xijiang, Dongjiang, and Beijiang. Among them, Xijiang is the longest, with a total length of 2,214 kilometers. The Pearl River has abundant flow, with an annual runoff of more than 330 billion cubic meters (Yang, Y. D. et al., 2019). The water network in the Pearl River Delta region is dense and crisscrossed.

The average annual precipitation in Guangdong is 1,771 mm, with uneven precipitation time and area distribution (Liu, D. D. et al., 2012). Rainfall is mainly concentrated in April-October, accounting for about 75%-95% of the year, and varies widely yearly (Guangdong Yearbook Compilation Committee, 2022). Guangdong is prone to flooding in summer and autumn and is often dry in winter and spring.

4. Marine Resources

Guangdong is close to the South China Sea, with extensive mudflats, a vast land shelf, excellent harbors and bays, numerous islands and reefs, and abundant marine resources such as marine life. Guangdong's coastline is long and winding, with a length of more than 4,114 kilometers, ranking first in China, and has many beautiful coasts, such as the coast of Nan'ao Island, the coast of Xunliao Bay, the coast of Dapeng Peninsula, the coast of Hailing Island, the coast of Jinsha Bay in Zhanjiang (Guangdong Yearbook Compilation Committee, 2022). Guangdong has 1,963 islands with 2,378 kilometers of coastline, of which 90% are uninhabited islands, and more than half of the islands are less than 500 square meters in area (Guangdong Yearbook Compilation Committee, 2022). There are many coastal harbors and bays.

5. Biological Resources

Guangdong has lush vegetation, and according to the Forestry Administration of Guangdong Province, 2021, by the end of 2020, the forest coverage rate of Guangdong Province will be 58.66%, and the forest accumulation will reach 584 million cubic meters, making it one of the provinces with the highest forest coverage rate in China (Guangdong Yearbook Compilation Committee, 2022). Forest cities are being built all over Guangdong. 11 cities in the province have met the requirements of forest cities. The Pearl River Delta region initially created China's first national forest city cluster.

The construction of nature reserves, mainly national parks, has achieved fruitful results. The number of nature reserves in the province is 1,359, which is the highest in China (Guangdong Yearbook Compilation Committee, 2022). The area of nature reserves accounts for 13.33% of Guangdong's land area. Guangdong's wetland protection rate has reached 49.24%, and the proportion of ecological public welfare forests above the provincial level has increased to 85.0% for Category I and II forests (Guangdong Yearbook Compilation Committee, 2022).

Guangdong is rich in biological resources. More than 7,700 species of plants belong to 2,051 genera and 289 families, including 6,135 species of wild plants (Guangdong Yearbook Compilation Committee, 2022). There are four classes, 36 orders, 143 families, and 928 species of terrestrial vertebrates in Guangdong Province (Guangdong Yearbook Compilation Committee, 2022).

6. Guangdong Climate

Guangdong belongs to the East Asian monsoon climate, with tropical and subtropical marine climate characteristics. Most parts of Guangdong belong to the subtropical monsoon climate. The main climatic features are abundant heat resources, a warm climate, no severe cold in winter, a long frost-free period, and frost-free in the south. The annual average temperature throughout Guangdong is between 18 - 24Celsius (Guangdong Yearbook Compilation Committee, 2022). The hottest month is July, with an average temperature of about 27--29 Celsius; the coldest month is January, with an average temperature of about 9--16 Celsius (Guangdong Yearbook Compilation Committee, 2022). The average sunshine hours throughout the year are about 1500 - 2100 hours (Guangdong Yearbook Compilation Committee, 2022). 2 Guangdong has abundant rainfall, with an average annual rainfall of 1500 - 2000 mm, annual evaporation of 1000 - 1200 mm, and a humid climate Guangdong has abundant rainfall, with an average annual rainfall of 1500 - 2000 mm, annual evaporation of 1000 - 1200 mm, and a humid climate. 3 The wind direction varies significantly with the seasons. South and southeast winds prevail in summer with low wind speed; north and northeast winds prevail in winter with high wind speed. Typhoons influence the summer season, and the coastal areas of Guangdong are sometimes attacked by storms from May to November.

7. Natural Resources and Retirement Community Design

Natural resources significantly impact architecture and therefore need to be carefully considered when designing retirement communities. Guangdong's landscape is predominantly mountainous and hilly, and retirement communities require as much flatness as possible, requiring topographic adaptation strategies. Guangdong's hot and humid climate requires climate-adaptive methods for Retirement Community Design through shading, ventilation, and moisture control. Guangdong is rich in water, marine, and biological resources. These quality resources must be utilized in the siting, planning, landscape design, and architectural design of retirement communities.

2.4.2 Human Environment of Guangdong

1. Politics in Guangdong

1) Political Overview of Guangdong

Guangdong is a provincial administrative region of China, abbreviated as "Yue," with Guangzhou as its capital. It has 21 prefecture-level cities, 65 municipal districts, 20 county-level cities, 34 counties, and three autonomous counties (Guangdong Yearbook Compilation Committee, 2022). Guangdong is the southern gate of China, the frontier of reform and opening up, and the most significant economic province in China. Guangdong's GDP accounts for about 1/8 of China's, and its comprehensive economic strength is the first in the country (Guangdong Yearbook Compilation Committee, 2022). Guangdong has two super first-tier cities, Shenzhen and Guangzhou, and two new first-tier cities, Foshan and Dongguan.

2) Policies Related to Retirement Communities in Guangdong

2022 The 14th Five-Year Plan for the Construction of Retirement Service System in Guangdong Province Interdepartmental Joint Conference on Retirement Services in Guangdong Province.

2019 Several Measures to Accelerate the Development of Senior Care Services in Guangdong Province Guangdong Provincial Government.

2018 Regulations on Elderly Services in Guangdong Province Standing Committee of Guangdong Provincial People's Congress.

2014 Implementation Measures of Social Pension Insurance for Urban and Rural Residents in Guangdong Province Guangdong Provincial Government.

3) Standard Codes for Elderly Buildings Implemented in Guangdong

2018-10-01 Architectural Design Standards for Elderly Care Facilities JGJ450-2018.

2022-07-15 Construction Standards for Community Day Care Centers for the Elderly.

2023-06-01 General Code for Fire Protection in Buildings GB 55037-2022.

2. Economy of Guangdong

1) Economic Overview of Guangdong

Adjacent to Macau and Hong Kong, Guangdong was the first province in China to set up a special economic zone. Since 1979, the economy has maintained rapid growth for a long time, and the total economic volume has been in first place in China. In 2021, Guangdong's GDP reached 12,436,967 billion Chinese Yuan, an increase of 8.0% over 2020 (Guangdong Provincial Statistics Bureau, 2022). GDP per capita is 98,285 Chinese Yuan. The primary industry is 500,366 billion Chinese Yuan, up 7.9%, and the secondary industry is 502,219 billion Chinese Yuan, up 8.7% (Guangdong Provincial Statistics Bureau, 2022). The tertiary industry is 6,914,682 billion Chinese Yuan, up 7.5% (Guangdong Provincial Statistics Bureau, 2022). The GDP of the core area of the PRD accounted for 80.9% of the province's share, while that of eastern Guangdong accounted for 6.2%, that of western Guangdong was 7.0%, and that of northern Guangdong was 5.9% (Guangdong Provincial Statistics Bureau, 2022). Guangdong's industrial structure distribution: The core area of PRD is mainly high-end manufacturing and the high-end service industry. High-end manufacturing includes electric cars, high-speed rail, cell phones, and drones. The high-end service industry consists of the financial and information industries. Other regions' industries include agriculture, general industry, and general tertiary industry. In 2021, Guangdong had a grain sowing area of 33,195,500 mu and a grain output of 12,798,700 tons, up 1.0% from 2020 (Guangdong Provincial Statistics Bureau, 2022). In 2021, Guangdong's per capita disposable income was 44,993 Chinese Yuan, up 9.7% from 2020 (Guangdong Provincial Statistics Bureau, 2022). During the same period, per capita consumer spending in the province amounted to 31,589 Chinese Yuan, an increase of 10.9% year-on-year. The per capita housing area for urban residents was 38.79 square meters, and for rural residents it was 50.14 square meters. (Guangdong Provincial Statistics Bureau, 2022).

2) Economic Characteristics of Guangdong

First, Guangdong Province had a huge economy. In 2021, GDP was 12,436,967 billion Chinese Yuan; In 2020, GDP was 11,115,163 billion Chinese Yuan; in 2019, GDP was 10,798,692 billion Chinese Yuan; in 2018. GDP was 9,994,522billion Chinese Yuan; in 2017. GDP was 9,164,873 billion Chinese Yuan (Guangdong Provincial Statistics Bureau, 2022).

Second, the economic structure was relatively reasonable. 2021, the proportion of the primary, secondary, and tertiary industries was 4.0:40.4:55.6.

Third, regional development was unbalanced. In 2021, Shenzhen had a total GDP of 3,066,485 billion Chinese Yuan and a per capita GDP of 173,663 Chinese Yuan; Guangzhou had a total GDP of 2,823,197 billion Chinese Yuan and a per capita GDP of 151,200 Chinese Yuan; in the same year, Meizhou had a GDP of only 130.801 billion Chinese Yuan and a per capita GDP of 33,764 Chinese Yuan; and Chiu Chow had a GDP of only 124.485 billion Chinese Yuan; with a per capita GDP of 48,427 Chinese Yuan (Guangdong Provincial Statistics Bureau, 2022).

3) Guangdong's Economy and Retirement Community Design

Although the total economic volume of Guangdong is the first in China for a long time, the GDP per capita is low, and the regional economic development needs to be more balanced. These conditions dictate that economic factors should be emphasized designing retirement communities to minimize construction and maintenance costs while ensuring high quality. At the same time, this economic disparity among different people in different regions should be fully considered in the adaptive design. Some older adults with better economic capabilities like Vacation-Types Retirement Communities. They have a strong consumption capacity and must be equipped with complete vacation facilities.

3. Culture of Guangdong

The culture of Guangdong belongs to the Lingnan culture, and to explore the culture of Guangdong, we need to understand the three Ethnic Groups of the Han Chinese in Guangdong: Guangfu, Chaoshan, and Hakka (Lu, Q., 2008). These three Ethnic Groups correspond to the Guangfu, Chaoshan, and Hakka cultures, which are the mainstream of Guangdong culture. The formation of the three major Ethnic Groups

resulted from the fusion of the Han Chinese, who migrated south from the Central Plains, and the indigenous people of Lingnan. Due to the different historical backgrounds, natural environments, economic conditions, cultural traditions of the three Ethnic Groups, and the language barrier, for a long time, the three cultures have maintained a parallel development, existing together but distinct from each other.

1) Guangfu Culture

Guangfu culture belongs to Lingnan culture, which has a distinctive personality and far-reaching influence on Lingnan culture (Li, Z. B., 2014). Guangfu culture includes the language, cuisine, folk customs, houses, literature, music, theatre, and arts and crafts (Lu, Q., 2008).

Guangfu culture is a Cantonese language culture centered in Guangzhou, with the Pearl River Delta as the core scope (Lu, Q., 2008). It has been proved that Fengkai County of Zhaoqing City is the "capital of Guangfu" and the birthplace of "Guangfu culture" (Xu, J. X., 2021). The Guangfu people moved in during the Tang and Song dynasties via Zhuguixiang in Nanxiong, northern Guangdong, and the main migration areas are in the Pearl River Delta (Lu, Q., 2008). The Guangfu people account for about 50% of the total population of Guangdong and is the largest Ethnic Group in Guangdong (Zeng, J. S., 2017). With its geographical and demographic advantages, Cantonese culture is Guangdong culture's main body and tends to radiate to the periphery. Cantonese, one of the hallmarks of Guangdong culture, is the result of the fusion of the ancient Yue languages with those of the Central Plains, Jingchu, and Wu Yue. Cantonese is spoken in 47 cities or counties in Guangdong, accounting for 1/3 of the province (Guangdong Yearbook Compilation Committee, 2022). The culture of Guangfu retains the qualities of ancient Yue culture and presents the typical characteristics of commercial culture: Business-oriented, pragmatic, and open.

2) Chaoshan Culture

Chaoshan culture belongs to Lingnan, one of Guangdong's three significant cultures. It is the sum of material and spiritual cultures created by the Chaoshan people. Chaoshan culture contains dialect, cuisine, Kungfu tea, folklore, houses, literature, music, theatre, arts and crafts (Lin, L. L., 2008). Chaoshan culture covers the four cities of Chiu Chow, Shantou, Jieyang, and Shanwei . Chaoshan people migrated

from the Central Plains to Guangdong in ancient times. The Chaoshan people are divided into Fulao and Helao, depending on how their ancestors migrated. The Fulao were ethnic groups that migrated from the Central Plains to Fujian and then from Fujian to Chaoshan. The Helao were ethnic groups that migrated directly from Central Plains to Chaoshan (Shen, J. R., 2000).

The Chaoshan area, adjacent to the South China Sea, has a well-developed water system, is densely populated, and has little arable land. These backgrounds have created the characteristics of Chaoshan culture: First, it has typical maritime cultural features, advocates adventure, and has a pioneering spirit; second, it is eclectic. Both retain the traditions of the Central Plains culture and absorb the local indigenous cultural characteristics and the essence of overseas culture. Third, excellence. Because there are many people and little land in Chaoshan, it is necessary to cultivate carefully, and a precise cultural characteristic is formed over time. For example, Chiu Chow wood carving, embroidery, craft ceramics, all the fine to the extreme. Fourth, the importance of business. Chaoshan region has permanently attached significance to the tradition of industry. The Chiu Chow merchant gang is the most typical Chinese merchant gang. Chaoshan people have a strong will to do business, and they have a keen sense and business skills, coupled with the Chiu Chow merchant gangs having a tradition of group business, resulting in a strong Chaoshan business culture (Xie, Y. Z. & Yuan, F. F., 2020).

3) Hakka Culture

Hakka culture is also a branch of Lingnan culture, which is co-created by the Hakka people and consists of material and spiritual culture. Hakka culture contains Hakka dialect, folklore, Hakka dwellings, Hakka food, literature, music, drama, and arts and crafts (Li, H. J., 2004). Hakka culture is centered in Meizhou, Guangdong Province, and is mainly distributed in eastern and northern Guangdong mountainous areas. In ancient China, there were many wars in the Central Plains, and some Han Chinese migrated southward to Guangdong, Fujian, and Jiangxi provinces to avoid danger. This part of Han Chinese formed the Hakka Ethnic Group in the Ming and Qing dynasties after a long-term integration with local Ethnic Groups (Jiang, B. Z., 1993). The Hakka language is one of the hallmarks of Hakka culture. Hakka is a branch of the Chinese language and is the result of the fusion of ancient Chinese with the local Yao and She

tribes. According to the pronunciation, the Hakka language can be divided into Meizhou, Heyuan, Huizhou, and Huiyang. Hakka people mainly live in mountainous areas, where conditions are complex and information is closed. The characteristics of the Hakka culture are: 1) It maintains the characteristics of the Central Plains culture, emphasizes Confucianism, respects teachers and education, emphasizes "cultivation and reading to pass on the family," and has a flourishing literary style and many talents. 2) It emphasizes living together in clans, has a strong family concept, and is sincere and united. 3) The mountainous environment constrains it, and it is hard-working.

4) Guangdong's Culture and Retirement Community Design

The three branches of Guangdong culture: Guangfu culture, Chaoshan culture, and Hakka culture, are the representatives of Lingnan culture, which is fruitful and wonderful. Adopting cultural adaptation strategies compatible with these three cultures is necessary when designing retirement communities. One of them directly related to the Retirement Community Design is the residential culture. Guangfu dwellings, Chaoshan dwellings, and Hakka dwellings are all very typical of Lingnan dwellings. The site selection, layout, architectural structure, building form, architectural decoration, and material selection of these three types of homes result from thousands of years of historical precipitation and are the crystallization of wisdom worthy of research and reference for Retirement Community Design. The folklore and traditions of these three cultures are different and must be given due attention and respect in creating retirement communities. In addition, all three cultures pay special attention to Fengshui. And the understanding of Fengshui varies among the three cultures, which must also be considered in designing retirement communities.

4. Population of Guangdong

1) Population Profile of Guangdong

According to the National Bureau of Statistics, in 2000 Guangdong's resident population was 86,420,000; in 2010, it was 104,303,000; in 2020, it was 126,840,000 (National Bureau of Statistics of China, 2001, 2011, 2021). The total population of Guangdong continues to maintain stable and rapid growth. The total population of Guangdong ranks first in the country in terms of both natural and incremental people.

Guangdong's population has several characteristics: One, Guangdong's population maintains a relatively fast growth rate, increasing by 40,420,000 people from 2000 to 2021 (National Bureau of Statistics of China, 2001, 2022a). There are several reasons for this rapid growth: 1 Guangdong is an economically developed region in China, which attracts a migrant population; 2 the influence of the policy of encouraging residents to have a second child; 3 the relaxation of the household registration policy, which attracts 12,871,000 people from 2010 to 2020 (National Bureau of Statistics of China, 2011, 2021). Second, the population gathered in the Pearl River Delta region, and the regional imbalance deepened. In 2021, Guangzhou had a population of 18,811,000, Shenzhen 17,682,000, Dongguan 10,537,000, and Foshan 9,613,000 (National Bureau of Statistics of China, 2022b). These four cities in the PRD alone account for about 45% of Guangdong's total population, and the PRD's population continues to flow in. Many cities in eastern, western, and northern Guangdong are experiencing population outflow. Third, household miniaturization. In 2000, there were 3.69 people per household in Guangdong. In 2010, 3.2 people per household. In 2020, only 2.63 people per household, and the number of people in households continues to decline (National Bureau of Statistics of China, 2001, 2011, 2021). The trend of household miniaturization is also an issue that must be considered when conducting retirement community studies. Fourth, the aging process is accelerating, with a population of 7,039,000 people aged 65 and over in 2010 and 10,813,000 in 2020 (National Bureau of Statistics of China, 2011, 2021). Guangdong's aging process is a relatively slow region in China, mainly because the foreign population that Guangdong attracts is young people. These young people reduce the proportion of the elderly population. However, When these young people settle down in Guangdong, many of them will bring their parents from their hometowns to Guangdong, which is an issue that needs to be taken into consideration when studying the problem of ageing in Guangdong.

2) Overview of the Elderly Population in Guangdong

Number and proportion of elderly population in Guangdong: In 2020, 10,813,000 people, accounting for 8.58%. In 2010, 7,039,000 people, accounting for 6.75%. In 2000,

5,230,000 people, accounting for 6.05% (National Bureau of Statistics of China, 2011, 2021).

Guangdong aging characteristics: One, the degree of aging is relatively light. The data shows that the degree of aging in Guangdong is low compared to other provinces in China. China entered an aging society in 2000 and Guangdong Province in 2013. Second, the aging population is enormous. The large population base of Guangdong leads to a large number of older adults, with 15,565,000 people aged 60 and above in 2020 (National Bureau of Statistics of China, 2021). Third, the proportion of low-age elderly is significant. In 2020, for example, there were 4,752,000 low-age older adults aged 60-65, accounting for 30.53% of the entire elderly population (National Bureau of Statistics of China, 2021). Fourth, aging needs to be more balanced. East, west and North Guangdong has a high degree of population aging, while the Pearl River Delta has a low degree of population aging. For example, In 2020, Chiu Chow's elderly population was 347,933, accounting for 13.27% of the total population, up 4.8% from 2010. (Chiu Chow Bureau of Statistics, 2021a). Chiu Chow has entered a heavily aging society. Shenzhen 's elderly population was 565,217, 3.22% of the total population, up 1.39% from 2010. (Shenzhen Bureau of Statistics, 2021). Shenzhen has yet to enter an aging society.

3) Population and Retirement Community Design in Guangdong

Guangdong has a relatively low aging level compared to other regions in China. This will bring a buffer time for designing and constructing retirement communities. Guangdong Province is the most populous province in China (National Bureau of Statistics of China, 2021), with a sizeable elderly base and a massive needs for retirement communities. It is also essential to pay close attention to the migration of the elderly population from other provinces, which will potentially impact the design of retirement communities in Guangdong.

2.5 Retirement Communities in Guangdong

2.5.1 Overview of Retirement Communities in Guangdong

According to the Guangdong Department of Civil Affairs, as of October 2022, Guangdong Province has more than 23,000 community elderly service facilities, more than 2,100 meal service points, and the overall coverage of comprehensive elderly

service centers built in townships and streets reached 68.5%, which has initially formed an urban community elderly service circle. There are 1,896 elderly institutions in Guangdong, with 246,000 institutional beds, more than half of which are nursing beds (Fu, C. et al., 2022). The construction of rural retirement communities is still weak and needs to be strengthened.

Guangdong's retirement communities include ordinary retirement communities, retirement communities that combine medical care, and vacation-type retirement communities. Due to Guangdong's overall better economic base, there is a strong needs for vacation-type retirement communities, which are currently in short supply.

2.5.2 Design Research of Retirement Community in Guangdong

Currently, there are few studies on the design of retirement communities in Guangdong. Zheng, X. Y. (2017). conducted a study on age-appropriate housing in Zhongshan City, using the "universal design principles" as a guide to study the product positioning, household type ratio, age-appropriate housing type, elderly support facilities, and service facilities of age-appropriate housing in Zhongshan City

Li, X. Y. (2020) conducted a study on CCRCs in Guangzhou and used the findings as a guide to design a diversified senior community in Guangzhou based on the local demographic structure and needs of older adults.

2.6 Summary

2.6.1 Research Summary

1. Retirement Communities Research

Retirement community research started earlier in developed countries such as the USA, France, Germany, Canada, Australia, and Japan. At the macro level, a theory focusing on the needs of older adults was established, and the strategies of active aging and aging in place for retirement were proposed. At the meso level, it began to promote integration and normalization, allowing older adults to return to society and integrate into the community. The concept of family-oriented and miniaturized space design is advocated. At the micro level, Western countries have established relatively complete technical standards related to senior living communities.

The research on retirement communities started late in China. At the macro level, a theoretical system commonly accepted by academics has not yet been

formed. Still, a consensus has been reached on the retirement model: Home care as the basis, community care as the foundation, and institutional care as the supplement (Zhou, Y. M., 2018c). At the micro level, most scholars still hold the idea of specialization for older adults, focusing on barrier-free design; in space design, institutionalized and large-scale design concepts still dominate. China has initially established technical standards for senior care design. However, these standards need to be further developed.

Villages, NORCs, cohousing residences and UBRCs are very promising retirement community models (Hou, S. I. & Cao, X., 2021)."Aging in place" is the most obvious retirement community trend (Chum, K. et al., 2022; Kim, K. I. et al., 2017; Wiles, J. L. et al., 2012). Retirement communities will be smaller and more home-based, and institutionalization will be eliminated. For Retirement Community Design, the hot spots and trends are: 1) Aging in Place, 2) Smart Aging(Ghayvat, H. et al., 2019; Kim, Y. H. B. et al., 2018), and 3) Rehabilitation Landscape(Luo, J. & Liu, H., 2021). Retirement Community Design advanced design concept: Older adults should return to mainstream society and integrate into the community; specialization and segregation will be eliminated(Li, Q. L. & Li, B., 2019).

In general, the research on retirement communities has a relatively deep accumulation in Europe and the USA, and the research results of these developed countries have implications for China. Still they cannot be directly copied due to different national conditions. Although the research on retirement communities is relatively mature in Europe and the USA, there are still research opportunities in niche areas, such as the lack of systematic research on resort-type retirement communities. Although the research on retirement communities in China has achieved certain research results, there are obvious shortcomings: 1) Many scholars' studies copy the experiences of Europe, America, and Japan, ignoring the special national conditions of China: Large aging population, super-fast aging, aging before the rich, obvious urban-rural differences, and an imperfect welfare system. 2) Many scholars focus too much on accessibility design, ignoring the leisure needs, social needs, and spiritual needs of older adults. 3) Most scholars focus on the needs of older adults, ignoring the needs of operators, investors, and the government.

2. Building Adaptive Design Research

Currently, the primary research of building adaptive design is focused on natural factors such as climate, space, and energy consumption. More attention should be paid to human factors such as policy, economy, and culture, precisely this thesis's breakthrough point.

3. Architectural Typology Research

After more than 100 years of development, architectural typology has gone through three stages of development: archetypal architectural typology, paradigmatic architectural typology, and contemporary architectural typology. Among them, modern architectural typology is divided into neo-rationalism and neo-regionalism. The research of architectural typology is continuing. The architectural classification of retirement communities needs to be clarified and organized by architectural typology. Also, case studies of retirement communities need to be sorted out with the assistance of architectural typology.

4. Guangdong Context Summary

Guangdong is strategically located with an ideal natural environment, warm and humid climate, high forest coverage, long coastline, and rich biological and marine resources, making it suitable for building retirement communities. Guangdong has the largest total population in China, and the aging rate is accelerating. Plus, there is a great potential needs for retirement from the foreign population, so there is a huge needs for retirement community construction. Guangdong's economy is well-developed and has sufficient financial resources to build retirement communities.

The retirement communities currently built in Guangdong are too institutionalized and lack consideration of three distinct regional cultures, including Guangfu, Hakka, and Chaoshan cultures; many of these built retirement communities are expensive and do not sufficiently consider middle-income and low-income groups; in addition, these retirement communities do not adequately consider the different needs of different age groups and have a low degree of adaptability. Therefore, there is an urgent need to research Building Adaptive Design for retirement communities in Guangdong.

2.6.2 Research Gap

In summary, scholars have yet to systematically study the combination of Vacation-Type Retirement Communities, Natural Villages, and Building Adaptive Design. The intersection of the three areas would be a research Gap (Figure 18).

Figure 18. Research Gap

Source: Author (2023)

Chapter 3 Research Methodology

The methodology was divided into three parts: 1. Qualitative Research, 2. Quantitative Research, 3. Comprehensive Research, and 4. Summary. Qualitative Research included literature research, policy research, and interviews. Quantitative Research included data collection, preprocessing, analysis, and visualization. Comprehensive Research had the Mutually Exclusive Collectively Exhaustive (MECE) rule and the 80/20 Principle. The framework of the research methodology is shown in Figure 19.

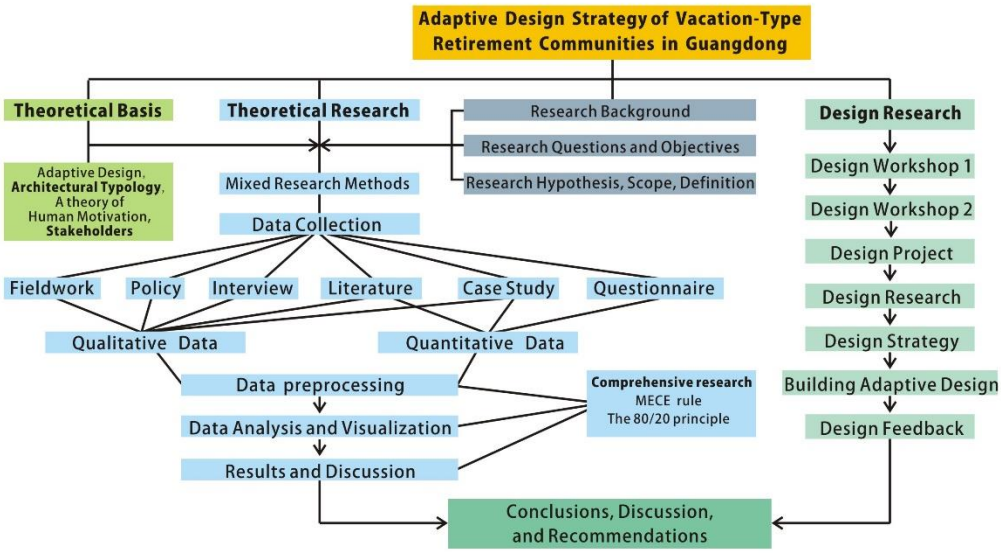

Figure 19. Research Methodology Framework

Source: Author (2023)

3.1 Qualitative Research

Qualitative research is an essential research paradigm that explores the main characteristics of things through induction and analysis, as well as logical reasoning, using mainly unquantifiable information such as text, pictures, and interviews. The specific qualitative research applied in this study consists of literature research, policy research, case studies, and interviews. Qualitative research ensured the breadth of this study and allowed for quick direction and framing of the research.

3.1.1 Literature Research

Literature research is a commonly used research method. This research had four dominant roles: First, the researcher identified research gaps by combing through the relevant literature and determined the research direction and topic selection. Second, by searching related literature, the researcher placed the questions and research objectives of this research. Third, by studying related literature, the researcher selected this research's orientation and technical route. Fourth, by reviewing related literature, the researcher combed the theoretical lineage related to this research to ensure the depth and breadth of theories. The literature of this research included journal articles, reviews, conference papers, dissertations, published books, and research reports. The literature research included three parts: literature collection, organization, and analysis.

1. Literature Collection

Literature collection was an essential foundation of this research and was mainly applied to the literature review and the theoretical basis of related studies. The authors used various methods to collect the literature as comprehensively and accurately as possible. The literature for this research was divided into three categories: 1) Journal articles, reviews, and conference papers; 2) dissertations; and 3) published books and research reports.

1) Journal Articles, Reviews, and Conference Papers

The researcher searched journal papers, reviews, and conference papers through WoSCC and CNKI. Search topics included "Retirement Communities," "Retirement Community Design," "Adaptive Design," "Building Adaptive Design, "Architectural Typology," "Retirement Community Types," and "Guangdong Profile." The searched literature was filtered by reading the title, abstract, and keywords. Classic papers, highly cited papers, papers from mainstream journals in the last five years, and documents by significant scholars were downloaded completely using school library privileges.

2) Dissertations

The researcher used two search engines for dissertations: ProQuest Dissertations & Theses (PQDT) and CNKI Dissertations. The search topics included "Retirement Communities," "Retirement Community Design," "Adaptive Design," "Building Adaptive

Design, "Architectural Typology," "Retirement Community Types," and "Guangdong Profile." The searched literature was filtered by reading titles, abstracts, and keywords online. The researcher retained the literature with high relevance and scholarly value to the study and deleted the rest. The researcher downloaded the screened literature in full text.

3) Books and Reports

Read journal articles, reviews, and dissertations on related research. While reading those classic papers and highly cited literature, we found the names of some important books and then borrowed them from the library or bought them from the bookstore. The literature of books and research papers focused on "Retirement Community Design," " Building Adaptive Design, "Architectural Typology," and other vital areas. For example, Professor Zhou Y.M. of Tsinghua University in China was a leading scholar in Retirement Community Design, and all the books published by Professor Zhou were worth reading. Therefore, we purchased the books published by Professor Zhou,Y.M.: *Design and Interpretation of elderly care facility 1* (Zhou, Y. M., 2018b)*, Design and Interpretation of elderly care facility 2* (Zhou, Y. M., 2018d)*, Design and Interpretation of elderly care facility 3* (Zhou, Y. M., 2020)*, Housing for the elderly* (Zhou, Y. M., Cheng, X. Q., et al., 2018). The research reports by China Labor and Social Security Press were better known. Therefore, we purchased their research reports in the last two years: *China Senior Services Development Report 2021* and *China Senior Services Development Report 2020* (Qing, L. B. & Jiang, D., 2020, 2021).

2. Literature Organization

The organization of the literature was crucial to the later research, and a reasonable organization method facilitated the analysis. The authors downloaded over 1,000 papers and organized them in three steps:

In the first step, the researcher used the traditional method of categorization by creating a table of contents according to the chapters of the paper and placing the articles in the appropriate table of contents according to their categories. The literature in each catalog was subdivided into journal papers and dissertations by type. The researcher categorized journal articles into three subcategories: Articles, reviews, and

conference papers. The researcher divided the dissertation into two subcategories: Doctoral dissertations and master's theses.

In the second step, these kinds of literature were quickly generally read through and categorized into three levels according to their academic level and relevance to this research. Among them, the number of literature in the category with the highest academic level and the highest relevance to this research was about 300, which needed to be read carefully.

In the third step, the researcher managed these key papers using EndNote X9, a document management software. In EndNote X9, the researcher grouped the documents according to the research chapters and then entered them in the format of APA Chapter 7. References from WoSCC and CNKI could be directly downloaded in EndNote format, imported into the EndNote X9, and moved to the corresponding chapter grouping of the thesis to complete the creation of reference entries. The researcher marked papers with asterisks according to their importance, with the most critical articles marked with five asterisks. After these three steps, the sorting of the literature was complete. Books and studies were relatively easy to organize due to their small number. They could be categorized according to the usual categories, such as Research Methods, Retirement Community Design, Adaptive Design, and Research Reports.

3. Literature Analysis

The collected literature could be analyzed both qualitatively and quantitatively. This research used two qualitative methods to analyze the literature. The first method was Bibliometrics, also known as scientometrics, where the characteristics and trends of a specific research area were derived through quantitative analysis of a large of literature (Jia, X. et al., 2014; Li, J. & Hale, A., 2016). The scientometrics analysis was divided into performance analysis and scientific mapping (Donthu, N. et al., 2021; Nakagawa, S. et al., 2019). The second method was to distill the current state of research and trends in the relevant research area by carefully reading the critical points of literature, writing notes, and then using logic, phenomenology, and hermeneutics as a guide.

3.1.2 Policy Research

Policy research was essential to this research and served the following purposes. First, it was part of the literature review and was a subsection of the Guangdong background research. Second, the government was one of the critical stakeholders in retirement communities and was an essential part of this research. Moreover, the policy was a window to study the government, which could be used to understand the government's thinking on governance by checking the policies of retirement communities. The policies in this research contain the core policies related to retirement design, Retirement Community Design, and rural revitalization, specifically the relevant laws, administrative regulations, local regulations, departmental regulations, building codes, and building standards. Since the policies had geographical application restrictions, the policy research area was the policies related to retirement communities and rural revitalization applicable to Guangdong Province. It contained three parts: Policy collection, policy collation, and policy analysis.

1. Policy Collection

Policy research was essential to Retirement Community Design research. This research used multiple channels to collect policies as comprehensively as possible.

First, Log on to government websites at all levels to collect relevant policies. The key websites were the Central People's Government of the People's Republic of China, the Ministry of Housing and Urban-Rural Development of the People's Republic of China, the Ministry of Agriculture and Rural Development of the People's Republic of China, and the Guangdong Provincial People's Government. Policies related to retirement communities and rural revitalization were public information and could be searched directly on these government websites. The search topics include "Retirement," "Retirement Communities," "Retirement Facilities," "Rural Revitalization," and "Traditional Village Preservation," "Traditional Village Preservation," and so on. The researcher filtered the search results to download policies that were primarily highly relevant to this research.

Second, we collected papers on relevant policy research and found policies through them. Search WoSCC and CNKI for topics such as "China" and "Retirement Policy," "China" and "Retirement Community Policy," "Guangdong" and "Retirement

Policy," "Guangdong" and "retirement community policy." The researcher filtered through quick reads, downloaded full text highly relevant to this research through library resources, and found applicable policies by downloading references to articles.

Finally, the researcher collected books on policy. There were fewer such books published, and the researcher categorized these books into two groups. One was compiling retirement industry policies, such as the *China Pension Industry Policy Encyclopedia,* which The China Labor and Social Security Press published. The other was the building codes and standards related to the design of retirement communities. These codes and standards were an essential basis for Retirement Community Design and must be given high priority. The main ones currently in use were *Planning Code for Urban Facilities for the Elderly GB50437-2007; Construction Standard for Community Day Care Centers for the Elderly JB 143-2010; Construction Standard for Elderly Care Homes JB 144-2010; Architectural Design Code for Retirement Facilities GB50867-2013; Architectural Design Code for Elderly Housing GB50340-2016.*

2. Policy Organization

The method of policy organization was similar to that of literature organization. The policies were organized in three steps: In the first step, the researcher used a traditional categorization method by creating a table of contents based on the chapters of the paper and then placing the policies in the appropriate table of contents. The researcher subdivided the policies into national and Guangdong policies. The national policies were divided into four subcategories: Laws, administrative regulations, departmental regulations, and building standards; the Guangdong policies were divided into three subcategories: Local rules, local departmental regulations, and local building standards. In the second step, these policies were quickly generally read through and grouped into three classes of 1, 2, and 3 according to their relevance to this research. Then, the researcher created three corresponding folders within each subcategory of the subcategories. Category 1 was the most relevant policy for this research, with less than 100 articles, and must be read carefully. In the third step, the researcher applied EndNote X9 to manage these critical policies. In EndNote X9, the researcher created groups based on the thesis chapters and then made policy entries based on the APA 7th edition format. These policies were marked with an asterisk according to their level

of importance. After these three steps, the organization of policies was almost complete. The number of books published on related policies was small, and organizing them was simple, following the usual categories.

3. Policy Analysis

The following dimensions were used for the policy analysis: The framework was organized according to the promulgation time sequence. Before 2000, the policy only needed to browse the directory; in 2000-2010, policies needed to be read, marking the key points; in 2011-2023, the approach must be read in detail, keeping the key paragraphs. Second, according to the nature of different, divided into legal laws, regulations, departmental regulations, standards, and norms. We focused on reading and commenting on the legal and national categories of Retirement Community Design related standards and norms. This was because these categories were mandatory and significantly impacted this research.

3.1.3 Case Study and Fieldwork

Case studies were an important part of this research. The case studies serve the following purposes: First, to establish an intuitive impression of Retirement Community Design by browsing cases and finding the design direction of retirement communities. Second, to study in depth the retirement community cases in the United States, Japan, Thailand, Europe, and China, to discover the strengths and weaknesses of existing Vacation-Type Retirement Community Design, to summarize the laws and accumulated materials, and to lay the foundation for later design practice. Third, through on-site investigation of typical cases of retirement communities, resort hotels, and Natural Villages, we considered the appropriate point of transforming Natural Villages into Vacation-Type retirement communities, found the innovation and breakthrough point of the design, and created a new paradigm of Vacation-Type Retirement Community Design. The case study contained three parts: Case collection, case organization, and case analysis.

1. Case Collection

The collection of cases was the basis of case studies. This research adopted multiple channels to collect relevant instances—the first was obtaining relevant cases through fieldwork. The second one was through professional architectural design

websites to manage appropriate circumstances. The third one, through WoSCC and CNKI, searched the papers of relevant case studies and then explored the relevant cases through these papers. The last one was to buy books of suitable case works.

First, the researcher obtained relevant case information through fieldwork. Fieldwork was the most critical case-collection method for this research. The researcher got first-hand information about Natural Villages, retirement communities, and resort hotels through fieldwork. These cases were vibrant and full of details, which lay a solid foundation for the subsequent research.

Second, the researcher collected cases through professional architectural design websites. To ensure that the design of the collected cases was of a high standard, the selection of design websites was essential. The leading architectural design websites were: www.archdaily.com, www.gooood.cn. We searched for examples of Retirement Community Design, natural village renovation and renewal, and resort hotels. After reading online and preliminary screening, we downloaded the cases with high design standards and relevance to this design.

Again, the researcher searched for papers on Retirement Community Design research and natural village renovation and renewal research through WoSCC and CNKI and then searched for relevant cases through these papers. The search topics included The search topics included "Retirement Communities" and "Design," "Retirement Facilities" and "Design," "Retirement Apartments" and "Design," "Retirement Villages" and "design," "Natural Villages" and "renovation," "Natural Villages" and "renewal. " The search results were filtered by general reading, and then the relevant cases were found by the references of the articles.

Finally, the researcher purchased books on relevant case works. As Retirement Community Design has become popular in recent years, more mixed-quality case study books have been published. It was necessary to do the required screening when purchasing: 1) Looked at the book's author. Usually, the core authors of Retirement Community Design cherished their academic reputation and compiled case books of a high standard. For example, Zhou, Y.M from Tsinghua University, Lin, W.J from the Beijing University of Architecture, and Zhou, B. from the Dalian University of Technology. 2) Looked at the publisher of the book. In terms of architecture books, the books

published by China Architecture & Building Press were of high quality. In addition, the quality of architecture books from Southeast University Press, Tongji University, and Tianjin University Press was also guaranteed. 3) An excellent way to log on to the book's online store and check the reviews of readers who have already bought.4) Going to the bookstore and reading the books on-site was the most direct and effective way of screening.

2. Case Organization

The organization of the cases was relatively simple and divided into three steps. In the first step, the researcher established a three-level catalog system: Retirement community cases, natural village cases, and resort hotel cases. Then, the researcher continued to build the second-level catalog. For retirement communities, the researcher categorized the secondary catalog into the USA cases, Japanese cases, European cases, Thailand cases, Chinese cases, and cases from other countries. The researcher ordered the secondary records of Natural Villages into Guangdong village cases, Zhejiang village cases, and other provincial village cases. The secondary catalog of resort hotels was divided into natural landscape resort hotels and cultural landscape resort hotels. The researchers split retirement communities into CCRCs, NORCs, UBRCs, and other types of retirement communities. The tertiary catalog of Natural Villages was divided into Natural Villages in cities, Natural Villages in the suburbs, Natural Villages in distant suburbs, and Natural Villages in remote areas. The three-level catalog of natural landscape resort hotels includes waterfront resort hotels, plain resort hotels, mountain resort hotels, and other natural landscape resort hotels. The three-level catalog of human landscape resort hotels was cultural relics and monuments resort hotels, ethnic style resort hotels, and modern humanities resort hotels. The second step was to organize the photos, effect drawings, construction drawings, and descriptive texts of the cases. The information should be as complete as possible, especially for retirement communities. Many natural village categories were missing drawings, using satellite maps instead of general plans. The third step was to put the relevant case materials into the corresponding folders, and the case organization work was completed. The number of books published on related case works was minimal, so it was easy to organize them to follow the standard classification.

3. Case Analysis

The researcher analyzed mainly the case of retirement communities and some typical cases in terms of Natural Villages and Vacation-Type Retirement Communities. The case analysis was based on qualitative research, supplemented by quantitative research. The qualitative study of Retirement Community Design contains several parts:

First, the designed orientation analysis contained the orientation of users, economic class, site selection, scale, retirement community type, building type, and other elements.

Second, the Adaptive Design analysis included the adaptation analysis of the environment and stakeholders. The environment contains both the natural environment and the human environment. The elements of the natural environment that were highly relevant to adaptability are topography, climate, biological resources, water resources, and local materials. The human environment was mainly about the local culture, customs, and religious beliefs. Stakeholders included users, operators, investors, and governments, and those highly relevant to the adaptation analysis were mainly users and operators.

Third, architectural design analysis. It included the analysis of the overall layout, building monolith, house design, elevation, building physics, traffic flow, and other elements.

Fourth, landscape design analysis. It included the analysis of plan layout, functional partitioning, dynamic planning, ground pavement, plant configuration, landscape installations design, age-appropriate, and other elements.

Fifth, interior design analysis. It contained the analysis of plan layout, functional partitioning, dynamic planning, decorative materials, furniture furnishing, lighting, and other elements.

The cases collected in this research were from different countries and types. The researcher adjusted the focus of the analyzed content according to the different situations.

3.1.4 Interview

Interviews are a commonly used qualitative research method. The role of interviews: Firstly, through interviewing the users, we could find out the defects of the

current senior living community, gain insight into the real needs of the users, and find the key points to improve the quality of life of older adults, to find the direction for the research of this topic. Secondly, by interviewing operators, we could discover the defects of retirement communities' current service space design, find ways to improve operational efficiency and reduce operating costs, and find the direction for this research. Third, through interviews with investors, we saw the crux of the low investment in retirement communities and found the innovation point of this research. Fourth, through the interviews with government officials, we found the thinking of retirement community government management, the underlying logic of policy formulation, and the innovation point of this research.

1. Interview Subjects

The interviews in this research were divided into four categories: Users, operators, investors, and government officials. When scholars conducted retirement community research in the past, they often interviewed only users and operators, neglecting investors and government officials, resulting in apparent flaws in the study and significantly reducing the scientific validity of the results. Retirement communities often have massive investment amounts and are livelihood projects, so it is necessary to interview investors and government officials.

2. Interview Design

Depending on the interviewees and the content of the interviews, the researcher conducted a targeted interview design. In this research, a combination of structured and open-ended interviews was used. The interview protocol consisted of four parts: introduction, structured Interview, open-ended Interview, and summary. The introduction process: The purpose of the Interview and self-introduction was explained first, then the interviewees were asked to introduce themselves, and finally, the interview rules were introduced. Structured interviews consist of common questions, with the advantage that the procedure is standardized, making it easy to control the process and compare results. The disadvantage is that the answers are usually shallow and cannot be expanded. Open-ended interviews typically have more in-depth questions that tap into potential needs. However, they are not easy to control the process, tend to deviate from the interview goals, and require a high level of quality

from the interviewees. The summary section verifies essential questions with the interviewee and concludes with an acknowledgment.

3. Implementation of the Interview

The implementation of the interviews for this research varied for different audiences. On-site interviews were used for users and operators of retirement communities, and telephone interviews were used for investors and government officials. To match the interview results with this research, the geographic scope of the discussions was within Guangdong Province.

3.2 Quantitative Research

Quantitative research is a standard paradigm in which problems and phenomena are expressed in quantitative terms and analyzed with appropriate tools to obtain objective data, tables, graphs, and other results to obtain meaningful research methods and processes. Quantitative research in this research contained data collection, integration, and analysis. Quantitative research could ensure the depth of this research.

3.2.1 Data Collection

Data collection is the basis of quantitative research, data is the raw material of research, and data quality directly affects the success or failure of research results. Therefore, the data used in this research were very cautious. The collected data included the elderly population, health and retirement tracking data, natural village data, literature data, and case data. Different data were collected in different ways.

1. Aging Population Data

Data on the aging population included data on the world's and China's aging populations. Population data for the world were collected and downloaded through the United Nations, Department of Economic and Social Affairs, Population Division. Data on China's aging population were ordered and downloaded through the National Bureau of Statistics. The primary demographic data used in this research were from the National Population Census, specifically the seventh census to be completed in 2021.

2. Health and Retirement Tracking Data

Considering the scope of the research, the researcher used health and retirement tracking data from mainland China. The China Health and Retirement

Longitudinal Study (CHARLS), conducted by Professor Zhao Yaohui of Peking University, is a high-quality, long-term follow-up data set that describes Chinese residents aged 45 and older's health status as their family, social, policy, and natural environments. The data set was available for download by registering for membership on the official website.

3. Natural Village Data

Natural village data was critical data for the study of the rural plight and rural revitalization. This data was downloaded through the National Bureau of Statistics and the Ministry of Housing and Urban-Rural Development of the People's Republic of China.

4. Literature Data

Literature data collection. The literature data were collected through the WoSCC and CNKI, searching for "Retirement Communities" and "Adaptive Design" to obtain search results, and then downloaded through the university's library resources. The specific search procedures and parameters were described in detail in the literature review.

5. Case Data

The case data were collected mainly through four channels: 1) Direct acquisition by the researcher's fieldwork; 2) Direct collection by the well-known architectural design websites archdaily and gooood; 3) Indirect collection by the literature databases WoSCC and CNKI; and 4) Direct collection by case books.

3.2.2 Data Preprocessing

The collected data types and file types were different. Some data have duplicates, missing, and errors. The researcher needed to preprocess the data for later data analysis and visualization. Data preprocessing included data cleaning, data conversion, and data integration.

1. Data Cleaning

Data cleaning was a necessary step to ensure data quality. Data cleansing was the process of cleaning duplicate, missing, and low-correlation data (Darkhorse programmer, 2020).

Duplicate data cleaning. For example, data on the aging population collected from the United Nations Department of Economic and Social Affairs, Population Division had the same parts as the data from the National Bureau of Statistics, and the duplicate population data needed to be removed. The data on Natural Villages had duplicated parts in the National Bureau of Statistics and the Ministry of Housing and Urban-Rural Development of the People's Republic of China and must be deleted. In the case data, archdaily and gooood websites, WoSCC and CNKI databases, and books have many duplicate data that must be deleted.

Missing data cleaning. There were some missing data in the collected data due to various reasons. It was necessary to determine whether the missing parts were critical or not. If the missing information is vital, it must be added and completed through other channels. If the complete information could not be added, the researcher had to delete data missing critical information. If the missing data was non-critical, it could usually be ignored. For example, when the researcher imported CNKI files into EndNote, keywords and journal volume numbers were occasionally missing. Keywords were critical data and must be made up by manual entry, while volume numbers were non-critical and could be ignored.

Low relevance data cleaning. The downloaded data contained a large amount of data that was not relevant to the study, which will take up many resources but have little value to the study. This part of the data could be cleaned directly. When downloading Retirement Community Design data from WoSCC, a significant portion was medical research data needed cleaning.

2. Data Conversion

Due to the different types and formats of downloaded data, data conversion was required for later data analysis and visualization. For example, downloaded construction drawings, such as floor plans, were usually in PDF or JPG format, which cannot be used for measuring area length. It was necessary to convert the downloaded PDF or JPG format files into CAD format files. Downloaded JPG tables cannot be databased, so they need to be converted into Excel tables. Some units of measurement also required to be corrected, such as some downloaded case data

using imperial lengths and imperial areas, which needed to be uniformly converted to international units.

3. Data Integration

Data integration was merging multiple data to address data fragmentation and semantic ambiguity. For example, data for 1950, 1970, 2000, 2020, and the projected years 2050 and 2100 were pooled when collating data on world population aging. In collating the population aging data of China, the population data of China in 2000, 2010, and 2020 were pooled. In collating population aging data for Guangdong, population data for 2000, 2010, and 2020 were pooled according to temporal latitude, while the aging populations of 21 cities were pooled according to spatial latitude. For the case data, cases from the United States, Japan, Thailand, China, and Europe were assembled according to geographical regions. The data were integrated to facilitate later analysis and visualization.

3.2.3 Data Analysis and Visualization

Analysis and visualization of data were essential ways to present the research results in this research. Different data analysis and visualization methods were used depending on the type and format of the data. Data analysis was done mainly using Excel and VOSviewer.

Simple data were analyzed using Excel. For example, data on the elderly population and natural village data. Excel was the most straightforward data analysis tool and primary visualization method.

Different analysis tools and methods would be used for complex data depending on the type. For example, two data analysis methods exist for WoSCC and CNKI literature data. The first type of analysis was relatively simple, such as the annual publication volume of articles on "Retirement Community Design," scholars or academic institutions with many achievements, and highly cited papers. This kind of simple quantitative analysis could be done through the quantitative analysis function of WoSCC and CNKI, and visual histograms and line graphs could be made. The second type of analysis was relatively complex, such as research collaboration network analysis and co-citation analysis. The analysis and visualization of this type of data require specialized literature visualization software. In this research, the authors

applied VOSviewer (version 1.6.18) to analyze research in related fields. Expressly, first set keywords from WoSCC and CNKI to search relevant literature; then downloaded and imported these data into VOSviewer, set parameters, and quickly obtained the current status of research, research trends, representative scholars, and research collaboration networks in the field.

3.3 Comprehensive Research

Comprehensive research is also a standard research paradigm used when studying complex problems where qualitative and quantitative research alone cannot solve the problem. The comprehensive research encompasses various approaches that must be carefully selected and matched to the problem. The comprehensive research chosen for this research contained the Mutually Exclusive Collectively Exhaustive (MECE) rule and the 80/20 Principle. The comprehensive research helped this research to build the research framework smoothly and ensure it was reasonable and valid.

3.3.1 The Mutually Exclusive Collectively Exhaustive (MECE) rule

The MECE rule was a classic analytical approach to complex problems proposed by Barbara Minto, the first female consultant at McKinsey & Company, in The Minto Pyramid Principle (Barbara, 2013). The MECE rule emphasized "Mutually Exclusive" and "Collectively Exhaustive" when analyzing problems. "Mutually Exclusive" meant that the issues in the same dimension must be independent, and there was no overlap between issues. For example, in the study of Guangdong's regional culture, Guangdong's regional culture was divided into Guangfu, Chaoshan, and Hakka. "Collectively Exhaustive" meant the research was comprehensive and complete, without omissions. For example, when studying the environmental elements of Building Adaptive Design for retirement communities, both the natural and human environments should be included. The issues involved in this research were complex and complicated. By applying the MECE rule, we could categorize the research elements, structure the problem, and establish a clear and rigorous research framework.

1. The MECE rule analysis

The MECE rule had five primary classifications: The dichotomous method, the elemental method, the process form, the formula method, and the matrix method (He, Y. L., 2020).

The dichotomous method split the problem into two parts and was suitable for dealing with relatively simple issues. For example, when studying the elderly population, it could be divided into males and females by gender. Retirement communities could be classified into for-profit and non-profit retirement communities by profit.

The elemental method analyzes what elements make up the problem, and the analysis should consider that the criteria for dividing the elements must be uniform. For example, when studying the adaptive design of retirement communities, the elements of the natural environment were broken down into topography and landscape, climate, water resources, biological resources, land resources, and other natural resources. In the spatial design study of retirement communities, the spatial design was decomposed into four parts: Planning and design, architectural design, landscape design, and interior design. The elemental method was the MECE rule analysis method frequently applied in this research.

The process approach was a research method that interprets things according to the sequence of their development. For example, when conducting a literature review study on Retirement Community Design, the first step was identifying the bibliometrics used in this research for the research analysis; the second step was to determine the use of VOSviewer as the analysis tool; the third step was to assess the use of WoSCC and CNKI as databases; the fourth step was to determine the keywords to be searched; the fifth step downloaded the search results; the sixth step, downloaded the data for pre-processing; the seventh step software processing by importing VOSviewer and setting reasonable parameters; step 8, exporting the processing results; step 9, analyzing the results and commenting on them.

The formula approach breaks down the problem into elements that fit the formula, and as long as the formula holds, the MECE rule is met. For example, when conducting a case study, there was a segment to study the law of area allocation in

retirement communities. Area of living /total area = share of living area; size of living /number of people = living area per capita; area of auxiliary space/complete area = share of extra space.

The matrix method is a research method that classifies or divides things according to a two-dimensional matrix. For example, the classification of retirement community residents in the study was divided into male and female according to gender: young elderly (60-69), middle-aged elderly (70-79), and older elderly (≥80) according to age. In this way, the entire elderly population was divided into six matrices.

2. Analysis steps of the MECE rule

Application of the MECE rule usually proceeded in four steps: Determining the scope, finding the appropriate entry point, continuing down the split, and checking for omissions or duplication (He, 2020).

The first step was to determine the scope. Before conducting the MECE rule analysis, the researcher identified the problem area and boundaries. For example, the geographic scope of this research was Guangdong Province, China; the type of retirement community studied was a Vacation-Type Retirement Community; the scope of the study design was the spatial design domain; and the scope of the study design strategy was an adaptive design strategy.

The second step was to find the appropriate entry point. The entry point was the latitude of preparing a subdivision of the research question, and it was the focus and the difficulty of using the MECE rule. There were many entry points to the same problem, and finding an appropriate and innovative entry point was a crucial consideration for the research. Choosing an entry point requires considering the core question, the goal, and the research's significance, and constant adjustment and optimization. For example, when exploring the research subject as an entry point, the entry point set in the beginning stage was the user. Later, the innovation and research value of the study were low just by cutting from users. After reflection, the entry point of the research subject was further refined by expanding to stakeholders, including users, operators, investors, and government.

The third step was to continue the decomposition down the line. In the usual case, the scope of the problem after one decay was still relatively large, which was

not conducive to the research and needed further splitting. For example, when studying the case of Retirement Community Design, it had been decomposed into architectural design, landscape design, and interior design according to the boundary of spatial design. If the study was carried out directly according to these three parts, the research would be very rough, so further subdivision was needed. For example, architectural design could be subdivided into the analysis of overall layout, building monoliths, house type design, elevation, building physics, and traffic flow. After such a split, the research was more detailed. Of course, the level to which the problem was split depends on the study's need, and the study's goal should be kept in mind, and the split should not be executed mechanically or with unnecessary splitting.

The fourth step was to check whether there were any omissions or repetitions. Since this study involved many problems, and after splitting it several times according to different sub-problems, it would form a vast system, and there would inevitably be omissions or repetitions. Timely checking was necessary to ensure logical rigor and the smooth conduct of the study. For example, in the earlier version, this research directly assembled the data as a sub-catalog in the quantitative survey. It was later found that data cleaning and transformation were omitted, so it was immediately corrected and formed a sub-catalog of data pre-processing with the original data collection. Some visualization tools were needed when checking for omissions or duplicates, and mind mapping was very effective.

3.3.2 The 80/20 Principle

The 80/20 Principle, also known as the Pareto Principle, Pareto Law, and the Imbalance Principle, was proposed by the Italian economist Pareto (Richard, K., 1999). The 80/20 Principle states that 80% of output came from 20% of input, 80% of the result came from 20% of cause, and 80% of achievement came from 20% of effort (Richard, K., 1999). In short, a few critical factors determine the outcome, while most non-critical elements have a limited impact. After the MECE rule analysis, a comprehensive research framework was established. However, the emphasis of the MECE rule on "Mutually Exclusive" and "Collectively Exhaustive" made the system too large for in-depth research and needed to be streamlined. The 80/20 Principle was the

perfect option for facilitating research. The 80/20 Principle was of great value in refining the framework of this research and identifying the determinants of in-depth analysis.

1. The 80/20 Principle and Literature Reviews

The 80/20 Principle was applied throughout the literature review study.

First, in selecting the literature databases, this research applied the 80/20 Principle and selected two representative databases in English and Chinese: WoSCC and CNKI. The rest of the databases were used as supplements.

Second, in selecting the literature review content, the 80/20 Principle was applied to determine the scope of this research, such as retirement communities, Building Adaptive Design, and the Guangdong context.

Third, in the quantitative analysis of the literature, the most critical quantitative indicators were analyzed according to the 80/20 Principle: The number of annual publications, highly productive authors, and highly cited literature.

Fourth, when conducting the VOSviewer analysis, the 80/20 Principle was used to analyze the co-occurrence of keywords and explore research trends.

2. The 80/20 Principle and Stakeholder Research

The 80/20 Principle was applied throughout the stakeholder study:

1) Only the most essential stakeholders were chosen: Users, designers, builders, operators, investors, and government.

2) When selecting the research tools for stakeholders, the 80/20 Principle was applied. Maslow's hierarchy of needs theory was identified as the primary tool, and different stakeholders had different research focuses.

3) The 80/20 Principle was also applied to analyze the key factors and objectives when studying specific stakeholders.

3. The 80/20 Principle and Case Study

The 80/20 Principle was applied throughout the case study:

1) Only a few countries with successful or distinctive retirement communities were chosen when selecting the countries for the case studies, such as the United States, Japan, Thailand, and China.

2) When selecting specific cases, we followed the 80/20 Principle and chose typical cases, such as the Sun City series in the United States and the Taikang House in China.

3) When analyzing the cases, we mainly analyze vital indicators, such as per capita living area, total area per capita, and cost per square meter.

4. The 80/20 Principle and Building Adaptive Design research

The 80/20 Principle was applied throughout Building Adaptive Design research. First, only the most essential aspects of the natural and human environments were chosen when selecting the content for Building Adaptive Design research. For example, the four critical factors for the natural environment were climate, topography, natural landscape, and local materials; the human environment's three key factors were local culture, lifestyle, and religious beliefs. Second, when analyzing specific factors, only the main aspects were analyzed. For example, local culture was all-encompassing, and this research only analyzed local customs, Fengshui concepts, site selection, and layout traditions that were highly relevant to architecture.

3.4 Summary

The research methodology was an integral part of this research, and the research methodology needed to be tailored to the selected topic of this research. This research methodology contains qualitative research, quantitative research, and comprehensive research. Qualitative research was the study of the nature of the problem, the establishment of a framework for the research, and the study of the antecedents of the problem. It contained four main parts: Literature research, policy research, case studies, and interviews. Quantitative research was the study of the details, quantitative relationships, and causal relationships of the problem, and it consisted of three steps: Data collection, pre-processing, analysis, and visualization. Comprehensive research bridged the gap between qualitative and quantitative research. It was an effective tool to build the initial framework of this research and deepen the dissertation's research, including the MECE rule and the 80/20 Principle.

Chapter 4 Research Results

The research results on the Building Adaptive Design for Vacation-Type Retirement Communities were divided into four parts: 1. Stakeholders and Building Adaptive Design; 2. Environment and Building Adaptive Design; 3. Buildings and Building Adaptive Design; 4. Summary.

Before conducting comprehensive research, the researcher derived a stakeholder-build-environment model based on the classical human-machine-environment theoretical model based on the Building Adaptive Design research needs in Vacation-Type Retirement Communities. Moreover, questionnaires were given to seven experts, and the result of the experts' feedback was 4.29 out of 5, which was highly approved. Therefore, this research was conducted according to the stakeholder-buildings-environment model.

4.1 Stakeholders and Building Adaptive Design

One phenomenon of great concern in China's Vacation-Type Retirement Communities was that, on the one hand, there was a "hard to find" bed in some regions, and on the other hand, some regions were heavily unused, even with an alarming 48% vacancy rate (Zhou, 2018). The "hard to find beds" phenomenon was easy to understand, as China's elderly population was rapidly increasing, and there was a massive shortage of retirement communities. It was puzzling that many retirement communities were vacant. There were many reasons for this phenomenon, but one of the key reasons was a problem with the stakeholders. As users of retirement communities, seniors should be the focus of research but were surprisingly absent from the design and construction of retirement communities. Some local officials pushed the design and construction by administrative order to quickly complete the construction targets for retirement communities against the science and laws of the market, believing that researching older adults was unnecessary and a waste of time. As professional consultants, architects are also happy to skip the user study process to complete the design project quickly. In addition, operators were often absent from the entire design-build process, and the reason was simple: Investors often hired operators after the Vacation-Type Retirement Communities had been completed to

save costs. The recurrence of these phenomena was detrimental to the construction of Vacation-Type Retirement Communities in China. The author believed a stakeholder study was necessary to advance the design and construction of Vacation-Type Retirement Communities.

The concept of stakeholders was first introduced in 1963 by a research group at Stanford University (Liu, H. P., 2015). In academic circles, there were various definitions of stakeholders. Freeman, R. E. (1984) gave a broad description of stakeholders: Any persons and groups that might affect the realization of the objectives of the enterprise. Clarkson, M. E. (1995) gave a narrow definition of stakeholders: Those subjects who invested physical capital, money, labor, and other valuable things in the enterprise's activity and thus bear risks in business were considered stakeholders. Only a scientific classification of stakeholders allowed for an in-depth study of stakeholders (Fu, R., 2021). Freeman, R. E. (1984) classified stakeholders based on ownership, economic dependence, and social interest. Clarkson, M. E. (1995) classified stakeholders into primary and secondary categories according to their closeness to the firm. Primary stakeholders were people or organizations closely related to the company, including shareholders, customers, suppliers, etc. Secondary stakeholders refer to people or organizations generally close to the company, including government, media, public organizations, etc.

Stakeholder theory was born in the field of management and subsequently extended to the fields of economics, education, engineering, medicine, and architecture.

By searching the WoSCC and CNKI databases, scholars had yet to be found to combine stakeholder and Vacation-Type Retirement Community design. Many scholars studying Retirement Community Design gather in the field of user research. Since Retirement Community Design involved many stakeholders, studying users alone was insufficient. This research was innovative in examining the design of Vacation-Type Retirement Communities from a stakeholder's perspective. Four key stakeholders were identified in this research through an expert questionnaire (Table 1: 1) User, 2) Operator, 3) Investor, and 4) Government, in which User research was the focus and core of the study.

Table 1. Importance Score for Stakeholders in Vacation-Type Retirement Community

Category	Type	Score	Ranking
Stakeholder	User	4.71	1
	Operator	4.29	2
	Investor	4	3
	Government	3.86	4
	Medical Institution	3.14	5
	Designer	3	6
	Builder	2.71	7
	Material Suppliers	2.43	8
	Service Providers	2.29	9
	Community Volunteer	2.14	10

Note. The score was done on a Likert scale. Not important at all 1, Not important 2, Important 3, More important 4, Very important 5.

4.1.1 User Research

Norman, D. A. (1986) first proposed the concept of "user-centered design (UCD)." In 2010, the international standard ISO 9241-210 proposed the definition of UCD: Understanding the usage environment, specifying user requirements, generating design solutions, and evaluating design (Ni, M. N., 2022). The core idea of UCD was obvious: To include the user in every aspect of product development. UCD originally belonged to computer interaction design and later extended to product design, service design, and space design. It was the mainstream design concept in business design. User research was the critical part of UCD, which was to conduct in-depth research on user segmentation, user needs, user pain points, and user characteristics. User research focused on insight into users' core needs and pain points.

1. User Research Objectives and Methods

The objectives of user research: To discover the shortcomings of current Vacation-Type Retirement Communities by studying the classification of users, their characteristics, needs, and pain points, and to optimize Vacation-Type Retirement Communities through adaptive design. The user research methods included qualitative, quantitative, and comprehensive research. Among them, the qualitative analysis included literature and interview research; quantitative research included aging

population data and CHARLS data research; comprehensive research included the MECE rule, The 80/20 Principle. The specific steps of each method have been elaborated on in Chapter 3.

2. Classification of Users

The classification of users was a necessary prerequisite for user research. According to the standard of the United Nations, people who had reached the age of 60 or 65 were defined as elderly (United Nations, 1956, 1982b). Older people were a large group and must be subdivided according to specific criteria to facilitate later research. The classification criteria were first developed comprehensively according to the MECE rule. According to The 80/20 Principle, unnecessary classifications were removed, and only those that were highly relevant to this research were retained. The researcher categorized older adults into three groups based on age: 1) Young-old, between 60-69 years old; 2) Middle-old, between 70-79 years old; and 3) Old-old, late old age 80 years old and above (Forman, D. E. et al., 1992). The scope of this research was young-old and middle-old. The researcher categorized seniors into three groups by income: 1) Low-income, 2) Middle-income, 3) High-income.

3. User Characteristics

The researcher categorized the characteristics of users into two areas: Physiological and psychological.

With aging, the body functions of the elderly degenerate, and their adaptability to the environment decreases, a phenomenon called physiological aging in medical science. Usually, physiological aging occurrs at 65 or above for men and 60 or above for women. The physiological aging of seniors had an essential impact on their lives, in which the degeneration of sensory functions, motor functions, neurological functions, and immune functions of seniors was highly correlated with the design of Vacation-Type Retirement Communities (Zhou, Y. M., Cheng, X. Q., et al., 2018).

1) Degeneration of Sensory Functions

Human sensory functions include vision, hearing, touch, smell, and taste. The decline in sensory functions usually starts with vision and hearing when aging, followed by touch, smell, and taste (Zhou, Y. M., Cheng, X. Q., et al., 2018). Declining sensory function reduced the ability of older adults to gather information, turn reduced their

ability to cope with the environment. The decline in visual ability began with a decrease in visual acuity. Decreased lens elasticity and reduced number of retinal cells in the eyes of older adults led to blurred vision, especially when looking at close objects. At the same time, the risk of eye diseases in the elderly was increasing. Visual decline led to a decreased ability to distinguish images, colors, etc., in the elderly. In older adults, visual decline leads to decreased ability to distinguish images, colors, etc. The decline in hearing ability began with inaudibility. It was common for older adults to have a degenerative inner ear, a thickened tympanic membrane, and reduced elasticity, leading to inaudibility or deafness. Hearing loss inconveniences the lives of older people: It affects social interactions and could even put them at risk because they cannot hear sirens. In addition, the senses of touch, smell, and taste in older adults might decline. The decline of the sense of touch would lead to a decrease in the ability of older adults to feel the temperature; the decline of the sense of smell would reduce the sensitivity of older adults to harmful gases; the decline of the sense of taste will reduce the appetite of older adults. In response to these changes, the design of Vacation-Type Retirement Communities required reasonable responses regarding space layout, furniture selection, and equipment selection.

2) The Decline in Motor Function

Seniors' decline in motor function included skeletal, muscle, and limb aging. Skeletal aging was mainly manifested in reduced bone density, brittle bones, bone toughness and elasticity, reduced bone regeneration ability, and susceptibility to osteoporosis and osteophyte diseases. The aging of bones led to uncomplicated fractures after falls and difficult recovery for seniors. Muscle aging was mainly manifested in reducing muscle fibers, muscle strength, muscle elasticity, and muscle atrophy. Muscle aging could lead to difficulties getting up and down stairs and exercising or working for long periods in seniors. Aging of the limbs was mainly manifested by a decrease in flexibility and control of the limbs and a slow response. To a certain extent, performing regular movements such as bending, squatting, and leg lifting is challenging. Given the deterioration of the motor function of the elderly, the design of Vacation-Type Retirement Communities must consider the barrier-free design;

the ground should be anti-slip treatment, eliminate minor height differences, and set up the necessary handrails.

3) Neurological Degeneration

The leading physiological cause of neurological degeneration was the reduction of nerve cells; after 30 years, the brain's weight decreases. The number of brain cells started to decrease, and by 60 years of age, the number of brain cells in a person was significantly reduced, and by 75 years of age, the brain cells were only about 60% of those in youth (Zhou, Y. M., Cheng, X. Q., et al., 2018). At the same time, cerebral blood vessels gradually harden, leading to an insufficient supply of nutrients and oxygen to the brain, and brain function gradually declines, mainly manifested as memory loss, reduced adaptability, and dementia. The most typical sign of memory loss in older adults is forgetfulness. Seniors often forget where items are stored and that water is being boiled for cooking, which can lead to severe consequences. Therefore, it was necessary to set up apparent reminders in Vacation-Type Retirement Communities, such as storing frequently used items in prominent locations, eliminating open flame cooking equipment, and installing fire warning devices.

4) Degeneration of Immune Function

The degradation of the immune function of seniors was reflected in their reduced ability to adapt to climate changes such as temperature and humidity, as well as their reduced ability to resist epidemic diseases. Therefore, the design of Vacation-Type Retirement Communities should consider appropriate sunlight intensity and natural ventilation to avoid the effects of bad weather, such as rain, strong wind, and haze.

The results of the research showed that the physiological aging of older adults and changes in social factors caused by retirement led to a series of changes in the psychological characteristics of older adults: Reduced psychological security, decreased adaptability, and feelings of loss, inferiority, loneliness, and emptiness (Zhou, Y. M., Cheng, X. Q., et al., 2018).

Older adults often worry about falls and illnesses and have unnecessary associations with negative situations, significantly reducing their sense of psychological security. In the design of Vacation-Type Retirement Communities, a barrier-free design

was configured, medical spaces were allocated nearby, and materials, colors, and lighting were reasonably applied to improve the sense of security of seniors. Decreased adaptability was caused by neurodegeneration and other physical deterioration in seniors, reducing their willingness to try new things, thus tending to live in familiar surroundings. The literature review found that "Aging in Place" was a significant trend in today's senior communities; it was also the perfect solution to address these relocation pressures.

Feelings of loss and low self-esteem. According to current Chinese regulations, men retire at 60 and women at 55. The abrupt reduction of social relationships for seniors after retirement led to a psychological mood of loss. The abrupt reduction or complete cessation of productive work after retirement, coupled with the fact that some older adults suffer from illnesses and need care, created a sense of inferiority in seniors. The feeling of loss and inferiority will further deteriorate the physical and psychological health of seniors, which needs to be solved by considering the appropriate setting of social and labor spaces in the design of Vacation-Type Retirement Communities.

Feelings of loneliness and emptiness. According to the Seventh National Population Census Bulletin, the family structure in China tends to be smaller (National Bureau of Statistics of China, 2021). Many young people live apart from seniors for long periods as they study or work elsewhere. Communication between seniors and their children and grandchildren is limited to electronic communication and is limited in time and frequency. These realities led to loneliness and emptiness for seniors. Creating and maximizing time to reunite with family members in a Vacation-Type Retirement Communities design was a critical response to alleviate seniors' feelings of loneliness and emptiness.

4. User Needs

Maslow, A H (1943) first proposed the hierarchy of needs theory from the perspective of human motivation, dividing human needs into five levels: Physiological needs; Safety needs, Love and Belonging, Esteem needs, and Self-actualization (Figure 20).

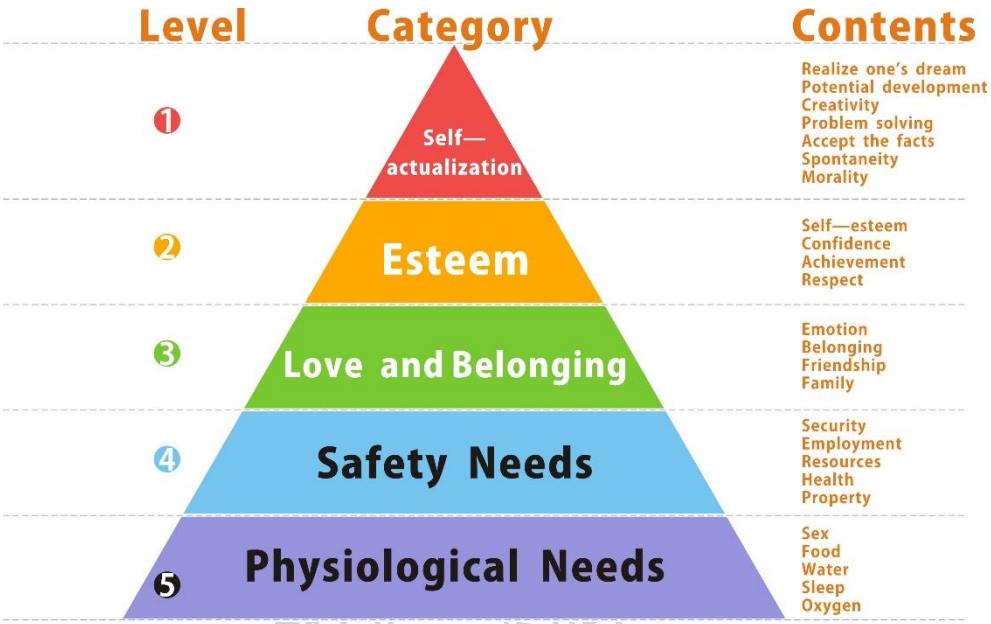

Figure 20. Hierarchy of Needs Theory

Source: Author Adapted From Maslow, A.H. (1943)

Each level of needs contained many specific needs. The first level, physiological needs, refers to the most basic requirements for human survival, including food, water, oxygen, sleep, sex, etc. Physiological needs were the lowest level of needs but also the most intrinsic needs. With the initial construction of a well-off society in China, this need was satisfied in retirement communities. The second level, safety needs, refers to security, order, and stability to avoid anxiety and anxiety. The needs at this level were mainly reflected in the barrier-free design and medical support in the design of retirement communities. The safety needs of CCRCs built in China in recent years have been well accomplished; however, there were still many safety hazards in China's NORCs, and the safety needs need further improvement. The third level, Belonging and Love, refers to the need for socialization. Belonging refers to the social attributes of people, the need to belong to a group, such as friends, partners, neighbors, and other relationships. Love encompasses the need for companionship, friendship, and family. Belonging and Love's main focus in the design of Vacation-Type Retirement Communities was the design of social spaces. Most new CCRCs were closed in design and management, creating a disconnection between older adults and the community. Although many NORCs were open-plan, they needed more social spaces. The fourth level, Esteem, was divided into two categories by Maslow, A.H.: Esteem for others and

Esteem for oneself. Many commercial retirement communities were overly focused on Return on Investment (ROI) and operators were highly focused on efficiency, with undesirable conditions such as disrespecting the privacy of seniors. Many seniors feel they lack social contributions and perform poorly in respecting themselves. The fifth level, self-actualization, refers to maximizing one's potential, improving oneself, accomplishing everything commensurate with one's ability, and achieving one's ideal. Self-actualization was the highest level of need, and it was also the direction of effort to stimulate this need in the design of Vacation-Type Retirement Communities.

Noriaki, K. (1984) proposed the Kano model(Figure 21). The Kano model was an effective tool for studying user requirements and prioritization, and it analyzed the relationship between the degree of achievement of user requirements and user satisfaction. Based on the different characteristics and the relationship with user satisfaction, Noriaki Kano classifies user needs into five types: Basic Quality, Performance Quality, Excitement Quality, Neutral Quality, and Reverse Quality.

Figure 21. Kano Analytical Model

Source: Author Adapted From Noriaki Kano (1984)

Each type of requirement had a distinctly different impact on user satisfaction. The first type, Basic Quality, or Must-be Quality, was the basic requirement for a product or service. If Basic Quality did not meet the requirements, users would be very

dissatisfied; if Basic Quality met or exceeded the requirements, users' satisfaction would not increase accordingly. For example, the barrier-free design in Vacation-Type Retirement Communities. The second type, Performance Quality, or One-dimensional Quality, was the value users expect a product or service to have. Performance Quality and customer satisfaction were significantly positively correlated: A high degree of performance completion results in increased user satisfaction; conversely, user satisfaction was low. This was the key to designing Vacation-Type Retirement Communities to enhance the quality of life for seniors, such as the layout and design of social spaces.

The third type, Excitement Quality, or Attractive Quality, refered to products or services that exceed and surprise users' expectations. If this part of the value was missing, the user's satisfaction would not be significantly reduced; however, if this part of the value performed well, it could greatly enhance the customer's satisfaction. For example, in the design of a Vacation-Type Retirement Community, the space design reflected the self-worth of seniors.

The fourth type, Neutral Quality, called Indifferent Quality, refers to the value that does not affect user satisfaction. This value, whether provided or not, or provided at a high or low level, does not affect user satisfaction. For example, adding unnecessary frills to the logistical space for a Vacation-Type Retirement Community.

The fifth type, Reverse Quality, refered to the values users do not expect to have. These values were negatively correlated with user satisfaction: The more value provided, the lower the user satisfaction. For example, too much intelligent monitoring in retirement communities. By sorting out the needs of seniors in Vacation-Type Retirement Communities through the Kano model, we could reasonably assess the categories and importance of user needs and lay a solid foundation for the research and design of Vacation-Type Retirement Communities.

A questionnaire was designed based on the Kano model and Maslow's Hierarchy of Needs theory, combined with some research results of Professor Zhou, Y.M. Considering that many older adults have dyslexia, this questionnaire was completed as an interview. The results are shown in Table 2.

Table 2. Kano Analysis

Category	Contents
Basic Quality	Living Space, Cafeteria, Aging Friendly Design, Medical Facilities, Living Facilities
Performance Quality	Recreational Facilities, Beautiful Environment, Facilities for Children
Excitement Quality	Flexible House Types, Adaptable Design, Personalized Furniture, Small Farm
Neutral Quality	Public Bathrooms, Senior College
Reverse Quality	Too Much Intelligent Monitoring

5. User's Space Needs

Combining the Hierarchy of Needs Theory, Kano analysis, and expert opinions, the researcher compiled a User's Space Needs model for Vacation-Type Retirement Communities (Figure 22).

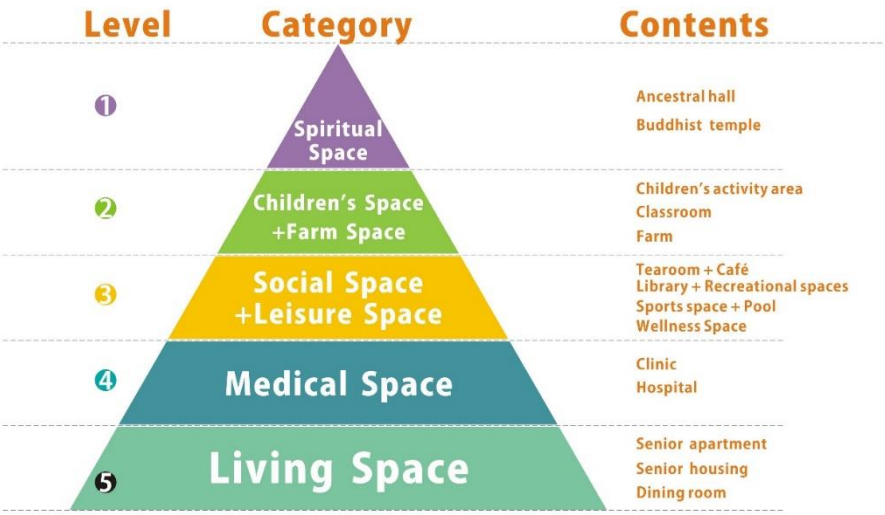

Figure 22. User's Space Needs

Source: Author (2023)

6. User and Building Adaptive Design for Vacation-Type Retirement Communities.

Through the preliminary user classification, the user and Building Adaptable Design focuses on the following aspects: 1) Age and health status, 2) Income, and 3) Personalized needs.

The young- old (60 - 69 years old) were usually healthier, and the standard layout of the living unit was as in Figure 23 A. By about 70, one spouse might have health problems that affect the other spouse's sleep. Thus, adaptive design was applied to change the furniture layout, as in Figure 23 B. As their health deteriorated, seniors needed separate rooms to avoid disturbing each other at night, as in Figure 23 C. The overall health condition of seniors in senior apartments changed from a healthy state to a nursing state, requiring a change in the function of the space, such as turning the storage room into a nursing station or changing a standard room into a nursing room (Figure 24).

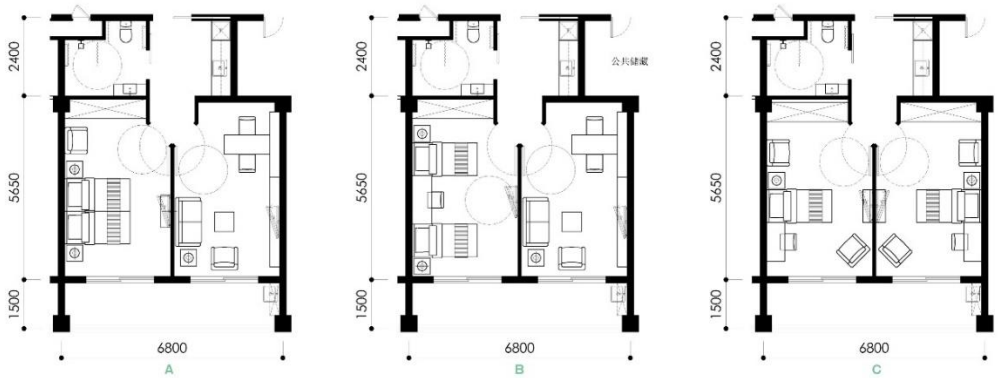

Figure 23. User's Age and Adaptive Design

Source: Author (2022)

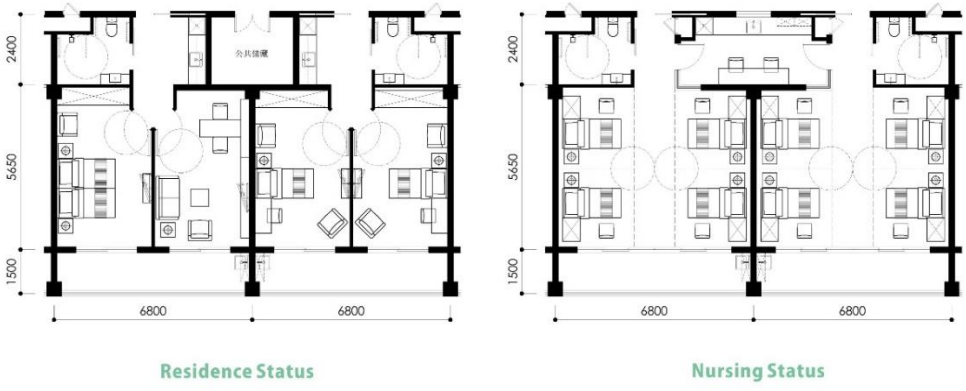

Figure 24. User's Health Status and Adaptive Design

Source: Author (2022)

As users had different incomes, resulting in different spending power, they also needed different household types to accommodate (Figure 25).

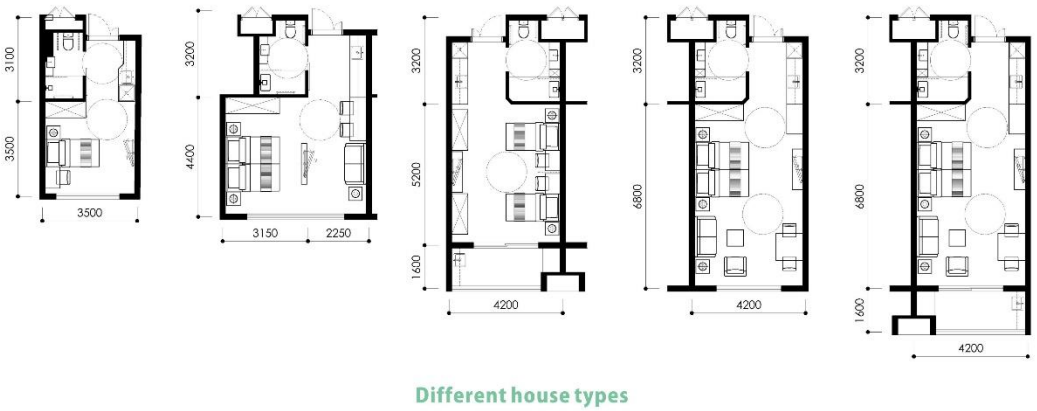

Figure 25. User's Income and Adaptive Design

Source: Author (2022)

Currently, because investors and operators placed too much emphasis on return on investment and operational efficiency, the living spaces of Vacation-Type Retirement Communities are uniform and do not consider users' individual needs, resulting in a poor user experience. Therefore, it was necessary to adapt the design to the user's individual needs. Figure 26 shows that different designs are used for the floor, walls, furniture, and lighting of the same household type according to the individual needs of the users. Personalized design can significantly improve user satisfaction.

Figure 26. User's Personal Needs and Adaptability Design

Source: Author (2023)

4.1.2 Operator Research

Vacation-Type Retirement Communities Operators included caregivers, doctors, nurses, customer service staff, cooks, dishwashers, cleaners, security guards, maintenance workers, financial staff, outside staff, and managers. Operators were responsible for providing services to seniors, which directly determine the quality of

services and significantly impact the quality of life of seniors and therefore need to be studied. Operator research focuses on uncovering their needs, discovering pain points, and providing solutions.

1. Operator Research Objectives and Methods

The objectives of the operator research were to discover operators' pain points related to architectural design, optimize the operation level of Vacation-Type Retirement Communities through adaptive design, and ultimately improve the quality of life of seniors.

The method of operator research included qualitative research and comprehensive research. Among them, qualitative research included literature and interviews; comprehensive research included the Mutually Exclusive Collectively Exhaustive (MECE) rule, The 80/20 Principle.

2. The Core Needs and Pain Points of Operators

Vacation-Type Retirement Communities operators' core needs were reducing work intensity and improving work efficiency. The pain points related to space design were found during the interviews: The design defected added a lot of work burden to the operators and reduced the work efficiency. These design defects include insufficient service space area, unreasonable location, and long moving lines.

3. Operator and Building Adaptive Design for Vacation-Type Retirement Communities.

The space deficiencies that lead to inefficient operation must be solved by architectural adaptation design: Setting up reasonable service spaces. It Included sufficient service space, proper location, and convenient movement lines.

4.1.3 Investor Research

Investors in Vacation-Type Retirement Communities included various investment institutions. Investors provided funds for the construction and operation of Vacation-Type Retirement Communities. Currently, investors are not actively investing in the Vacation-Type Retirement Communities sector. Therefore, it was necessary to research to uncover the reasons for this. Investor research focuses on finding their needs, discovering pain points, and providing solutions.

1. Investor Research Objectives and Methods

The research objectives on investors were to identify why investors were reluctant to invest in Vacation-Type Retirement Communities and provide solutions by sorting out the classification of investors and studying their needs and pain points.

The methodology of the research on investors included qualitative research, quantitative research, and comprehensive research. Among them, qualitative research included literature and interview research; quantitative research included financial data research; comprehensive research included the Mutually Exclusive Collectively Exhaustive (MECE) rule, The 80/20 Principle.

2. Classification of Investor

There were various ways to classify investors according to different criteria. According to the investment stage, investors could be classified into angel investment, VC investment, PE investment, and pre-IPO investment. Angel's single investment of 1-10 million CNY, the goal was to get 10-1000 times return. VC single investment of 10-200 million CNY, the investment goal was to get 10-100 times return. PE single investment and Pre-IPO single investment were usually tens of millions to hundreds of millions of CNY, and the investment goal was to obtain 1-3 times the return.

Investment in Vacation-Type Retirement Communities needed to be matched with the right institution.

3. Investor Needs

Since there were different investor categories, investors had joint and individual needs. The typical needs of investors were to avoid various risks and obtain reasonable investment returns.

Due to the significant investment scale and long investment cycle of Vacation-Type Retirement Communities, there were certain investment risks and uncertainty of investment returns. These characteristics determined that some investment institutions, such as small and dollar investors, were unsuitable for this investment area. Large and medium-sized state or private investors could invest in this area.

4. Investor and Building Adaptive Design for Vacation-Type Retirement Communities.

Based on literature research and interviews, the main pain points of investors in Vacation-Type Retirement Communities were found to be: Large investment capital, high investment risk, long investment cycle, and poor investment returns. Hu, X. et al. (2019) found several significant obstacles hindering the development of CCRCs in China by studying news from 14 mainstream media in China: First, significant investment, long cycle time, low return on investment, and high risk. Second, immature profit models. Third, lack of policy support. Fourth, lack of customer spending power. Research by Great Wall Securities showed that the annual return on investment for retirement communities was 8-10%, which was only 30-50% of that for residential projects (Great Wall Securities, 2014). These pain points made investors reluctant to invest in this sector, resulting in a shortage of capital to build Vacation-Type Retirement Communities.

The vast investment scale of Vacation-Type Retirement Communities was caused by excessive planning scale and high-cost design standards. There was no unified standard for Vacation-Type Retirement Communities in China, and many designers copied the scale and standards of resort hotels. The scale of construction usually reaches tens of thousands of square meters, and the cost per square meter reaches 10,000 CNY. The result of such planning and design inevitably led to massive investments. In addition, the necessary accessibility facilities and professional management staff also pulled up the investment scale of the project (Campbell, N., 2015). The solution to the problem: Scaled down planning, reduced non-essential costs, and focused on ensuring the quality of life for older adults. In the user study section, we found that many investments were ineffective and needed to be optimized through planning and design to reduce the size of the project while reducing the investment risk.

There were still risks from many aspects, including policy, market, and operational, because Vacation-Type Retirement Communities were still new in China, and there was no mature business model yet. The risk from the policy was mainly reflected in the government's policies that could be better.

The risk from the market was mainly reflected in the fact that the development mindset of many Vacation-Type Retirement Communities in China was still stuck in the real estate model, which only pays attention to hardware facilities such as architecture and landscape and neglects the research on the elderly groups, resulting in the development of projects that do not adapt to the needs of seniors and poor market feedback. For the market risk, investors need to give up the real estate model of development thinking, pay attention to the in-depth research on the elderly groups, dig into the pain points and needs of the elderly, pay attention to the service design, improve the service quality, to develop the project that suits the needs of customers.

The risk from operators was mainly reflected in the different operators' different operational concepts and project requirements. To save costs, some investors did not hire the operation team to participate in the communication during the design and construction of the Vacation-Type Retirement Communities and only found that many areas needed to be modified after the building was completed and the operation team moved in. These losses could have been completely avoided. So the solution is simple: the operations team needs to be involved from the beginning of the project design to advise on the design and construction of the Vacation-Type Retirement Communities.

The main reason for the long investment cycle and low return on investment is that the current retirement communities in China are mainly public benefits in nature. Government departments have strict regulations on the fees charged by retirement communities, resulting in low investment efficiency of the projects. The solution to this problem is that government policies need to be adjusted accordingly: retirement community fees for the general public still highlight their public benefit attributes, but investors need to be provided with specific policy incentives, such as tax breaks; retirement community fees for the affluent class adopt market mechanisms, allowing investors to make a reasonable profit. This will motivate their investment and promote the implementation of funds to construct retirement communities.

4.1.4 Government Research

The administration of Vacation-Type Retirement Communities included all levels of government. The government regulated Vacation-Type Retirement Communities by establishing relevant legal regulations and industry standards.

Moreover third, formulating relevant policies. The government's governance of the Vacation-Type Retirement Communities industry could be more effective, so it was necessary to conduct a study.

1. Government Research Objectives and Methods

The objectives of the government research: To research the laws, standards, and policies highly relevant to Vacation-Type Retirement Communities and to promote adaptive building design consistent with these laws, standards, and policies.

The methodology of government research mainly uses qualitative research and comprehensive research. Among them, qualitative research included literature, policy, and interview research; comprehensive research included the MECE rule and the 80/20 Principle.

2. Classification of Government

The government classification was divided into central government, provincial government, municipal government, county (district) government, and township government according to the level.

3. Government Needs

In the case of Vacation-Type Retirement Communities, the needs of all levels of government were the same: Effective administrative governance of Vacation-Type Retirement Communities to enhance the quality of life of seniors and actively respond to the aging of society's population.

4. Government and Building Adaptive Design for Vacation-Type Retirement Communities.

According to literature research and interviews, poor governance was the main pain point of government management of Vacation-Type Retirement Communities. Two highly relevant aspects to this topic were: 1) Unreasonable partial architectural design standards. 2) Inadequate implementation of architectural design standards.

Some architectural design standards were unreasonable in the following ways: Too strict emphasis on safety. For example, the fire safety standards related to senior citizen buildings. Due to the massive shortage of senior care facilities in China, the adaptive reuse of part of the old unused buildings to transform them into senior care facilities was necessary. However, many old buildings cannot be implemented

according to the current fire protection standards, resulting in a massive waste of social resources. Therefore, the actual situation should be fully considered, and the industry standard should be appropriately lowered. Second, some standards were developed with too much emphasis on national uniformity and need to give more consideration to local adaptability. For example, when developing the living units of retirement communities, each standard floor was required to be equipped with a particular area of public bathhouses. This standard did not apply to the Guangdong region keen on independent bathing. China is a vast country with many Ethnic Groups and considerable differences in customs and habits, so developing industry standards should be tailored to local conditions. Third, the industry labeling development mindset in China was still predominantly directive, leading to excessive restrictions and limitations in design (Zhou, Y. M., Lin, J. Y., et al., 2018). It was reassuring that the government was aware of these issues and had begun to arrange for experts to work on revising the standards and transforming the mindset and approach to standards development with the expectation that it would be of more practical value in implementing programs in retirement communities.

Implementation of architectural design standards for Vacation-Type Retirement Communities. At present, the architectural design standards that are highly relevant to Vacation-Type Retirement Communities are: "Construction Standards for Community Day Care Centers for the Elderly," "Architectural Design Standards for Elderly Care Facilities" JGJ450-2018 and "General Building Fire Prevention Code" GB 55037-2022. When implementing these standards, special attention should be paid to the mandatory standards therein. In the Architectural Design Standards for Elderly Care Facilities JGJ450-2018, articles 4.2.4, 5.1.2, 5.6.4, 5.6.6, 6.5.3, and 7.2.5 were mandatory provisions and must be strictly enforced. For example, 5.2.1 stipulates that the winter solstice sunshine time of living space was not less than 2 hours. The disadvantage of this clause was that the flexibility of the building layout was restricted, and it determined that the living space for seniors should avoid a north-facing layout with poor land utilization (Figure 27A). The right side was the case of the United States, where the layout was more flexible, using the walkways and saving land resources.

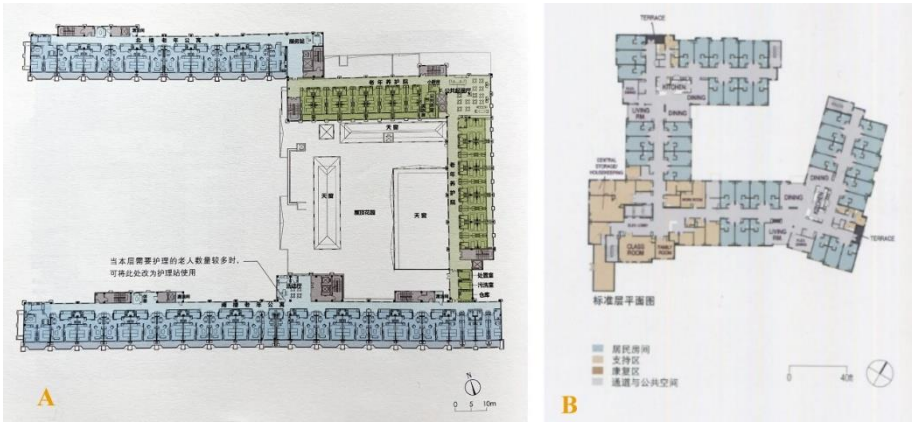

Figure 27. Building Design Standards and Adaptability Design

Souce: A Zhou, Y. M. (2018d), B The American Institude of Architects (2017)

4.2 Environment and Building Adaptive Design

A close relationship exists between the environment and the Building Adaptive Design of Vacation-Type Retirement Communities. The environment is the sum of all-natural and artificial elements that interact with human existence and can be divided into two categories: natural environment and human environment. Since this research was to transform a Natural Village into a Vacation-Type Retirement Community, the cases in this section were divided into two categories: Natural Village and Vacation-Type Retirement Community.

Through literature reading and fieldwork, the researcher compiled the natural and human environment elements related to this research and invited seven experts to score them after several rounds of revision to obtain the key elements of the environment (Table 3). The research would be carried out according to the key elements in the later stage.

Table 3. Environmental Elements Score in Vacation-Type Retirement Communities

Category	Type	Score	Ranking
Natural Environment	Climate	4.71	1
	Natural Landscape	4.57	2
	Air Quality	4.57	2
	Terrain	3.86	4
	Local Materials	3.14	5
	Land Resources	3	6
Human Environment	Local Culture	4.57	1
	Life Style	4.28	2
	Religious Beliefs	4	3
	Folk Art	3.57	4
	Cultural Landscape	3	5
	Educational Resources	2.57	6

Note. The score was done on a Likert scale. Not important at all 1, Not important 2, Important 3, More important 4, Very important 5.

4.2.1 Natural Environment and Building Adaptive Design

A close relationship exists between the natural environment and Building Adaptive Design for Vacation-Type Retirement Communities. Four key elements were identified through literature reading, field research, and expert interviews: Climate, natural landscape, topography, and local materials. Air quality was mainly reflected in the project site selection, so there was no particular section to discuss.

1. Climate and Building Adaptive Design for Vacation-Type Retirement Communities.

Climate is the overall condition of the atmosphere of a region over many years. The main climate elements include temperature, wind, light, and precipitation, the general climate is calculated for 30 years and is relatively stable(Zheng, Y., 2020).

The relationship between climate and architecture has long been reflected in traditional dwellings. For example, most of Thailand has a tropical monsoon climate, which is hot all year round, so Thai houses focus on ventilation and heat dissipation. In northern China, Inner Mongolia has a temperate continental climate with cold winters, and the walls of local houses are 1 meter thick to keep warm. Guangdong is located in south China, and most of its areas belong to the subtropical monsoon

climate. A few areas, such as the Leizhou Peninsula, belong to the tropical monsoon climate. For the whole year, Guangdong is hot, so shade and ventilation are the primary needs. The dense layout of Guangdong dwellings is designed to shade each other and provide shading (Figure 28 A). For ventilation, the traditional doors of Guangfu houses are designed as hollow doors (Figure 28 B). In addition, thermal and wind pressures are also used to solve the ventilation problem (Figure 28 C).

Figure 28. Climate and Building Adaptive Design

Source: By Author (2022)

The Vacation-Type Retirement Communities at Sanya Haitang Bay by Line+ Studio (2020) were designed with large overhanging eaves to shield the area from the fierce local sun and, in response to high-intensity rainfall, to accommodate the local subtropical monsoon climate (Figure 29).

Figure 29. Sanya Haitang Bay Retirement Community

Source: Line+ Studio (2020)

2. Topography and Building Adaptive Design for Vacation-Type Retirement Communities.

Topography refers to the various forms of the land surface. Topography is usually divided into five types: Mountains, plateaus, plains, hills, and basins. The topography of Guangdong mainly includes of mountains, plains, and hills.

Traditional dwellings are very good at solving the problem of the adaptive design of topography and architecture. For example, the hanging foot tower in western Hunan uses the elevated structure of the bottom floor to solve the uneven terrain. Research on terrain and Building Adaptive Design is relatively mature. Through reading the literature and expert interviews, the researcher has compiled typical design approaches for terrain and Building Adaptive Design: 1) Overhead; 2) Group; 3) Underground; 4) Footing; 5) Staggered; 6) Fall; 7) Overhanging; 8) Retreat (Figure 30).

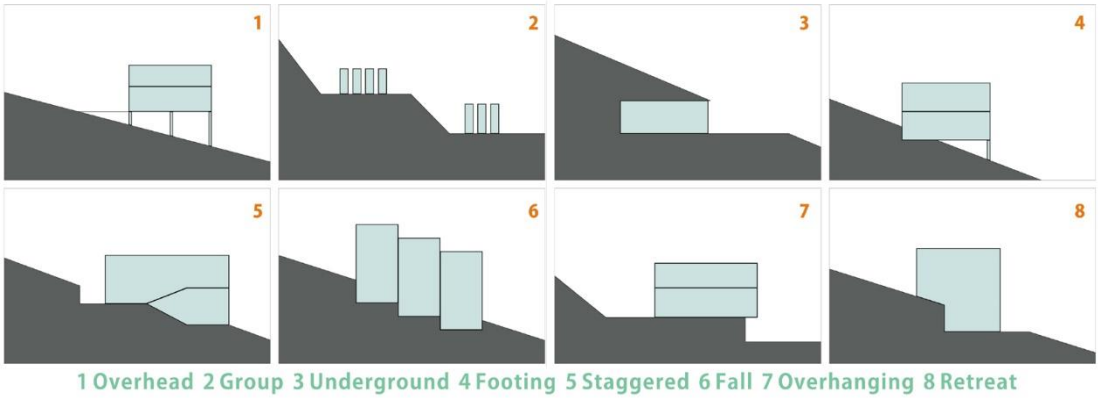

Figure 30. Topography and Building Adaptive Design

Source: Author (2022)

Figure 31 shows that the resort community designed by Line+ studio is well integrated into the topography, with buildings built on hills and connected by staircases in a staggered manner.

Figure 31. Courtyard No. 7, Tai'an Dongximen Village

Source: Line+ Studio (2019b)

3. Local Materials and Building Adaptive Design for Vacation-Type Retirement Communities.

Local materials are construction materials collected, processed, and produced on or around the site of a building. They are usually natural resources, such as stone, wood, soil, sand, bricks, etc. These materials are usually processed and handled on the building site to facilitate their use in construction. Figure 32's resort guest house design used local stone masonry for the walls, which was rustic and natural and reduces transportation costs.

Figure 32. Courtyard No. 8, Tai'an Dongximen Village

Source: Line+ Studio (2019b)

4. Natural Landscape and Building Adaptive Design for Vacation-Type Retirement Communities.

Natural landscape comprises various topographical features, vegetation, water systems, and other natural environmental elements. It includes the organic combination of natural ingredients such as topography and landform, vegetation, hydrology, rocks, and soil. Natural landscapes are characterized by natural beauty, diversity, complexity, and dynamism. The natural landscape is vital for leisure activities, such as vacations. It can be classified into several types: mountain landscape, water landscape, forest landscape, grassland landscape, desert landscape, etc. Natural Villages are far from cities and usually have better natural landscapes. The natural landscape is a unique resource for villages to build Vacation-Type Retirement Communities.

The natural landscape is a critical factor in the adaptive design of buildings. The building should choose the building form, location, and orientation according to the surrounding natural landscape to improve the efficiency of using natural landscape resources. In addition, it is also necessary to consider the protection and utilization of the surrounding natural landscape. The design of the building should avoid damaging and polluting the surrounding natural environment to improve the energy efficiency and sustainability of the building. Figure 33 is a successful example of a resort facility's three zones: Changing room, soaking pool, and fitness, designed with organic shapes and constructed along the mountain to integrate with the natural landscape.

Figure 33. Tai'an Jiunvfeng Soaking Pool

Source: Line+ studio (2019a)

4.2.2 Human Environment and Building Adaptive Design

There is a close relationship between the human environment and Building Adaptive Design. Three key factors were identified through literature reading, field research, and expert interviews: Local culture, lifestyle, and religious beliefs (Table 3).

1. Local Culture and Building Adaptive Design for Vacation-Type Retirement Communities.

Local culture refers to the unique cultural characteristics of a specific region, people, or society. It is essential to consider local cultural factors in Building Adaptive Design for Vacation-Type Retirement Communities. This way, the building will be better integrated into the surrounding environment and provide residents with a more pleasant living experience.

First, architectural style and design should consider the local cultural and historical heritage, such as architectural style, decorative elements, and architectural colors. This can make the buildings more local and complement the surrounding environment. The design of Vacation-Type Retirement Communities in different regions needs to be integrated with the local architectural style. For example, the Wuzhen

Yayuan retirement community is in Zhejiang Province. The architectural style continues the local traditional residential houses with white walls and black tiles, continuing the local architectural culture (Figure 34).

Second, the building's interior design should also incorporate local cultural elements. For example, the regional cultural characteristics can be reflected in the interior decoration, furniture arrangement, and artwork display (Figure 35). This will allow residents to feel the charm of local culture in the internal environment and also help promote cultural inheritance and exchange.

Finally, the landscape design of resort-type retirement community buildings should also consider local cultural factors.

Figure 34. Wuzhen Yayuan

Source: Author (2022)

Figure 35. Theater, Wood Carving, Embroidery in Chiu Chow

Source: Author (2022)

2. Lifestyle and Building Adaptive Design for Vacation-Type Retirement Communities.

Lifestyle refers to a person's or a group's daily living habits, eating habits, recreational activities, social behaviors, and values, which can deeply influence the adaptive design of Vacation-Type Retirement Communities buildings.

One of them is food habits. Guangdong's food culture is vibrant and diverse, and the food service of Vacation-Type Retirement Communities should provide local specialties to meet the needs of the elderly. The elderly in Guangdong like to drink morning tea and afternoon tea, need to provide corresponding restaurants (Figure 36). The elderly in Chiu Chow like to drink Kungfu tea and need to provide a tea room or tea-tasting area (Figure 37).

Second, sports and exercise. Sports and exercise are an important part of modern lifestyles, and Vacation-Type Retirement Communities should provide a variety of fitness and recreational facilities, such as swimming pools (Figure 38), gymnasiums, table tennis rooms, and tennis courts, to meet the needs of residents.

Third, socialization and recreation. Socialization and entertainment are essential components of lifestyle. To meet residents' needs, Vacation-Type Retirement Communities should provide various social and entertainment facilities, such as clubhouses, chess, card rooms, bars, and audio-visual rooms (Figure 39), etc.

Fourth, health and wellness. The adaptive design of Vacation-Type Retirement Communities buildings should consider the health and wellness of the elderly by providing appropriate spaces, such as Spa spaces and Massage rooms (Figure 40).

Figure 36. Restaurant in Vacation-Type Retirement Community

Source: Author (2021)

Figure 37. Tea Room in Vacation-Type Retirement Community

Source: Author (2023)

Figure 38. Swimming Pool in Vacation-Type Retirement Community

Source: Author (2021)

Figure 39. Audio and Video Room in Vacation-Type Retirement Community

Source: Author (2021)

Figure 40. Massage Room in Vacation-Type Retirement Community

Source: Author (2021)

3. Religious Beliefs and Building Adaptive Design for Vacation-Type Retirement Communities.

Religious beliefs are highly relevant to the adaptive design of Vacation-Type Retirement Communities buildings. In Guangdong, many older adults believe in Buddhism, and some believe in Matsu. In addition, Cantonese people have a strong clan concept, and many Natural Villages keep ancestral halls, which are places of worship for ancestors and a form of faith. Therefore, it is necessary to reserve or retain beliefs space for older adults, such as setting up Buddhist halls and repairing ancestral halls, in the adaptive design of buildings in Vacation-Type Retirement Communities.

4.3 Buildings and Building Adaptive Design

4.3.1 Overview of Guangdong Traditional Houses

Guangdong traditional dwellings is an integral part of traditional Chinese architecture, with unique styles and characteristics. The Lingnan region's natural environment, climatic conditions, and cultural traditions influence the architectural style of Guangdong traditional dwellings. In Guangdong, there are three main types of traditional dwellings: Guangfu dwellings, Chaoshan dwellings, and Hakka walled houses. They correspond to Guangdong's Ethnic Groups: Guangfu, Chaoshan, and Hakka (Figure 41).

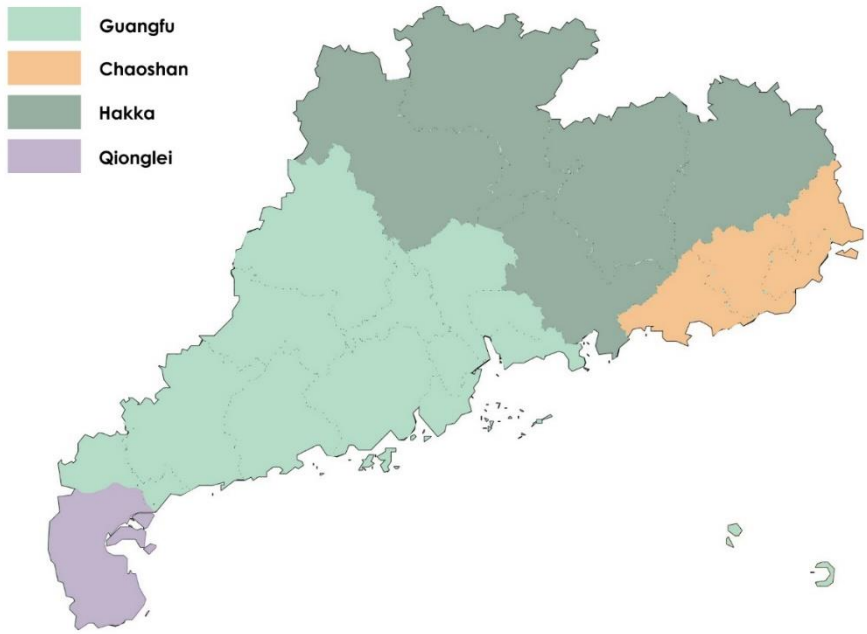

Figure 41. Distribution of The Three Ethnic Groups in Guangdong

Source: Author Adapted From Institute of Residential Architecture, South China University of Technology (2019)

The location and overall layout of the three types of dwellings are different: Guangfu dwellings are located in the Pearl River Plain, where the water network is intertwined, and laid out in a ribbon along the river. Chaoshan dwellings are located in the Han River Plain, mostly on flat land, and because of the small amount of land and people, the dwellings are laid out densely. Hakka dwellings are located in the mountainous areas of Guangdong, where land resources are scarce, and most dwellings

are built on hills not to occupy arable land. The overall layout of Hakka dwellings uses parallel and vertical contour layouts (Figure 42).

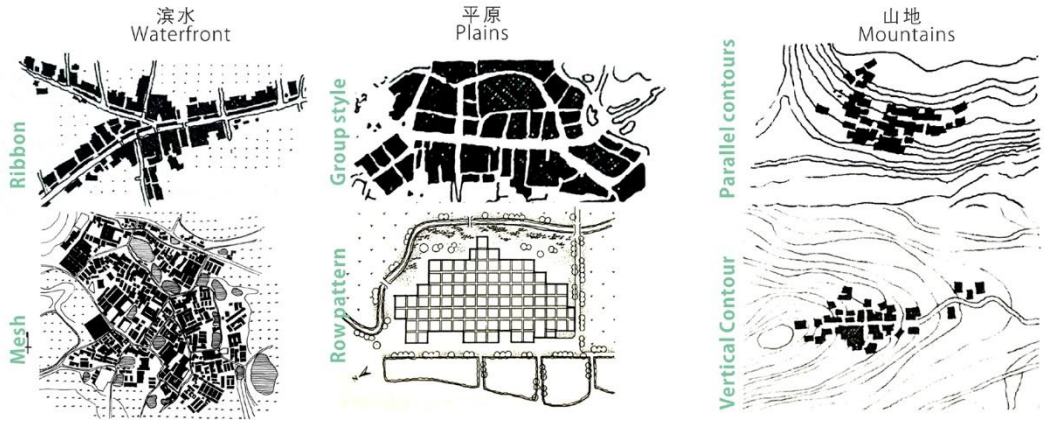

Figure 42. Site Selection and General Layout

Source: Lu, Q. (2008) and Peng, Y.G. (2018)

The unit plan layout of the three types of residential houses shows distinctly different characteristics (Figure 43): Guangfu dwellings are mansion-style buildings, typically the Xiguan Grand House. Chaoshan dwellings have a variety of layouts depending on the economic power of the users. The typical ones are Pashi, Sidianjin, Sanzuoluo, and Wujianguo (Figure 44). The typical layout of Hakka houses is circular.

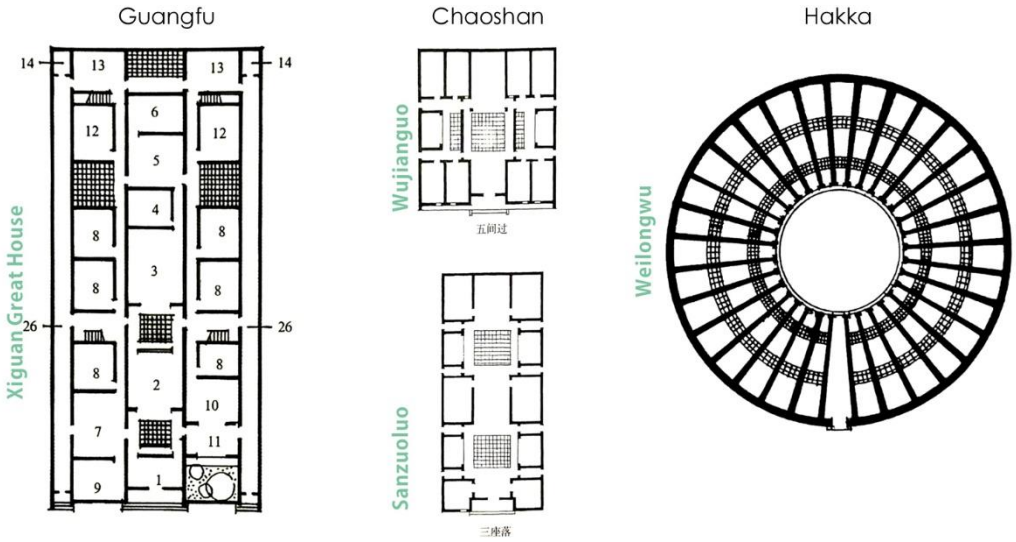

Figure 43. Local Culture and Building Adaptive Design

Source: Lu, Q. (2008)

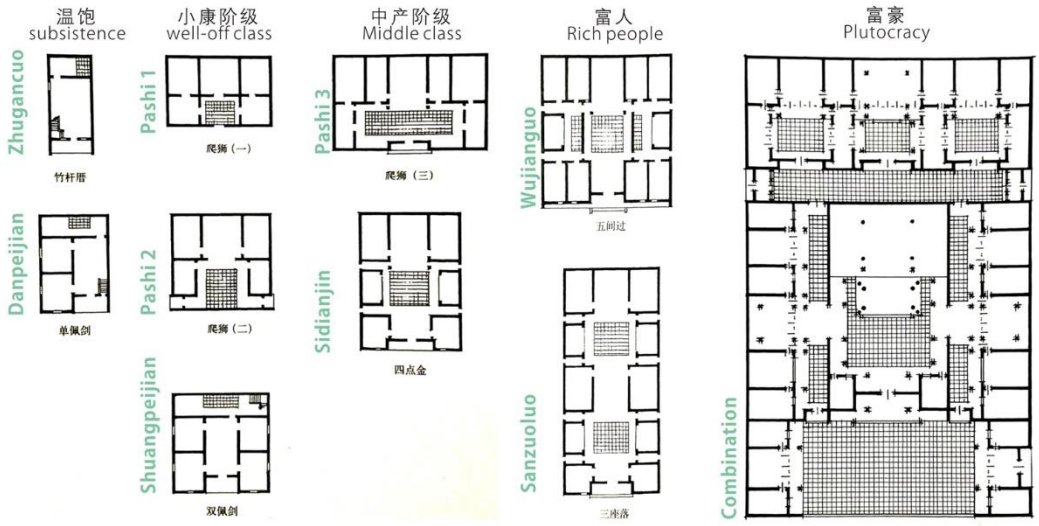

Figure 44. Floor Plan of Chaoshan Houses

Source: Lu, Q. (2008)

There are differences and similarities in the materials used in the three types of dwellings. Differences (Figure 45): Most of the walls of Guangfu houses are made of gray bricks, while some are made of seashells; the walls of Chaoshan houses are made of a triple mixture of shellac, raw sand, and red clay; the walls of Hakka dwellings are made of rammed earth as the main body and cobblestones as the footings. Commonality: All three types of dwellings are made of locally sourced materials from nearby. The primary local materials commonly used in the construction of traditional dwellings in Guangdong are as follows: 1) Stone: Guangdong is mountainous and hilly, with abundant stone resources. Stone is often used for walls, floors, doors, and windows, and its natural texture and color give buildings a sense of natural beauty. 2) Bricks: Guangdong's bricks are often handmade gray bricks with a unique texture and texture. Bricks can be used for walls, columns, beams, etc. 3) Wood: The abundant forest resources in Guangdong's mountainous and coastal areas make wood a critical building material for traditional local dwellings. Wood can be used for beams, columns, doors, windows, etc. Its natural texture and color give buildings a sense of warmth and comfort. 4) Tile: Tile is the primary covering material for the roofs of Guangdong dwellings. The tiles in Guangdong are usually handmade, and their styles and colors are distinctive, adding a sense of culture to the buildings. 5) Rammed earth: Rammed

earth walls are one of the main architectural structures of Hakka dwellings, built with rammed soil and materials such as weeds and stones, the colors present shades of gray, red, and yellow with a natural, rustic aesthetic. In addition, local materials such as bamboo and shells are available. These materials are not only well adapted to the local natural environment but also have the characteristics of environmental protection and sustainability.

Figure 45. Local Materials and Building Adaptive Design

Source: Author (2022)

The decoration of each of the three types of dwellings also has its characteristics: Guangfu dwellings use wok-ear (Huoer) style hill-walls with orderly undulations, forming typical Guangfu dwelling characteristics (Figure 46). The Chaoshan houses are the most decorative among the three types of houses: 1) the five elements of the hill-walls named after gold, wood, water, fire, and earth (Figure 47), which have great local characteristics; 2) the roof ridge and the top of the hill-walls are inlaid with ceramic pieces, which are colorful (Figure 48); 3) wood, stone, and gray sculptures are used in the lintels and beams, with exquisite craftsmanship and a variety of subjects (Figure 49). Hakka is the least decorated, with only a few wood carvings and murals embellishing the doors, windows, beams, and shade walls.

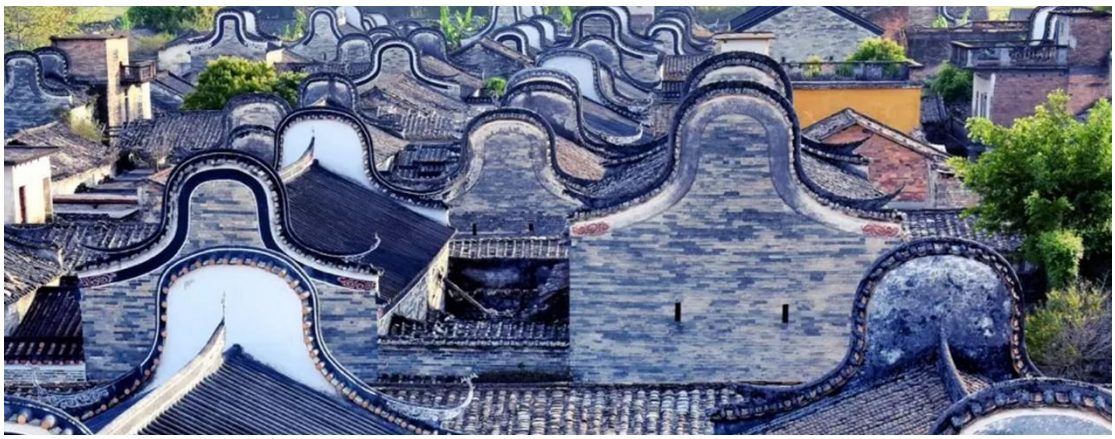

Figure 46. Hill Wall of Guangfu Houses

Source: Author (2022)

Figure 47 Hill Wall of Chaoshan Houses

Source: Cai, H.S. (2012)

Figure 48. Ceramic Inlay of Chaoshan Houses

Source: Author (2022)

Figure 49. Decoration of Chaoshan Houses

Source: Author (2022)

4.3.2 Guangdong Villages and Vacation-Type Retirement Communities

According to the Guangdong Provincial Government, there are 133,403 Natural Villages in Guangdong Province. 54% of these villages were established in the Qing Dynasty, and 26% were established in the Ming Dynasty, with considerable historical and cultural deposits. Most Natural Villages are built in places with beautiful mountains and rich natural landscape resources. Most of these villages are configured with agricultural resources such as arable land, rice fields, ponds, fruit forests, and mountain

forests. The villages in Guangdong have a pleasant subtropical and tropical monsoon climate, with no severe cold in winter and no scorching heat in summer. In addition, the Natural Villages in Guangdong have good infrastructure, developed transportation, and complete communication networks.

In addition to the conventional retirement community's residential and dining functions, Vacation-Type Retirement Communities also emphasize vacation functions. Research has revealed that Vacation-Type Retirement Communities usually have high requirements for site selection: 1) Beautiful scenery. The project should be close to a waterfront, lake, mountain range, or other natural beauty. 2) A pleasant climate. The project's location is usually considered to be in a subtropical area with no cold winters or hot summers to increase the comfort level of seniors. 3) Quiet and comfortable. The project should be located away from the city's hustle and bustle and noise to ensure that seniors enjoy peace and comfort. 4) Abundant resort facilities. A Vacation-Type Retirement Community is equipped with resort facilities such as restaurants, swimming pools, gyms, spas, etc. 5) A medical facility with a hospital or clinic to give seniors peace of mind. 6) Convenient transportation. Although retirement communities should avoid the hustle and bustle of the city, seniors still need to get out, and convenient transportation is suitable for family and friends to visit. 7) Complete life support: Configure supermarkets, vegetable markets, banks, post offices, and other living facilities.

By analyzing the characteristics of Natural Villages in Guangdong and the site selection needs of Vacation-Type Retirement Communities, we have found that many Natural Villages have the potential to be transformed into Vacation-Type Retirement Communities. According to the different locations of Natural Villages, they are divided into 1) Natural Villages in cities, 2) Natural Villages in the suburbs, and 3) Natural Villages in distant suburbs. According to the scores of seven experts, the Natural Villages in different zones scored differently. (Table 4) shows that: 1) urban Natural Villages have low scores for landscape resources, quietness, and comfort and are almost difficult to change. As a result, most Natural Villages in cities are unsuitable for Vacation-Type Retirement Communities. 2) distant suburban Natural Villages have high scores for landscape resources, quietness, and comfort but lack resort facilities, medical facilities,

and living facilities. However, these can be increased at a later stage of implementation. Therefore, Natural Villages in distant suburbs can be transformed into Vacation-Type Retirement Communities. However, the investment capital is larger and riskier. 3) The Natural Villages in the nearby suburbs have high and balanced scores for all items; Moreover, the project will be substantially improved through adaptive design. Thus, there is great potential to transform natural suburban villages into Vacation-Type Retirement Communities.

Table 4. Site Selection Score for Vacation-Type Retirement Communities

Category	Type	Score
Natural Villages in the Citys	Landscape	1.57
	Climate	4.71
	Quiet and Comfortable	1.29
	Vacation Facilities	2
	Medical Facilities	4
	Traffic Conditions	4.71
	Living Facilities	4.86
Natural Villages in the Suburbs	Landscape	3
	Climate	4.86
	Quiet and Comfortable	3.43
	Vacation Facilities	3.29
	Medical Facilities	3.71
	Traffic Conditions	4.57
	Living Facilities	4
Natural Villages in the Countryside	Landscape	4.86
	Climate	4.86
	Quiet and Comfortable	5
	Vacation Facilities	1.57
	Medical Facilities	1.14
	Traffic Conditions	3
	Living Facilities	1

Note. The score was done on a Likert scale with a minimum score of 1 and a maximum score of 5.

4.3.3 Buildings and Building Adaptive Design Strategies

According to the researcher's field survey and expert interviews, the village buildings in Guangdong are classified into five levels according to the degree of damage:

Damaged, Severely damaged, moderately damaged, slightly damaged, and in good condition. Each degree is explained in detail below:

1. Damaged: this means that the building has suffered severe damage, with only broken walls left, or only the foundation left, and has completely lost its use value (Figure 50).

2. Severely damaged: The structure of the building has been more seriously damaged, such as the collapse of the roof, and part of the wall collapse, making the building can not be used commonly (Figure 51).

3. Moderately damaged: refers to some parts of the building that suffered some damage, such as damage to doors and windows, and part of the non-load-bearing wall damage, but the overall structure is still relatively intact, and use is limited (Figure 52).

4. Refers to the extent of damage to the building that is relatively minor, only partially damaged, such as decorative construction damage or part of the wall skin off, and will not affect the overall structure and use of the building (Figure 53).

5. Good condition: The building has not been damaged and is in good condition, and can be used commonly (Figure 54).

Figure 50. Completely Damaged, Woshicun

Source: Author (2022)

Figure 51. Severely Damaged, Woshicun

Source: Author (2022)

Figure 52. Moderately Damaged, Woshicun

Source: Author (2022)

Figure 53. Slightly Damaged, Lanwucun

Source: Author (2022)

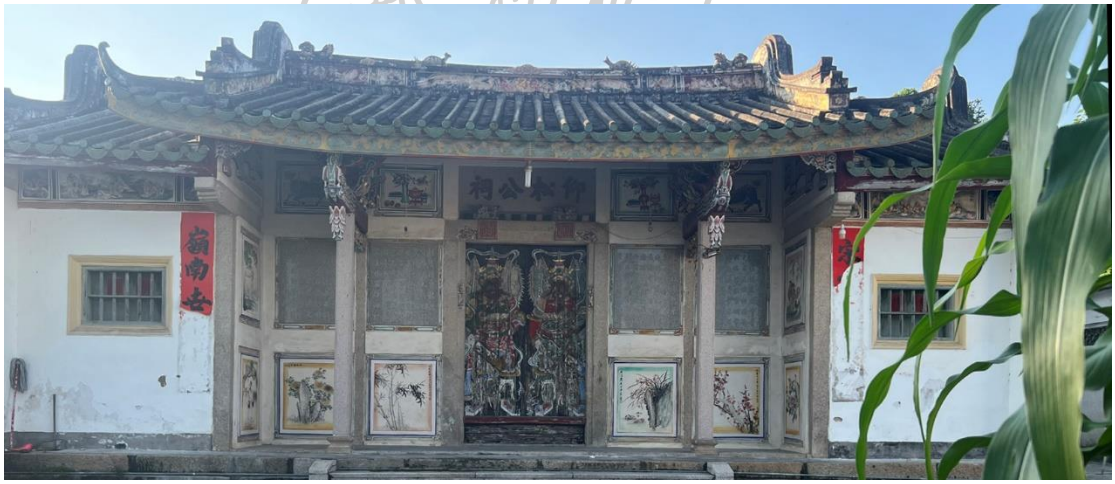

Figure 54. Good Condition, Woshicun

Source: Author (2022)

Building Adaptive Design strategies were developed for different building damage conditions and optimized based on input from research experts (Table 5). It usually includes new construction, reconstruction, addition, expansion, alteration, renovation, and maintenance.

New construction: refers to a new building on a previously damaged site, which can differ from the original building in function and form. For example, a new hotel can be built on the base of a demolished residential building.

Reconstruction: Usually refers to the restoration of the original building on the site where the old building was demolished, and the new building has the same function and form as the original building or even requires as much as possible the same, which can also be expressed as the restoration of the building. Reconstruction usually corresponds to important historical monuments.

Addition: This usually refers to adding a part of a new structure to an existing building to expand the used space or improve the function. Additions generally extend and improve the structure and layout of an existing building to accommodate new needs and uses. For example, apartments in early senior communities did not have elevators, which made travel inconvenient for the elderly, and could be designed to add elevators. Additions may require changes to the exterior and structure of the building but usually do not alter the core structure of the original building.

Expansion: Refers to increasing the size and usable space by modifying or expanding the core structure of an existing building to meet additional needs. Expansions may involve extensive changes to the original structure of the building, including adding or removing interior walls, strengthening or replacing support structures, changing the roof structure, etc. Expansions usually require additional design and construction work to ensure that the structure and function of the new building are compatible with the original building.

Alterations: are often the result of changes in the building's use function, where the original building space cannot meet the new requirements, and the adaptation to the new conditions is achieved by changing the building's layout, size, height, spatial sequence, and movement lines. For example, residential houses are transformed into restaurants, libraries, etc.

Renovation: usually means that the overall framework of the old building and the basic building structure is well preserved. However, the skin of the building, furniture, furnishings, etc., cannot meet the needs, and through renovation, the building is better adapted to the new requirements.

Maintenance: keeps a building operating, looking, and performing well to ensure its safety, comfort, and longevity.

The first edition of Building Adaptive Design Strategies has only a simple correspondence with the damage to the building, which needs to be more specific and targeted. The changes in the second edition are (Table 5): 1) For Completely damaged and severely damaged, only New Construction is retained, and Reconstruction is removed because Reconstruction is usually applied to historic buildings and is unsuitable for Vacation-Type Retirement Communities. 2) For Slightly damaged is more targeted with the Renovation strategy. The changes in the third edition are: For Moderately damaged use Expansion and Alteration, delete Addition because Expansion and Addition are often intertwined, and Expansion contains Addition. This change will make the strategy more clear.

Table 5. Buildings Damage Levels and Building Adaptive Design Strategies

Versions	Village Buildings Damage Levels	Building Adaptive Design Strategies
1	Completely Damaged	Reconstruction, New Construction
	Severely Damaged	Reconstruction, New Construction
	Moderately Damaged	Alteration
	Slightly Damaged	Alteration
	Good Condition	Maintenance
2	Completely Damaged	New Construction
	Severely Damaged	New Construction
	Moderately Damaged	Addition, Expansion, Alteration
	Slightly Damaged	Renovation
	Good Condition	Maintenance
3	Completely Damaged	New Construction
	Severely Damaged	New Construction
	Moderately Damaged	Expansion, Alteration
	Slightly Damaged	Renovation
	Good Condition	Maintenance

4.4 Summary

1. Theoretical Model

Figure 55 shows the theoretical model of this research. Three key factors influence Building Adaptive Design of Vacation-Type Retirement Communities: Stakeholders, environment, and architecture. The relationship between Building Adaptive Design and the three key factors was interactive. On the one hand, the three

key factors influence the development of strategies and methods for Building Adaptive Design. On the other hand, Building Adaptive Design can, in turn, affect the state of the three key factors through strategy, method, and implementation.

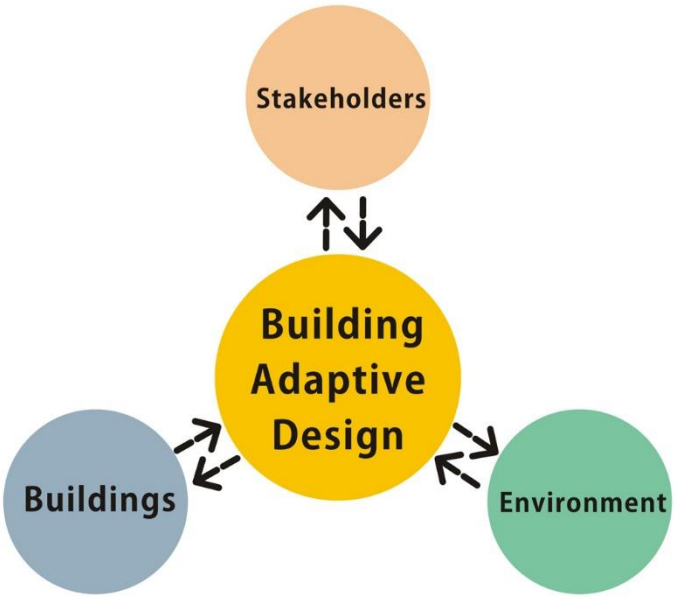

Figure 55. Theoretical Model of Building Adaptive Design

Source: Author (2023)

2. Stakeholder and Building Adaptive Design

Stakeholders primarily included users (older adults), operators, investors, and the government, where users were the core. Questionnaires and expert interviews obtained a hierarchy of users' primary spatial needs. Figure 56 shows that these levels of spatial needs range from low to high, covering the primary spatial needs of the adults in Vacation-Type Retirement Communities.

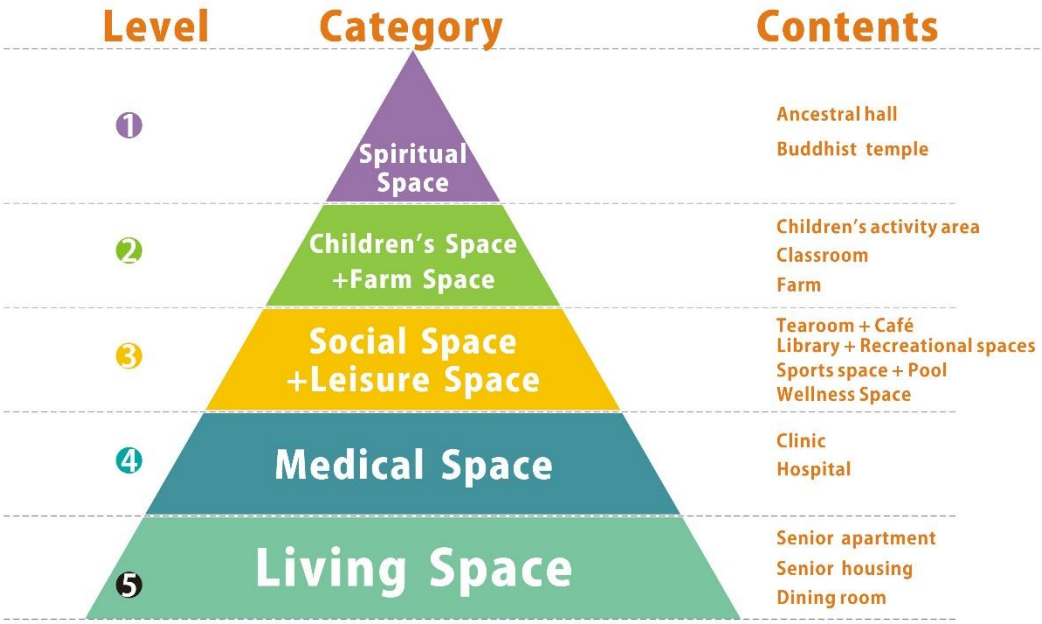

Figure 56. User Space Needs Levels

Source: Author (2023)

3. Environmental and Building Adaptive Design

The environment that influenced Building Adaptive Design for Vacation-Type Retirement Communities includes the natural and human environments. The natural environment mainly includes Climate, Topography, Topography, Local materials. The human environment mainly includes Local culture, Lifestyle, and Religious beliefs. Table 6 shows the specific contents.

Table 6. Environment and Building Adaptive Design Strategies

Category	Type	Contents
Natural Environment	Climate	Light, Temperature, Wind, Precipitation
	Topography	Mountains, Plateaus, Plains, Hills, Basins
	Local Naterials	Stone, Wood, Rammed Earth, Sand, Brick
	Natural Landscape	Mountains, Hills, Rivers, Lakes, Seas, Biological Resources
Human Environment	Local Culture	Custom, Building Style, Folk Art, Fengshui
	Life Style	Living Habits, Food Habits, Recreational Activities, Social Behavior, Values
	Religious Beliefs	Religious Rituals, Religious Festivals

4. Village Buildings and Building Adaptive Design

The buildings in this research mainly refer to the buildings in Natural Villages. The theoretical model of Building Adaptive Design Strategies (Figure 57) was obtained through fieldwork, expert interviews, and questionnaire surveys. According to the damage to the original buildings, the corresponding adaptive design strategies were matched.

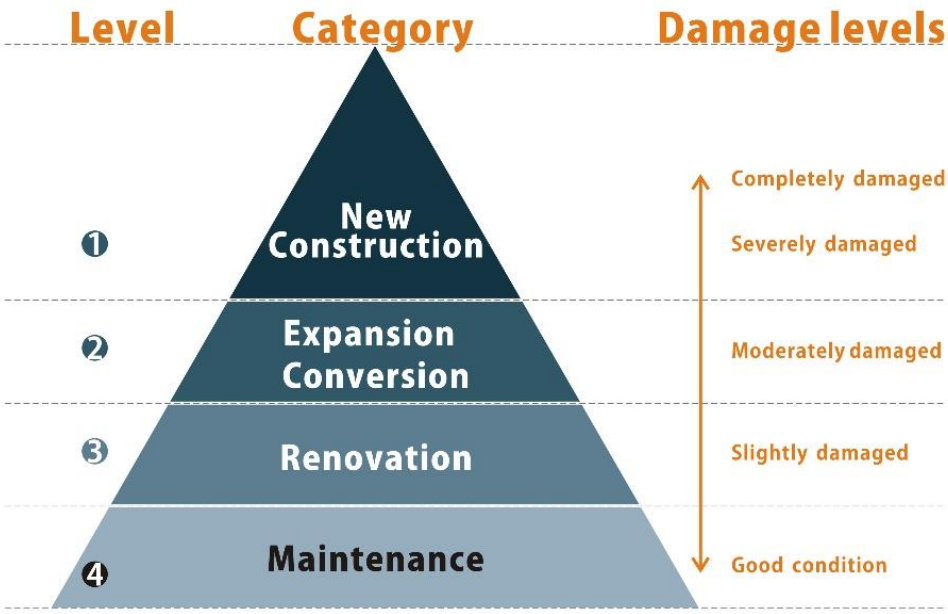

Figure 57. Building Adaptive Design Strategies

Source: Author (2023)

Building Adaptive Design strategies alone cannot yet guide design practice. Therefore, the researcher also summarized Building Adaptive Design methods through fieldwork, case studies, expert interviews, and questionnaires (Figure 58). They were divided into five levels according to the difficulty of their implementation: Lighting adaptive design was the easiest, and structural adaptive design was the most difficult. In practice, not only one design method was used, but often several methods were used together.

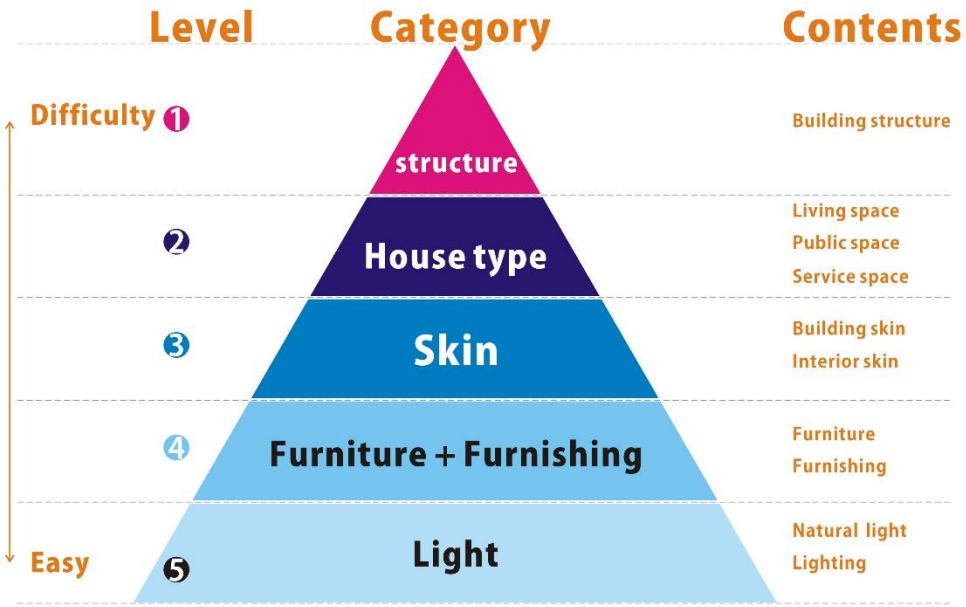

Figure 58. Building Adaptive Design Methods

Source: Author (2023)

Chapter 5 Design Practices

Chapter 5 consisted three parts: 1. Design workshop; 2. Design Practice in Chiu Chow; and 3. Feedback on the Design

The design workshop was a preliminary exploration, and each workshop addresses 2-3 key issues of Building Adaptive Design. The final design application aims to validate and refine the theoretical framework and design methodology of this study. The project sites are located in Zhuhai, Rao Ping, and Chiu Chow, which correspond to three Ethnic Groups in Guangdong, namely Guangfu, Hakka, and Chaoshan.

5.1 Design Workshop

5.1.1 Design Workshop 1

1. Design Workshop Objectives

The objectives of Design Workshop 1 are threefold: first, to address the design of adaptive Vacation-Type Retirement Community buildings to the terrain. Second, to address the policy adaptation of Vacation-Type Retirement Community buildings, and third, to address the climate adaptation of Vacation-Type Retirement Community buildings.

2. Base Overview

The project is located on Jiuzhou Island, Zhuhai, at the mouth of the Pearl River, 2.3 km from Jiuzhou Port in Zhuhai and 2.4 km from Zhuhai Jiuzhou Airport, with convenient transportation. The base is 4.2 km away from the nearest Zhuhai Hospital, meeting the principle of the proximity of medical resources (Figure 59).

Figure 59. Jiuzhou Island, Zhuhai

Source: Google Earth (2022)

Jiuzhou Island still maintains a pristine natural environment, with forests covering almost the entire island, many natural stone landscapes spread along the coast, and excellent air quality (Figure 60).

Figure 60. Jiuzhou Island, Zhuhai

Source: Author (2022)

3. Climate of Jiuzhou Island

Jiuzhou Island has a subtropical maritime climate. The average yearly temperature is 22.5 Celsius, the average yearly relative humidity is 80%, and the rainfall is abundant, with the annual average rainfall reaching 2061.9mm (Liu, J. L. & Zheng, H. Y., 2016). The climate is suitable for building a Vacation-type retirement community, with no cold winters or hot summers. The rainy season is from April to September each year, when the southeast monsoon prevails and 85% of the year's precipitation falls. The dry season is from October to March, with the northeast monsoon prevailing.

4. The Topography of Jiuzhou Island

The topography of Jiuzhou Island is mainly hilly, with some flat areas, surrounded by beaches (Figure 61). The hills are divided into three groups: Northern, central, and southern. The northern hill is 43.45 m high; the central hill has two peaks, 38.32 m and 41.87 m high; and the southern hill has 56.15 m and 63.93 m high (China Zhuhai Group, 2016). The northern hill has two sets of rocky escarpments: the northwest-facing one has a height drop of over 30 meters and a cliff length of about 109 meters; the southeast-facing one has a height drop of about five and a cliff length of about 69 meters (China Zhuhai Group, 2016). The central hill has two sets of steep rocky cliffs: The height drop of the cliff in the northwest direction is more than 9 meters, and the length of the cliff is about 122 meters; the height drop of the cliff in the southwest direction is about 13 meters, and the length of the cliff is about 152 meters (China Zhuhai Group, 2016). There is a set of steep rocky cliffs in the northwest of the southern massif: The height drop of the cliffs exceeds 14 meters, and the length of the cliffs is about 78 meters; the peak is flat and rocky, and there is a stone terrace path connecting the top of the mountain (China Zhuhai Group, 2016). There is a flat area between the northern and central massif: About 128 meters between east and west and 85 meters between north and south (China Zhuhai Group, 2016).

Figure 61. Master Plan of Jiuzhou Island

Source: Author (2022)

5. Project Positioning

The design orientation is developed from five aspects: 1) City type; 2) Location; 3) Scales; 4) Grade; 5) Age. City type: Medium-sized city; Location: Near suburbs; Scales: Small, about 40 beds; Income: High income; Age: 80% are healthy seniors aged 60-69, 20% are 70-79 who need care.

6. Project Site Selection

There are several cliffs on Jiuzhou Island with large height drops, and the project site needs to avoid these areas. Topographical and climatic factors, such as ventilation and sunlight, should also be considered. At the same time, traffic and landscape should be taken into account. Taking all these factors into consideration, the site was finally chosen in the southeast of North Mountain (Figure 62). This area has some cliffs, but the height difference is slight. The southeast wind prevails in the summer and the northeast wind in the winter on Jiuzhou Island. This location can enjoy the southeast wind in the summer to lower the indoor temperature and use the mountain to block the cold northeast wind in the winter. In addition, this location has a good view: With the mountains at the back and the sea at the front.

Figure 62. Project Site Selection

Source: Author (2022)

7. Design Solution A

Figure 63 shows the generation process of Scenario A. 1) Original topography; 2) According to the topography of the site, three levels of building blocks are placed first; 3) By moving the building blocks to form an occlusal relationship, the bottom of the building blocks is designed to be elevated; 4) In the horizontal direction, the blocks are allowed to follow the changes of the mountain; 5) Optimize the architectural details; 6) Add landscape facilities.

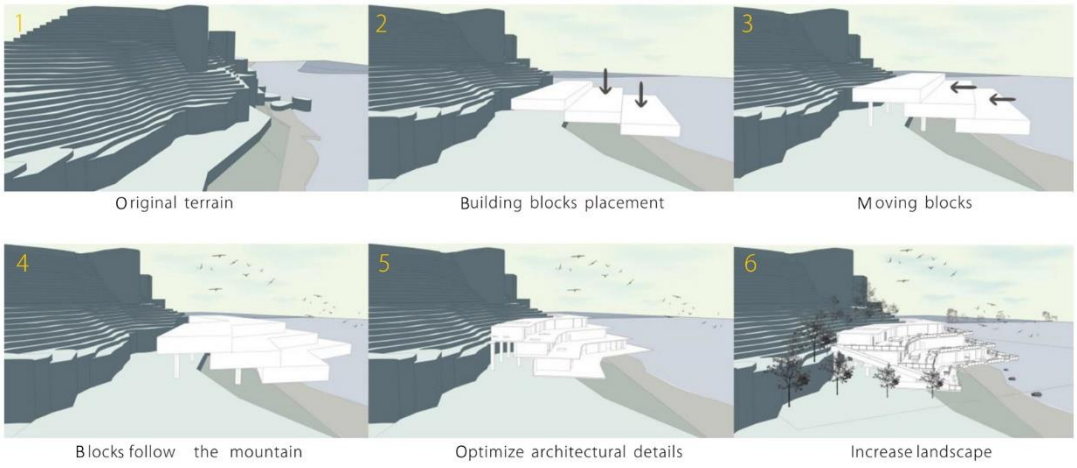

Figure 63. Solution A Generation Process

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Field observations and a search of the relevant literature revealed the following scenarios as the main activities of the elderly: Daily life, interest, environment, social Interaction, spirit, emotion, and exercise (Figure 64).

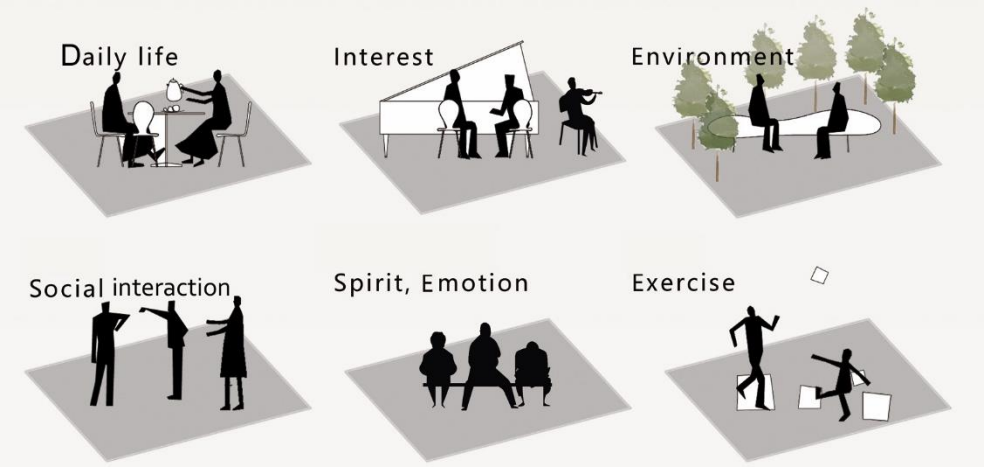

Figure 64. The Main Activities of the Seniors

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

By studying the main living scenes of the Seniors, we found that the space of many living scenes requires courtyards. Therefore, including a courtyard in the architectural design provides a spatial carrier for the living scenarios of the Seniors on the one hand. On the other hand, the courtyard space can significantly enhance the overall living experience (Figure 65).

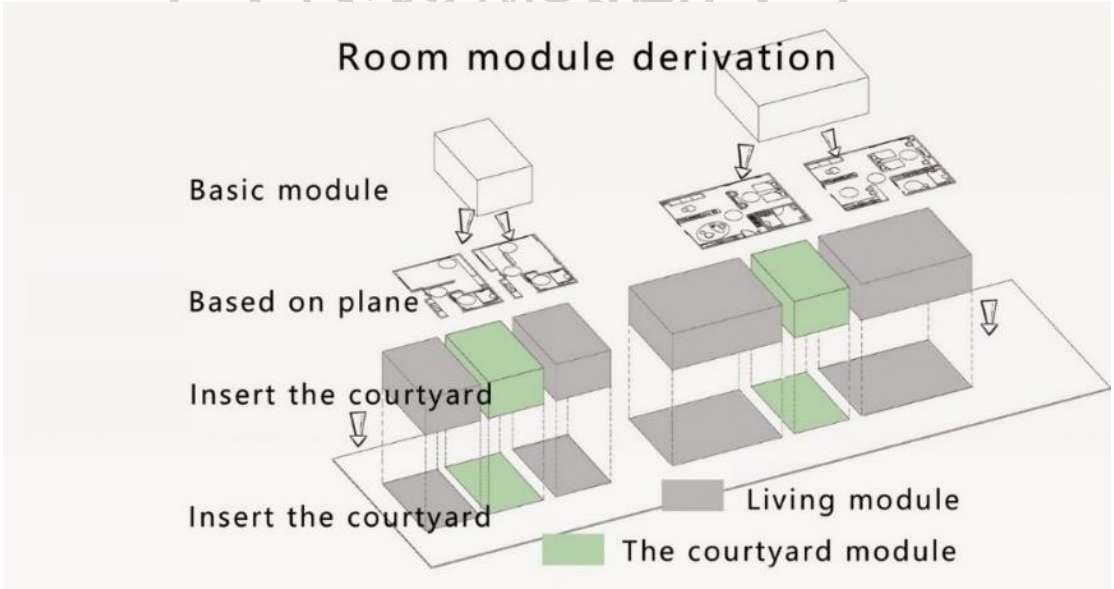

Figure 65. Room Module Derivation

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Figure 66 shows that the first floor of the building is elevated to minimize the damage to the original base and to protect the natural ecology; Figure 67 shows that the building is designed with receding terraces, each floor has sufficient outdoor activity area, and these terraces are connected to increase the interaction space between users and enhance the landscape quality. The eaves of the gable are designed to shade the sun, and the terraces on each floor have three rectangular holes to increase airflow and adapt to the local climate. The overall rendering of the building is shown in Figure 68, and the architectural model is shown in Figure 69.

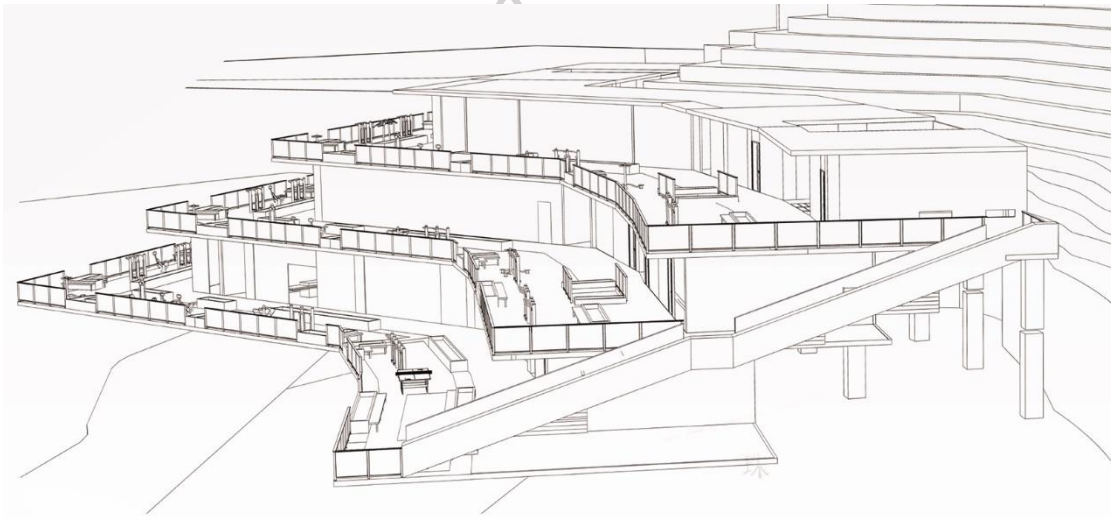

Figure 66. Axonometric Drawing

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

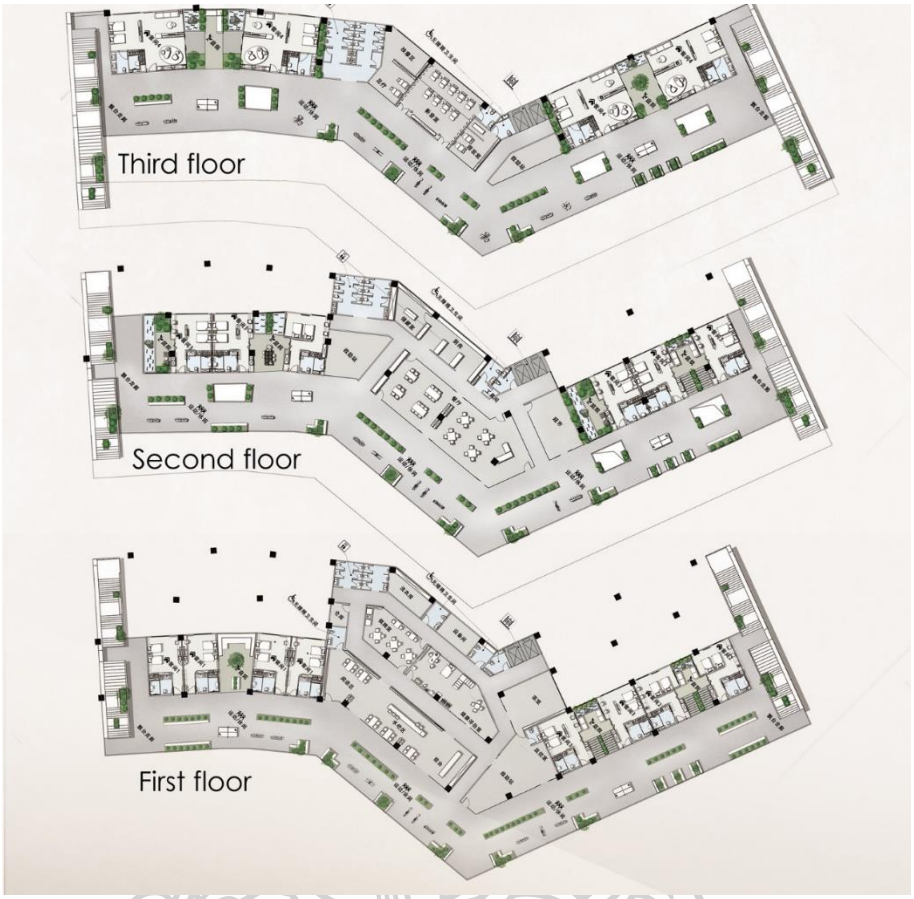

Figure 67. Floor Plans

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Figure 68. Overall Rendering of the Building

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Figure 69. Model of the Building

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

The four household types A, B, C, and D, were designed by adopting a modular and Building Adaptive Design Strategy according to the different economic situations and needs of seniors (Figure 70). These four household types can produce a flexible combination relationship according to the needs. Each household type can be divided into Bathroom, Storage, Foyer, Sleeping, Leisure, Partitions, Living room, Kitchen, and other spaces according to the function of the space.

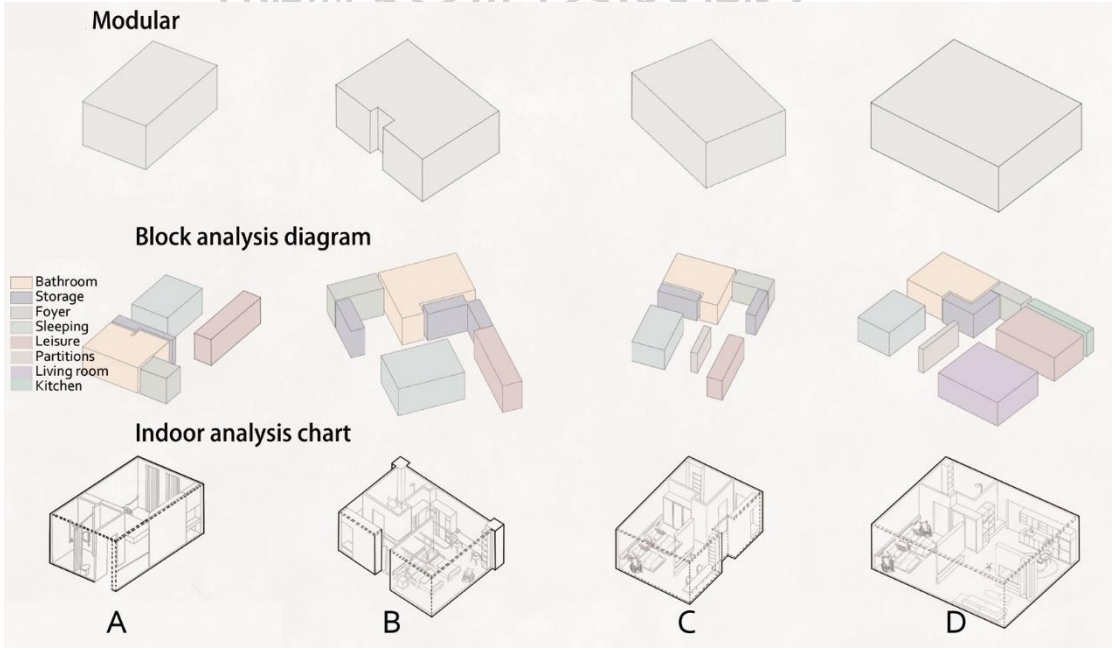

Figure 70. Household Design

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Depending on the health status of seniors, the rooms can be presented in two states: Independent living rooms (Figure 71) and nursing rooms (Figure 72). The independent living rooms are designed conventionally, while the nursing rooms are equipped with professional nursing beds, with two beds per nursing room in consideration of operating costs, and the necessary curtains for privacy. The lighting system in the nursing rooms is functional.

Figure 71. Independent Living Room

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Figure 72. Nursing Room

Source: Hu, X.F., Li L., Liang, Y. H. (2022)

Jiuzhou Island has rich landscape resources: lush vegetation, high forest coverage, and characteristic stone landscape resources. The landscape design maximizes the value of the original landscape resources by setting up large terraces and floor-to-ceiling windows. In addition, the courtyard (Figure 73) and large terrace (Figure 74)between different house types highlight this plan. The courtyard is the most popular space for Chinese people. The courtyard between different house types has different forms, with water features, tree ponds, leisure tables and chairs, planting ponds, etc., creating various leisure activities. The oversized terrace solves the problem of the lack of flat space on the site. It adds the functions of resting, planting, exercising, viewing, and socializing through the configuration of resting benches, planting pools, and exercise equipment.

Figure 73. Courtyard Space.

Source: Hu, X.F., Li L., Liang, Y.H. (2022)

Figure 74. Terrace Space

Source: Hu X.F., Li L., Liang Y.H. (2022)

8. Design Solution B

Figure 75 shows the overall layout of Design Solution B. Design Solution B has two main functional zones: The vacation homes and the infinity pool. The vacation homes are located in the woods in the northwest, taking advantage of the dispersion of the plan and the elevation difference of the façade so that each vacation home gets a good view and protects its privacy. The infinity pool is located to the southeast, near the beach. A wooden walkway connects the lodge to the infinity pool. Users are 60-69 years old and in good health. The vacation home is made of wood and can be dismantled or relocated whenever needed. The timber-frame vacation home is environmentally friendly and is the government-recommended way to build on the island, reflecting the design's adaptability to policy.

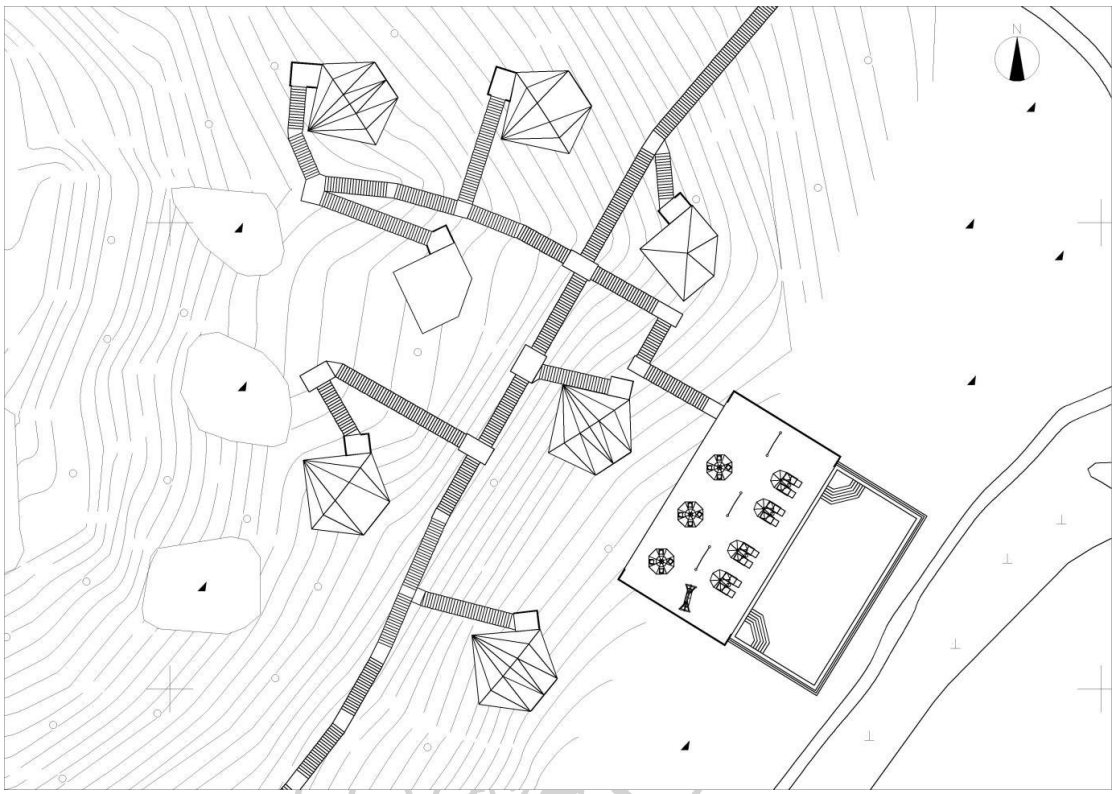

Figure 75. General Plan

Source: Li, J.H. (2022)

Figure 76 shows the generation process of Design Solution B. 1) Original plot; 2) Block rotation; 3) Local descent; 4) Form primary type; 5) Separated essential body; 6) Local block contraction; 7) Block extension; 8) Block push-pull.

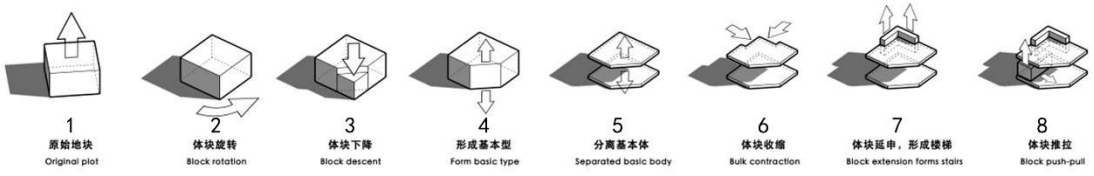

Figure 76. Generation of Vacation Home Space

Source: Li, J.H. (2022)

Design Solution B fully uses the light changes at different times of the day to create different scene atmospheres. We choose three typical periods to illustrate. Figure 77 shows a scene in the morning when the sun is just rising: the sun rises slowly from sea level, and the orange light gradually softens in the atmosphere. The forest, the vacation home, and the pool are bathed in golden sunlight, giving a sense of

nature's charm. Figure 78 shows the scene during the day: The vacation home seems to be set in the forest exterior, facing the sea, and the residents can enjoy the stunning sea view from the balcony. Figure 79 shows a scene at night: Night falls, and a hazy mist shrouds the forest by the sea. It adds a mysterious atmosphere to this island. The resort house is warmly lit, and the sea breeze gently blows, making everything peaceful and serene. Down the road from the lodge, the infinity pool is elevated by the beach, where seniors can swim, chat, listen to the waves lapping at the shore, and watch the clouds roll in (Figure 80).

Figure 77. Scene of the Sun Rising

Source: By Li, J.H. (2022)

Figure 78. Daytime Scene

Source: Li, J.H. (2022)

Figure 79. Moonlight Night Scene

Source: Li, J.H. (2022)

Figure 80. Infinity Pool

Source: Li J.H. (2022)

Figure 81 shows the structure of the vacation home. The frame and envelope of the vacation house are made of wood structure, which is green and in line with the government's policy and reflects the adaptive design of the policy. In addition, the wooden structure is easy to install and dismantle. The outer shell is made of aluminum

alloy plates, which are durable and adaptable to the climate of Jiuzhou Island. The side of the vacation house facing the sea is designed with oversized floor-to-ceiling windows, which can get excellent views on the one hand and open part of the windows to get a good natural ventilation.

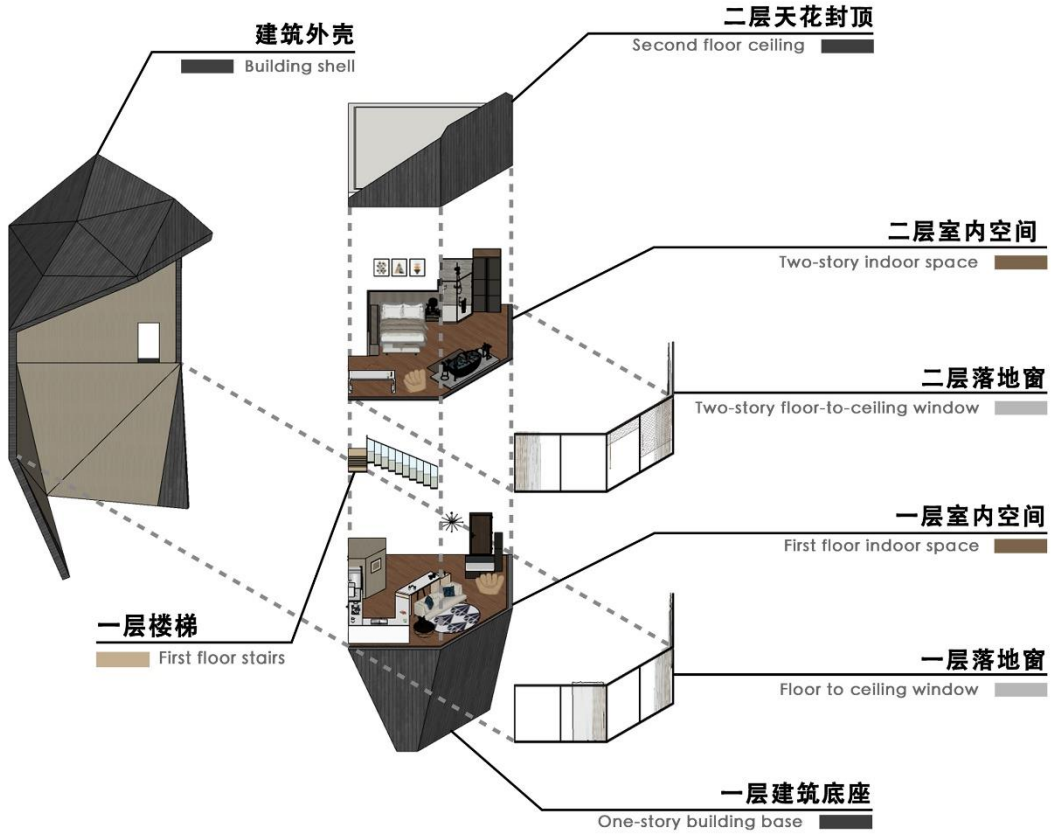

Figure 81. Exploded View of the Vacation Chalet

Source: Li, J.H. (2022)

The vacation home is divided into two floors (Figure 82). The first floor is the living room, which contains the entrance, living room, bar, kitchen, and bathroom. The second floor is the bedroom, which contains the sleeping, bathing, study, and working areas.

Figure 82. Vacation Home Floor Plans.

Source: Li, J.H. (2022)

The interior design of the vacation home adopts a minimalist design style, which on the one hand, reduces the cost and facilitates the construction, and on the other hand, makes the visual focus of the interior stay on the large floor-to-ceiling windows and the introduced natural landscape becomes the most luxurious decoration of the interior. The floor and part of the walls are made of wood texture, adding warmth to the minimalist space. The comfortable upholstered furniture makes people relax quickly. A bathtub is placed on the second floor by the window, and users enjoy the seaside view while taking a bath. The whole interior space creates a bright and cheerful vacation atmosphere. (Figure 83, Figure 84, Figure 85, Figure 86).

Figure 83. First Floor of the Vacation Home

Source: Li, J.H. (2022)

Figure 84. First Floor of the Vacation Home.

Source: Li J.H. (2022)

Figure 85. Second Floor of the Vacation Home.

Source: Li, J.H. (2022)

Figure 86. Second Floor of the Vacation Home.

Source: Li, J.H. (2022)

5.1.2 Design Workshop 2

1. Design Workshop Objectives

Design Workshop 2 is twofold: First, to address the Building Adaptive Design in Vacation-Type Retirement Communities with local culture. Second, to address the adaptive reuse of old buildings in villages.

2. Project Positioning

The design orientation is developed from five aspects: 1) City type; 2) Location; 3) Scales; 4) Icoming; 5) Age. City type: Small-sized city; Location: Countryside; Scales: Small, about 40 beds; Icoming: Middle -icoming; Age: Healthy older adults aged 60-69.

3. Design Research

1) Base Overview

The project is located in Yongshan Village, Shangrao Town, Rao Ping (Figure 87). Yongshan village is in the eastern mountainous region of Guangdong, far from the city, 96 kilometers from Chiu Chow city and 120 kilometers from Meizhou city. The village has a history of nearly 800 years, and in October 2022, it was selected as one of China's "Sixth Batch of Traditional Chinese Villages." Surrounded by mountains on all sides and a stream on both sides. The provincial road S221 passes around the village with convenient and smooth traffic.

Figure 87. Site of Yongsan Village

Source: Google Earth (2022)

2) Site Status Analysis

The base is located in the northeast of Yongsan Village. Yongsan Village is a typical Hakka village with many Hakka wai-long houses still intact. The original building for this adaptive reuse is a typical Hakka wai-long house: Dong Hua Lou. To the west of Donghualou is a small stream, to the northwest is a small field, and the surrounding

area is surrounded by mountains with an excellent overall view. A small bridge connecting Donghualou to the S221 highway makes it easily accessible (Figure 88). Around Donghualou are houses built by villagers one after another later on, and the architectural style could be more organized (Figure 89).

Figure 88. Site of Donghualou

Source: Google Earth (2023)

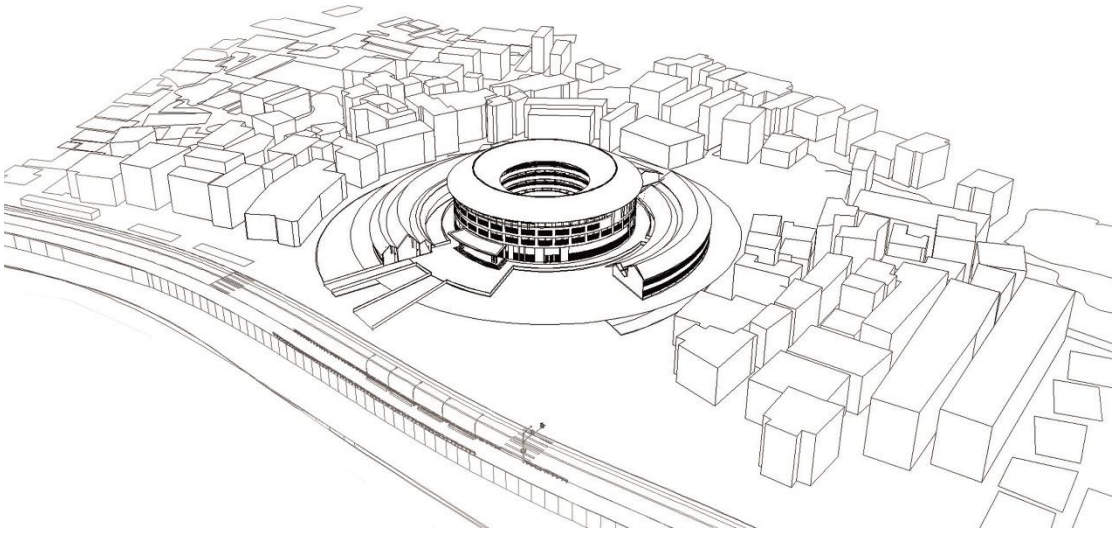

Figure 89. Bird's Eye View of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

3) Climate of Yongsan Village

Yongsan Village has a subtropical maritime climate. It has an average annual temperature of 21.2°C and abundant rainfall, with an average yearly rainfall of 1659.5 mm and 1,661 hours of sunshine. The climate is humid and pleasant, suitable for constructing a Vacation-type retirement community.

4) Analysis of the Current State of the Building

Donghualou was built in 1952. Sitting east to west, backed by mountains and facing the water, it is circular, 35 meters in diameter, with an area of 962 square meters. Donghualou is a double courtyard house, with a bungalow in the front and a two-story building in the back, with a well in the inner courtyard and a gatehouse constructed of green bricks. Stonewall base and walls are built with rammed earth, gray tile roof, and overhanging roof gables. Donghualou is well preserved and is a typical representative of earthen floor architecture in the 1950s (Figure 90, Figure 91).

Figure 90. Rao Ping's Donghualou

Source: Rao Ping Government (2022)

Figure 91. Status of Donghualou

Source: Raoping Government (2022)

5) User Insights

The users of this project are set to be the middle-income elderly group aged 60-69. This type of senior citizen is healthy, have a strong needs for vacation, has certain spending power, and like the peaceful countryside life. Many seniors in this group were born in the countryside or have lived in the country, so it is especially important to retain the local flavor in the design.

4. Building Adaptive Design Strategies

The Building Adaptive Design Strategies of the building are flexible according to different functional requirements and original building conditions. This project adopts three architectural adaptation design strategies. The first one, for the residential function, the layout of the original building is satisfied, and only the bathroom needs to be added, so two design strategies of addition and renovation are adopted. The second one is for resort functions such as the lobby and restaurant. The original

building lacks this function, so it needs to change the floor plan and adopt the design strategy of renovation. The third type, for resort functions such as swimming pools and landscape reflection pools, adopts the design strategy of addition.

5. Building Adaptive Design

1) Floor Plan Design

The original building was mainly used for residential functions and lacked the necessary resort facilities. Therefore, the original building was renovated when arranging the functional layout, and resort functions were placed. The lobby, lobby bar, elevator hall, full-time restaurant, and small stores are on the first floor. Water features were installed in the inner and outer courtyards of the building to enhance the landscape quality. A parking lot is set up near the entrance of the building. The second and third floors are mainly used to arrange various types of guest rooms to meet the needs of different users. The fourth floor is primarily set up with leisure function areas, including a swimming pool, gym, billiard room, table tennis room, and bar (Figure 92, Figure 93, Figure 94).

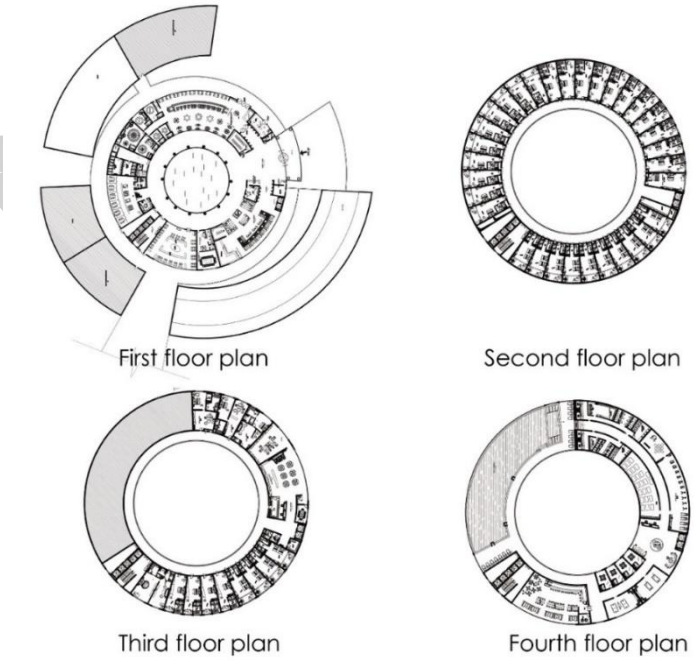

Figure 92. Floor Plans of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

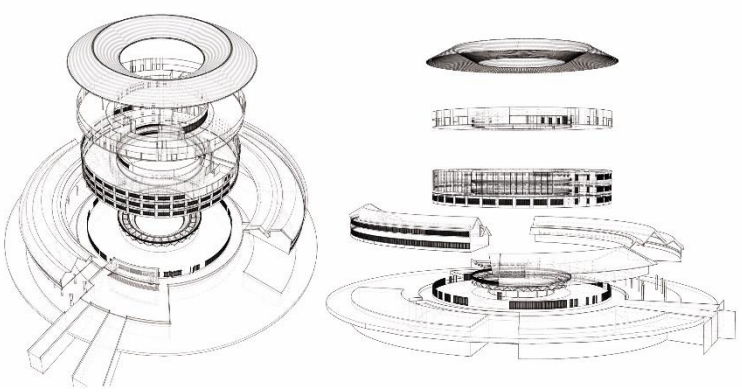

Figure 93. Axonometric Drawings of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Figure 94. Cross-sectional View of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

2) Building Exterior and Landscape Design

The exterior of the original building was well preserved, so the original appearance was retained in the adaptive reuse process, with only the windows enlarged for functional needs. Due to the cluttered style of the buildings added around the base, it was decided to demolish some surrounding buildings and replace them with reflecting pools, dotting the perimeter with landscape pine trees and lighting decorations to create a rural and serene atmosphere (Figure 95).

Figure 95. Building Exterior and Landscape Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

3) Interior Design

Lobby design. The lobby adopts a culturally adapted design approach: the entire space retains the size of the original foyer with a pleasant scale, and the façade retains the original rammed earth wall, with a partial addition of wood veneer and embellishment of local bamboo weaved bucket hats to increase the artistic effect. The roof is designed as a sloping roof, with a matrix of chandeliers made of bamboo fish baskets arranged in the center. The lighting adopts a 3000K color temperature to make users feel at home (Figure 96).

Figure 96. Lobby Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Tea Room Design. As tea drinking is an important leisure activity for seniors in eastern Guangdong, the tea room's design is essential. Figure 97 shows that the tea room's design continues the design approach of the lobby, retaining the original

rammed earth walls, sloping roof shape, and old wooden doors, and embellished with local bamboo farming tools, dustpan, rake and bamboo basket, full of life flavor. The tea table and seats are classic neo-Chinese style, and the pine tree bonsai is placed on the tea table to create a spatial mood.

Figure 97. Tea Room Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Restaurant Design. The restaurant is an integral part of the resort facilities. In designing the restaurant for this project, the dining is divided into a lobby dining area and a private dining area by the conventional design, and the design approach continues the culturally adapted design strategy of using local bamboo as the primary material to create a resort atmosphere (Figure 98, Figure 99).

Figure 98. Restaurant Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Figure 99. Restaurant Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Room Design. According to the different needs of the users, the rooms are designed into two categories: rooms and suites. Four types of rooms and suites were designed separately (Figure 100). Since the original building is circular, each room and suite is divided according to the modulus of the original building. Each room is narrower near the inner courtyard side and broader near the outer courtyard side. This original architectural framework increases the design's difficulty and interest. The design changes the positions of the bathroom, bed, sofa, and coffee table to create different spatial temperaments. In the façade design, the most characteristic rammed earth wall of the Tulou is retained, and the frame is supported by part of the wooden structure. The flooring is made of solid wood and partially embellished with carpets. Some of the walls are decorated with bamboo bucket hats with local characteristics. The ceiling retains the structure of the sloping roof, the lighting adopts 3000K color temperature, and the warm tones look warm and comfortable (Figure 101, Figure 102).

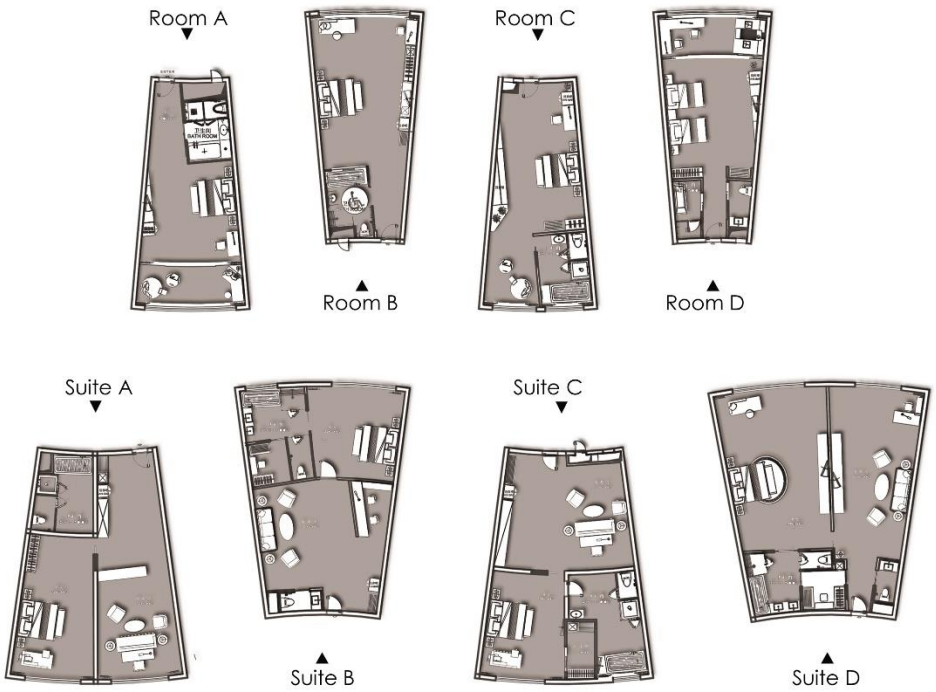

Figure 100. Room Floor Plans of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Figure 101. Twin Room Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

Figure 102. King Room Rendering of Donghualou

Source: Xie, J.M, He, T.S, Zhou, X.L., Guo, W.X. (2022)

5.2 Design Practice in Chiu Chow

5.2.1 Design Research

1. Design Objectives

The design objectives are threefold: the theoretical framework of Building Adaptive Design guides the design work and validates the theoretical framework of Building Adaptive Design. Second, to apply the Building Adaptive Design methodology to guide the design work and to validate the hypothesis of transforming a natural village into a resort-type retirement community. Third, after the design work is completed, summaries and reflections are conducted to support the improvement of the theoretical framework of architectural adaptability and architectural adaptability methods.

2. Design Positioning

City type: Small-sized city; Location: Near suburbs; Scales: Small, about 40 beds; Grade: Medium, Ordinary grade; User: 80% are healthy seniors aged 60-69, 20% are 70-79 who need care.

3. Site Selection and Overview

The design project was chosen in Chiu Chow (Figure 103) mainly for the following reasons: One, Chiu Chow is the birthplace of Chaoshan culture, and Chaoshan culture is one of the three generations of Guangdong culture, so the location in Chiu Chow is representative and has promotion value. Secondly, Chiu Chow is highly aged, with 19.17% of the total population over 60 years old, and the needs is strong. Third, the market is vacant; Chiu Chow is lagging in the construction of retirement communities, and there are no Vacation-Type Retirement Communities yet. Fourth, the researcher works in Chiu Chow, is familiar with Chiu Chow, and has certain resources to facilitate the smooth implementation of the study.

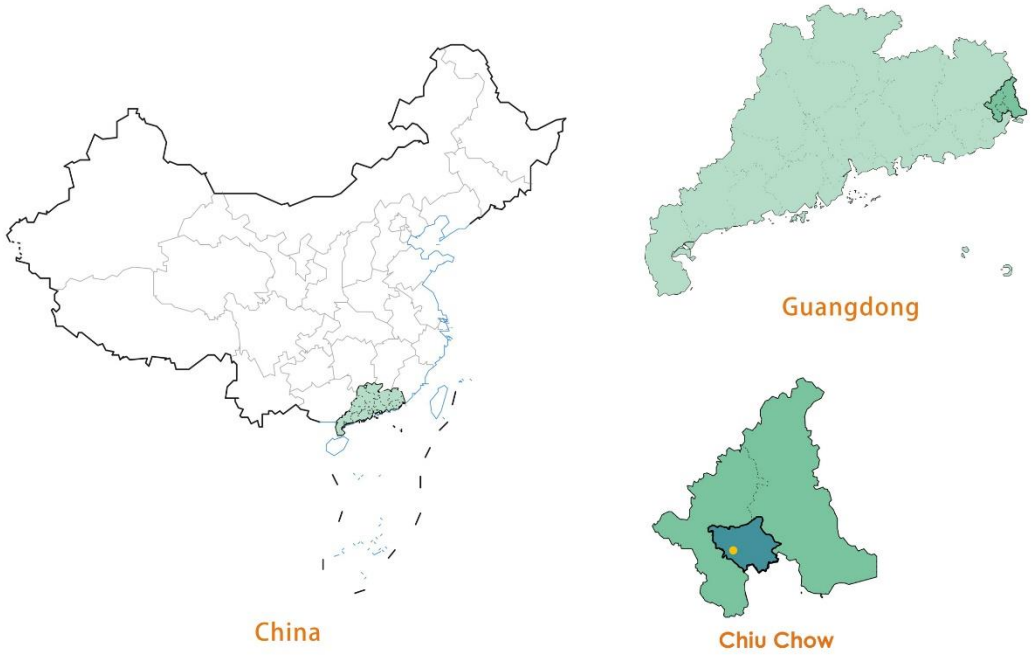

Figure 103. Project Site Selection

Source: Author (2022)

The design positioning allowed us to clarify the general location of the site: the outskirts of Chiu Chow. Our preliminary study found that the critical site selection factors for Vacation-Type Retirement Communities are medical resources, landscape resources, amenities, and accessibility. Chiu Chow has only one quality hospital on the city's outskirts: Central Hospital. Previous studies have shown that Vacation-Type Retirement Communities with senior care should ideally be located no more than 5

kilometers from a hospital to allow valuable emergency time during a health emergency.

Site selection steps: 1) Draw a blue circle with a radius of 3 km, using the central hospital as the origin. A good site selection should be within this blue circle. The 3 km radius was chosen to take into account curved roads. 2) Excellent landscape resources are several parks near the hospital. The residence of seniors is as close to the park as possible, within 20 minutes of walking distance, and studies have shown that the usual walking speed of seniors is 45 meters per minute. Therefore, it is appropriate for the project to be at most 900 meters from the park. Since the road is not straight, 60% of 900 meters was converted to diameter. A green circle with a radius of 540 meters was drawn, with the park as the center. Three villages were found to have potential: A - Sheguangcun, B - Woshicun, and C - Wushicun. 3) Taking into account the amenities (supermarket, food market, bank, etc.) and accessibility (road system, bus stops, parking lots, etc.), Woshicun was considered an ideal site for a Vacation-Type Retirement Community (Figure 104).

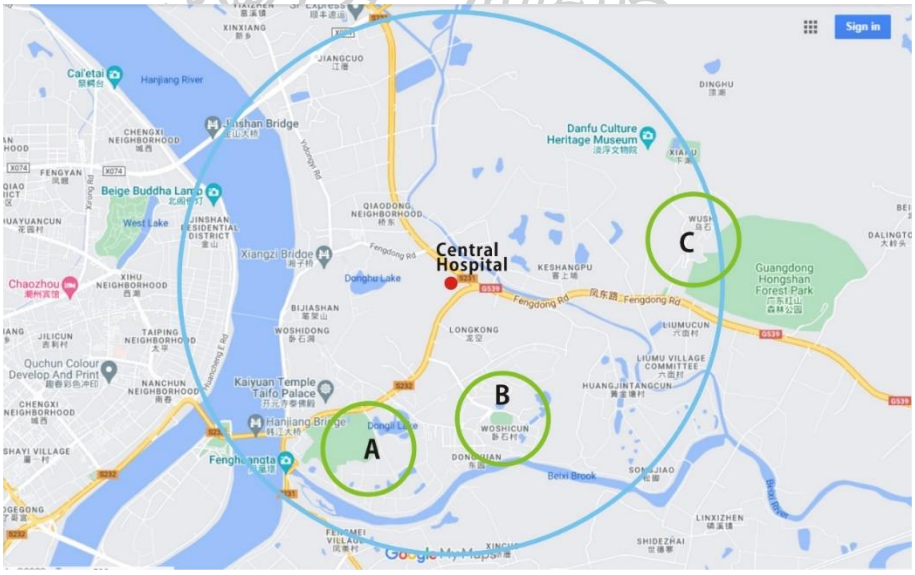

Figure 104. Project Site Selection

Source: Author (2022)

The project location has apparent advantages: only 2,200 meters from the best central hospital in Chiu Chow, with excellent medical facilities. The village of Woshicun has a history of over 700 years and has a rich culture. Houshan Park is adjacent to the

project and has rich landscape resources. The project is surrounded by a largely residential area with supermarkets, vegetable markets, stores, banks, and courier outlets. The project is conveniently located 8600 meters from the city center and 1200 meters from the G539 main road (Figure 105).

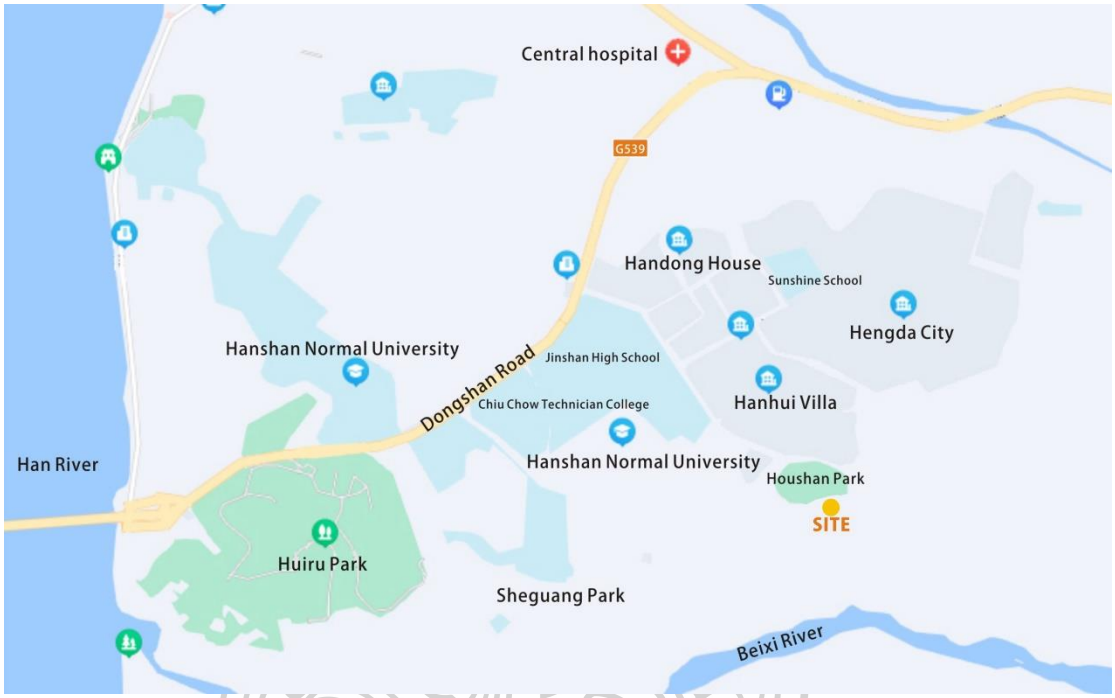

Figure 105. Project Site Selection

Source: Author (2022)

4. User Research

The project's users are divided into two categories according to their importance: the core users, which include the elderly who live in the village, and the elderly who are planning to move to the senior residence. The second category is non-core users, which includes young adults and children from the village; family members who live in the senior housing; service workers who work in the community; and village managers. The research focuses on the core user study.

First, we investigated the basic information of the users. The basic profile contains age, health status, and income. There are 173 older adults aged over 60 years in this village, of which 76 are male, and 97 are female. Figure 106 shows the age profile of older adults in this village. Figure 105 shows us 50.29% of 60-69, 37.57% of

70-79, and 12.14% of 80-100. 60-69 are very healthy, those aged 70-79 need partial assistance, and most elderly aged 80 and above need care in life

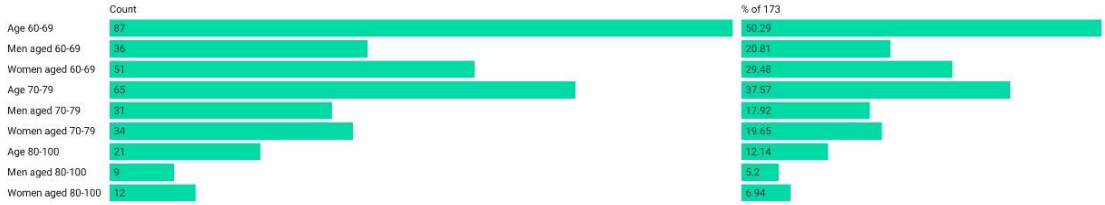

Figure 106. The Age of the Seniors in Woshicun

Source: Author (2023)

Through interviews and observations, it was found that the overall economic income of seniors in this village was not high. Most of seniors in this village were initially engaged in agriculture and handicrafts and did not pay social insurance when they were young. Therefore, the current income is mainly the government-issued pension and children's alimony. The government-issued pension is about 322-400 RMB, and the children's alimony fluctuates wildly, from a few hundred to several thousand RMB per month, depending on the respective children's financial situation. The elderly in Woshicun retains the typical Chiu Chow folk style and are hardworking. Many older adults in their 70s still go to work in the fields and grow their vegetables to meet their own needs and those of their families on the one hand and take the excess to nearby markets to sell and increase their income on the other. Most of the seniors in this village desire to improve their economic situation. Therefore, the later design should consider how to convert the idle resources of seniors (extra homes, extra fields) into income.

The potential clients who purchased the apartments in preparation for moving in were retired teachers from several schools near Woshicun. The interviews revealed that the overall financial ability of these potential customers is significantly higher than that of the local seniors. The retirement salary of these retired teachers is about 5000-8000 RMB per month. This income can be lived comfortably in Chiu Chow.

Second, we studied the User Pain Points. The interviews showed that these two types of older adults' pain points are similar and different (Figure 107). These pain points are the key points to be considered in the design. The most significant pain

point is the lack of time spent with family members. Seniors are happiest when their families come to visit them. On weekends, children often attend training in calligraphy, painting, music, sports, etc. The village lacks the appropriate facilities, and children must train elsewhere. This undoubtedly reduces the amount of time the seniors have to spend with their children. In the subsequent design, the training and play spaces for children must be considered to extend the companionship between the seniors and children. In addition, the shortage of leisure facilities and the lack of aging-friendly design are also critical pain points.

Pain points of elderly in Woshicun	Potential user pain points
Common pain points 1Less time to reunite with family, especially less time to see grandchildren 2 Lack of leisure facilities, lack of social space, monotonous life 3 Lack of aging-friendly design in homes	
1 Low income	1 Fractured social relationships after retirement.

Figure 107. Users' Pain Points

Source: Author (2023)

Again, we studied the spatial needs of local seniors and potential customers. Based on the previous research results, we conducted the study according to five layers of spatial needs (Figure 108). First, we studied users' living space needs. The research found that users are dissatisfied with the uniform senior apartments and senior housing and want personalized decoration and a home-like atmosphere, consistent with many scholars' surveys. In addition, the research on users' pain points also found that users' current living space is unsuitable for seniors and needs to be designed and modified for aging. Second, the medical space needs of the users were studied. A central hospital near the project has complete medical facilities, so the project only needs to be equipped with a small clinic. According to the interview, the users want the clinic equipped with Chinese and Western doctors. The functional configuration of a small clinic is only needed to meet daily medical needs. Third, the needs for leisure space. After interviews and questionnaires, users’ needs for leisure space are divided into four categories: casual dining, arts and culture, sports, and health and wellness. The users' favorite leisure activities are tea drinking. Drinking tea and

chatting become part of their life. Therefore, the subsequent design should focus on the space for drinking tea. In addition, the casual dining room is also a space that users care about a lot. The users' favorite literary activities are reading, painting and calligraphy, handicraft, music, and dance. Users like sports such as walking, swimming, table tennis, billiards, badminton, etc. Users like health and wellness activities such as SPA and foot massage. The spaces for these activities also need to be considered. Fourth, children's space and field space. After research, the children's space mainly contains a training classroom, library, children's play space, and children's sports space. Field space is mainly field, supporting some tool rooms and rest promenade. Fifth, spiritual space. The spiritual space that users think is important contains a Family Ancestral Hall and Buddha Hall.

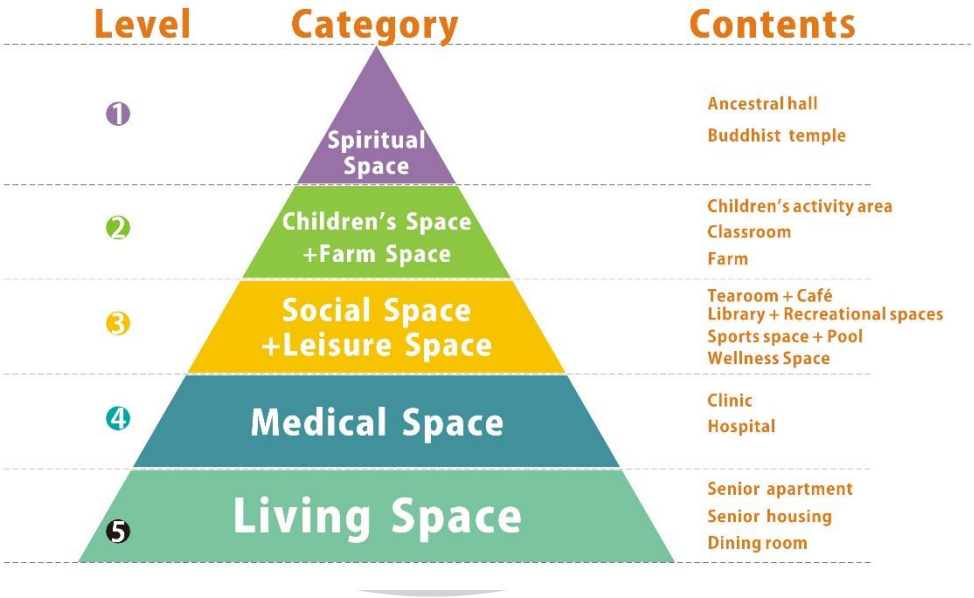

Figure 108. Spatial Level

Source: Author (2023)

Finally, we studied the users' schedules for the day.

Through the interviews, we found that the daily schedule of the older adults in Woshicun and the retired teachers in the nearby schools was very similar: wake up around 6:30 in the morning; have breakfast around 7:30; participate in leisure activities or go to work in the fields in the morning; have lunch around 12:30; take a lunch break from 13:30-14:30; Afternoon participate in leisure activities or go to work in the fields; have dinner around 18:30, participate in leisure activities after dinner and go to bed at

around 22:30(Figure 109). These working hours are also an essential reference for the design.

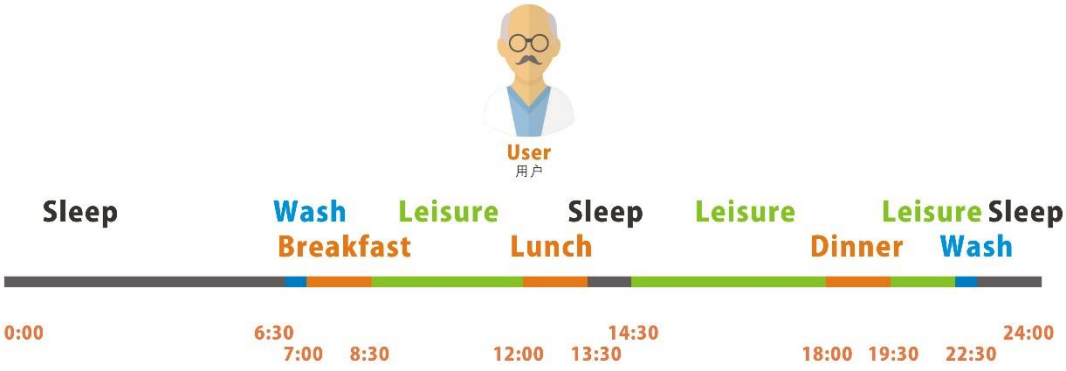

Figure 109. Woshicun Seniors' Schedule for Each Day

Source: Author (2023)

In addition, we also studied non-core users. Non-core users mainly contain the family members of seniors and staff members. Earlier closed retirement communities had a series of adverse effects, and in recent years, many scholars have advocated adopting an open state for retirement communities. The removal of young people caused the hollowing out of the village of Woshicun. Through interviews, it was found that the main reasons for young people moving out were the dilapidated old houses and the lack of necessary public facilities in the village, which caused inconvenient living. These young people usually visit seniors with their children on weekends. The staff is partly serving the resort-type retirement community and partly serving the nearby businesses. Designing public facilities for seniors with the needs of non-core users in mind may increase the time young people spend in the village and activate the community.

5. Other Stakeholder Research

According to the previous study, other stakeholders of Vacation-Type Retirement Communities contain three main categories: operators, investors, and government.

The operator's primary concern is operational efficiency. The rational configuration of the design layout is that each service group manages 10-12 rooms. In

addition, good service areas need to be designed, and the workflow of the service staff needs to be minimized to enhance efficiency.

Investors are most concerned about the return on investment. This project is a small investment of less than 50 million RMB and a required return period of fewer than ten years.

As far as the government is concerned, the competent authority for this project is the Xiangqiao District Government, and the executing authority is the Woshicun Village Council. Although the Xiangqiao District government is willing to support the construction of retirement communities, no specific policies have been introduced yet. And the leaders of the Woshicun Village Council are local people with a strong desire to revitalize Woshicun.

6. Natural Environment Research

Natural environment studies include climate analysis, terrain analysis, landscape resource analysis, and local material studies.

1) Climate Analysis

The project is located at a latitude near the Tropic of Cancer, bordering the South China Sea, with a subtropical oceanic monsoon climate, sunshine, mild climate, sufficient and abundant rainfall. The average annual temperature is 21.4 Celsius; Sunshine is 1986.1 hours, and rainfall is 1685.8 mm; The maximum temperature is 39.6 Celsius, and the minimum is -0.5 Celsius (Tang, K., 2013; Tang, K. et al., 2012). Chiu Chow has long summers and short winters, has no cold in winter, no heat in summer, and is always green all year round. The researchers used Energy Plus and weather spark to analyze the climate of the base. Figure 110 shows the main results of the analysis. From the results, it can be found that in terms of local climate, Chiu Chow buildings mainly address shading and ventilation, which is consistent with the view of scholars such as Lu Qi. Figure 111 shows the wind direction, speed, and optimal orientation: 12° south by west.

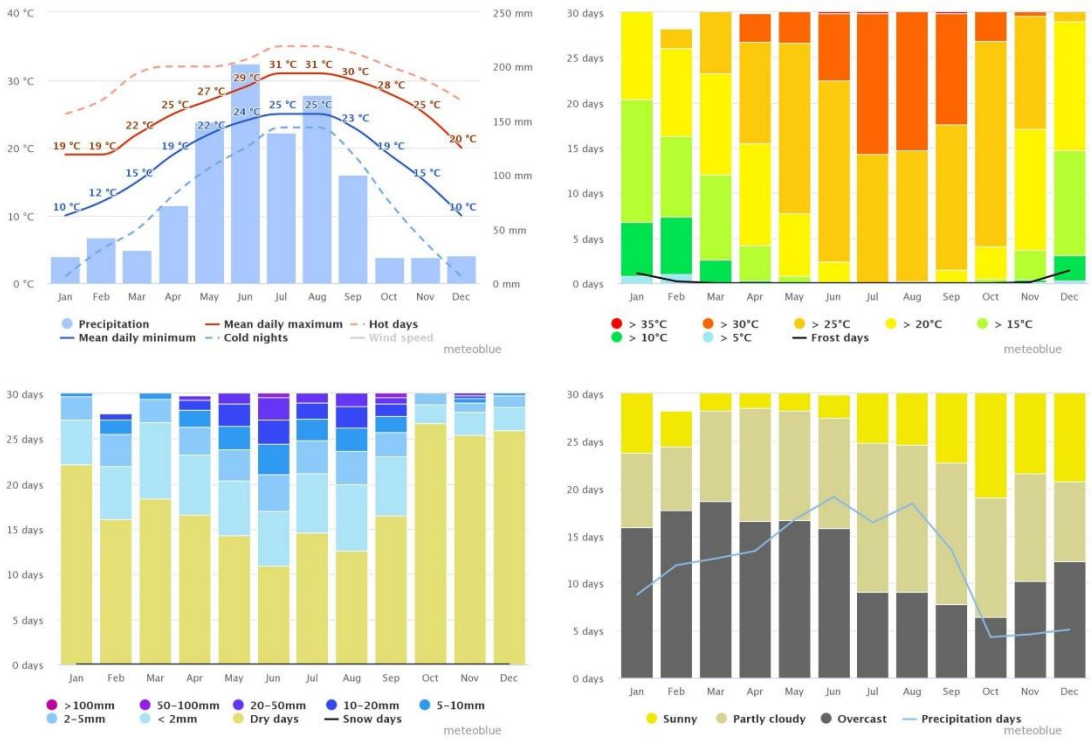

Figure 110. Climate Analysis of Chiu Chow

Source: Author (2023)

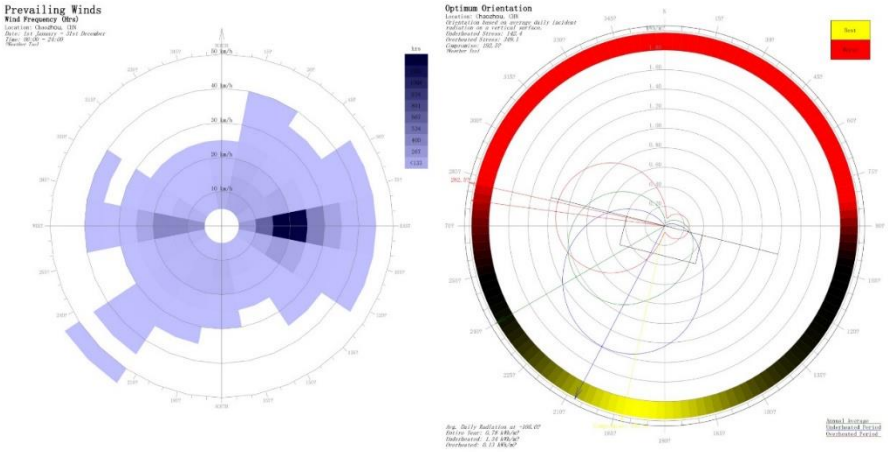

Figure 111. The Wind and the Best Orientation of Buildings in Chiu Chow

Source: Author (2023)

2) Terrain Analysis

The overall topography of Woshicun is flat, with a height difference of 1.5 m between buildings close to the park and other buildings. Houshan Park is a small hill, with the highest point being 34.5 m in height relative to the village. The slope of the hill is relatively uniform and has been calculated to be approximately 25°.

3) Landscape Resources Analysis

Woshicun's natural landscape resources include Houshan Park, field landscapes, Beixi River, and seven ponds. Although Houshan Park has an area of only 31,589 square meters, it is densely wooded, rich in vegetation(Figure 112), and has many animals. In addition, there are relatively good walking paths (Figure 113) and landscaping facilities (Figure 114). The landscape facilities include gazebos, seats, fitness equipment, trash cans, etc., which can meet the daily needs of healthy older adults. The field landscape mainly presents the original farmland texture (Figure 115) and has been maintained in the state of planted agricultural landscape. The pond is mainly used to grow lotus flowers (Figure 116) and breed freshwater fish.

Figure 112. Plant Resources of Houshan Park

Source: Author (2022)

Figure 113. Sidewalks in Houshan Park

Source: Author (2022)

Figure 114. Landscape Facilities in Houshan Park

Source: Author (2022)

Figure 115. Idyllic Texture of Woshicun

Source: Google Earth (2022)

Figure 116. Idyllic Landscape of Woshicun

Source: Author (2022)

4) Local Materials

The primary local building materials in Chiu Chow are Rammed earth, wood, gray bricks, gray tiles, stones, and shell ashes (Figure 117). Rammed earth and gray bricks are used to build the walls; wood is used for the roof's support structure; stones are used for the foundation and floor of the building; gray tiles are used for the roof, and Shell ashes are used to paint the walls. These materials are locally sourced, reflecting the local nature of the building and the regional culture; they also reduce the cost and reflect the economy of the building.

Figure 117. Local Materials of Woshicun

Source: Author (2022)

7. Human Environment Research

The study of the human environment encompasses Chiu Chow's political, historical, and cultural aspects.

Chiu Chow is a prefecture-level city in Guangdong Province, located in the eastern part of the province, in the middle and lower reaches of the Han River, bordering Zhangzhou City in Fujian Province to the east and Jieyang, Shantou, and Meizhou in Guangdong Province to the west, south, and north respectively. Chiu Chow

now has a total area of 3,613.9 square kilometers, including 533 square kilometers of sea area and 136 kilometers of coastline (Zhang, Z. S., 2016). On May 22, 2021, Chiu Chow released its seventh census data: Chiu Chow's resident population was 2568,387, of which 492,311 were aged 60 and above, accounting for 19.17%; compared to in 2010, the proportion of people aged 60 and above increased by 6.84 percentage points, and the degree of population aging deepened (Chiu Chow Bureau of Statistics, 2021b) . Comparing the population data of other cities in Guangdong Province, Chiu Chow is one of the cities with the most severe aging population in Guangdong (Chiu Chow Bureau of Statistics, 2021b). Regarding governance, Chiu Chow does not have a policy specifically for Vacation-Type Retirement Communities.

Chiu Chow is a famous historical city in China with a long history. According to excavated artifacts, Chiu Chow has more than 10,000 years of human life, 8,000 years of cultural history, and 5,000 years of civilization (Wu, R. Q., 1998). For more than 1,600 years since the establishment of the Eastern Jin Dynasty, it has been the seat of counties, states, roads, and provinces, the political, economic, and cultural center of eastern Guangdong; the distribution center of commodities and the origin of overseas trade for Fujian, Jiangxi, and Guangdong in the Han River basin (Wu, R. Q., 1998). Woshicun, where the project is located, has a history of over 700 years and is the residence of the Ding family. The Ding ancestors moved from Putian, Fujian, to Chiu Chow and have continued to this day.

Chiu Chow is the birthplace of the Chaoshan culture, one of Guangdong's three primary cultures. The culture of Chiu Chow is profound and unique. Chiu Chow culture includes dialect, drama, music, customs, tea tasting, architecture, arts and crafts, food, etc. The subsequent design should consider how to combine the local culture and reflect the cultural adaptability of the design.

8. Building and Site Status Research

Woshicun is a typical Chiu Chow village with many Chiu Chow traditional dwellings preserved. Through the satellite map, we found that the core area of the village preserves the complete texture of Chiu Chow's traditional houses (Figure 118). The site is rich in human and natural resources. The village topography is generally flat, with a 1.5-meter height difference at the foot of the park relative to the rest of the

village. The project site is conveniently located 1200 meters from the main road and adjacent to secondary urban roads. However, the village road network lacks layers, and the road interrupts at the park's base, which needs to be optimized in the design.

Figure 118. Site for the Project

Source: Author (2022)

Figure 119 shows the general plan of Woshicun, where the red wireframe area is the scope of the design.

Figure 119. Woshicun Master Plan and Design Scope

Source: Author (2022)

According to the site survey, the existing buildings can be divided into three categories according to damage. The first category is buildings that are destroyed or severely damaged. Most buildings in this category are located near parks, and the main maintenance structures of the roofs or walls are damaged or crippled; these buildings are in danger and may collapse anytime (Figure 120). The second category is slightly damaged buildings. These are buildings where the protective layer of the exterior wall is partially peeling off, exposing the wall structure, and some of the tiles, windows, etc., are defective but can be used after repair (Figure 121). The third category is Good condition buildings. These buildings have been in good condition because they have been used and maintained (Figure 122).

Figure 120. Damaged and Severely Damaged Buildings, Woshicun

Source: Author (2022)

Figure 121. Slightly Damaged Buildings, Woshicun

Source: Author (2022)

Figure 122. Good Condition Buildings, Woshicun

Source: Author (2022)

5.2.2 Building Adaptive Design Strategies

We represent the three categories of buildings on site in a single building status diagram (Figure 123). The first category, destroyed or severely damaged buildings, is gray. The second category, slightly damaged buildings, is represented in light blue. The third category, good condition buildings, is represented in light yellow.

Figure 123. Building Status Map of Woshicun

Source: Author (2023)

Different design strategies are used for buildings with varying levels of damage (Figure 124).

The adaptive design strategy of new construction or reconstruction is used for the first category of damaged or severely damaged buildings. New construction refers

to the construction of new buildings on the original damaged sites, and the new buildings can be different from the original buildings in function and form. For example, a new hotel can be built on the site of a demolished residence. Reconstruction generally refers to restoring the original building where the old building was demolished. The new building has the same function and form as the original building or even requires the same as possible, which can also be expressed as the restoration of the building. Reconstruction is usually directed to important historical monuments. In the case of Vacation-Type Retirement Communities, a new construction strategy is usually used for the first category of destroyed or severely damaged buildings. And the new building is systematically adapted to better respond to the different age and health status changes, incomes, and individual needs of older adults.

Four Building Adaptive Design Strategies are generally used for the second category of slightly damaged buildings: the first is the addition strategy. The addition is adding part of the building equipment or space to the original building. For example, the apartments in early senior communities did not have elevators, and it was inconvenient for seniors to travel, so that elevators could be added by design. Expansion means that the original building's length, width, or height cannot meet the new needs, and the area or volume of the building is expanded to accommodate the needs. The alteration is often the result of a change in the use of the building's function; the original building space can not meet the new needs by changing the layout, size, height, space sequence, and dynamic line of the building to adapt to the new requirements. For example, residential buildings are transformed into restaurants, libraries, etc. Renovation generally means that the overall framework of the old building and the basic building construction are well preserved; however, the building's skin, furniture, and furnishings can’t meet the needs, so through renovation, the building can better adapt to the new needs.

In the third category, buildings in good condition, simply need to be left as they are. The functional configuration of a Vacation-Type Retirement Community is much more complex than that of a typical retirement community. Previous studies have found that if each functional space is designed and built separately, the investment and operating costs can significantly increase, making the investment more risky. In

addition, a functional space is only sometimes used, and there is often a great deal of time in idleness. Therefore, a shared space strategy can be developed to take advantage of the variability and flexibility of the space to transform multifunctional scenes by quickly switching lighting, furniture, and partition walls.

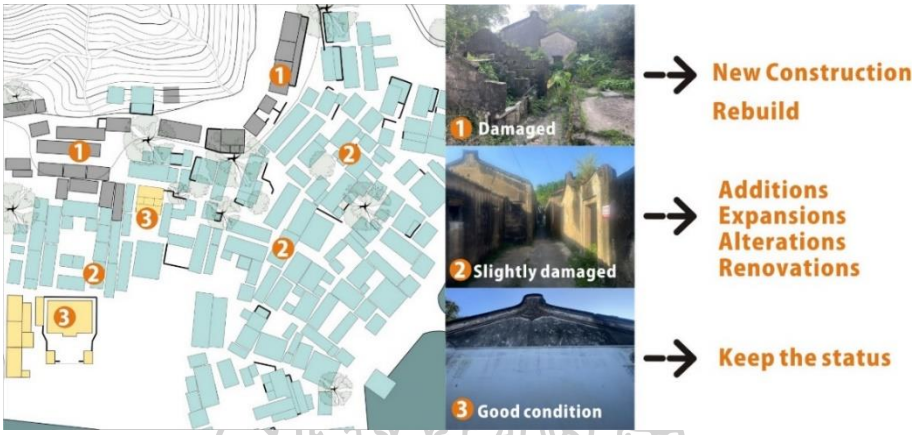

Figure 124 . Building Adaptive Design Strategies

Source: By Author (2023)

5.2.3 Building Adaptive Design

Building Adaptive Design Strategy was used to transform Woshicun's unused buildings and land resources into a Vacation type retirement community.

1. Function Configuration

According to the project positioning and preliminary research, the functional configuration of the project contains five modules: 1) living space (including dining space); 2) medical space; 3) social space and leisure space; 4) children's space and idyllic garden; 5) spiritual space.

The living space is divided into two types. The first one is the senior apartment, which is newly built and has an area of about 3,000 square meters. The second type is a home for seniors, renovated from the original residence. The living space contains the space for seniors to have daily meals.

There are also two types of medical spaces, the first is a clinic, and the second is a hospital. The clinic is in the community and is used for daily treatment and needs to be designed. The hospital is 2200 meters from this project and has already been built, so no design is needed.

The Vacation-Type Retirement Communities design focuses on social and leisure spaces. After a preliminary study, the leisure spaces in this project were divided into four categories: leisure and dining, arts and culture, sports, and health and wellness. The critical point of the design is how to combine and share these spaces according to the time of use, which is also a key initiative to improve space utilization and reduce construction and operation costs.

The children's space is mainly for children visiting seniors, and the number need not be large but attractive. Also, the spaces used by children can be shared with other spaces. The fields highlight the village's transformation into Vacation-Type Retirement Communities. The fields are where the elderly work during the week and become a place for families to experience farming and relaxation on weekends.

The spiritual space is the highest level of space. This project has a 700-year-old ancestral hall, an essential spiritual space for the local elderly. The building attached to the ancestral hall has a Buddhist temple, which can satisfy the new villagers to worship Buddha. As the building is well maintained, no design is needed.

2. Master Plan Design (Figure 125, Figure 126)

A review of the preliminary study revealed that the road network of the site needed to be improved: Lack of main roads, unclear road network hierarchy, and interruption of the Houshan Park carriageway. Considering the accessibility, construction cost, and renovation difficulty, following the contour lines' location through the park's carriageway roads is a feasible solution. Considering the overall construction scale and the safety of seniors, the width of the carriageway around the park was designed as a 4-meter one-way road, with 1.5-meter-wide sidewalks on both sides of the road.

The northwest corner of the design area has a mountain park with rich natural landscape resources and its landscape infrastructure, which can be used as the main space for socializing and relaxing. The newly constructed senior apartment is about 3,000 square meters. With the height restrictions imposed by the old village building policy (no more than 12 meters for the eaves and 15 meters for the roof), the foothills to the south of the park can meet the requirements (Chiu Chow Natural Resources Bureau, 2020). In addition, there is a narrow strip of the site at the foot of the hill to

the southeast of the park, which is suitable for the layout of an infinity pool. The old building between the old apartment and the swimming pool is well preserved and in the middle of the village, suitable to be transformed into a public living space. On the west side of the pool, there is a platform of about 420 square meters with two old trees next to it, which is suitable for a small recreational square. To the west of the plaza is a triangular-shaped open space, ideal for arranging a children's area. To the east and southeast of the bases are ponds and cultivated land, which can be used as a recreational space and field space.

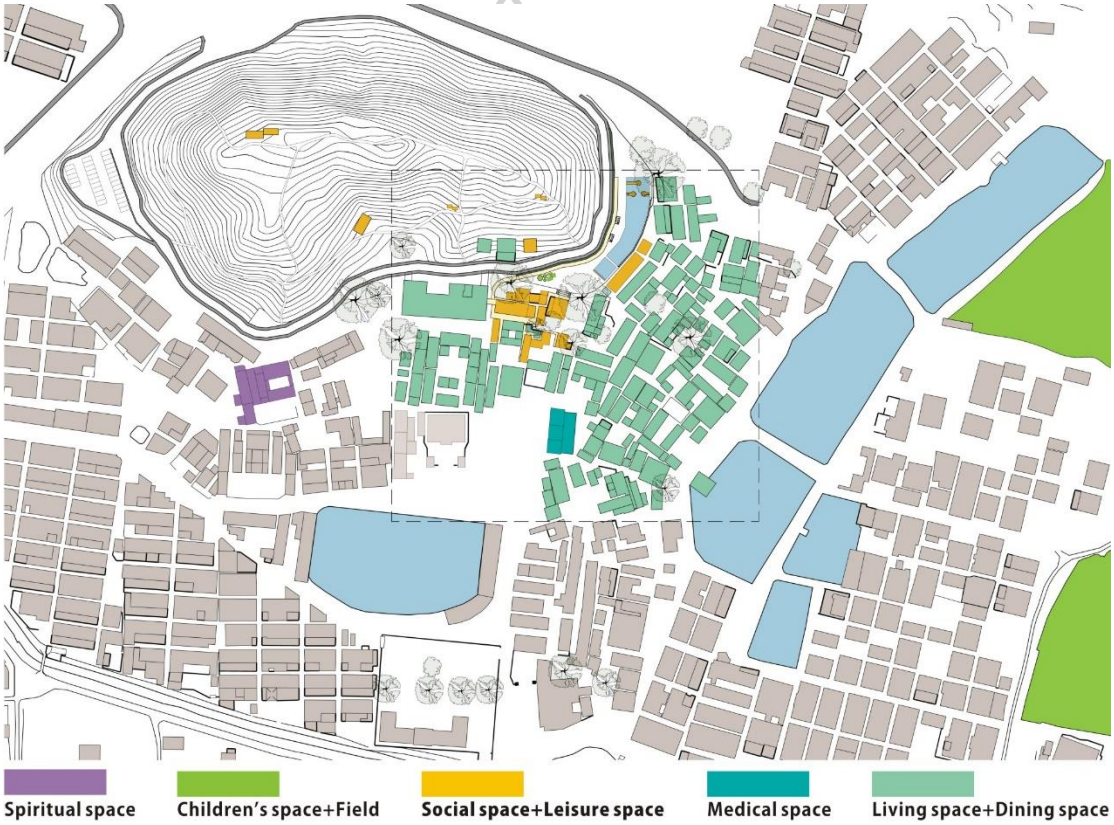

Figure 125. Functional Partition of Woshicun

Source: Author (2023)

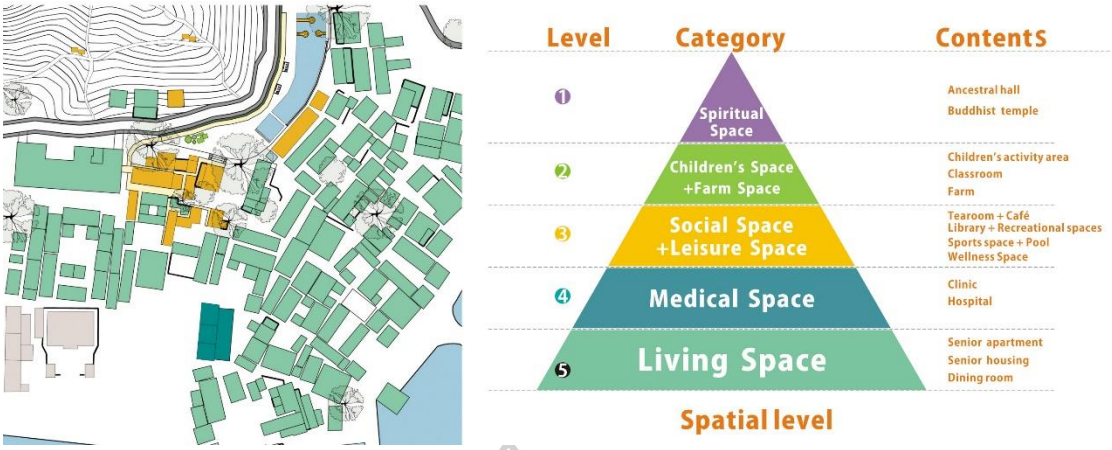

Figure 126. Functional Partition of Woshicun and Spatial Level

Source: Author (2023)

3. Living Space Design

The living space consists of senior housings and senior apartments. Senior housings are adaptive reuse of the old buildings of each family, and the specific design strategies include additions, extensions, and renovations. Senior apartments are a new construction project. Its design analysis mainly includes functional zoning, floor plan design, space generation, and architectural adaptation design. According to the architectural design specifications and research results, the functions of the senior apartments mainly include living, dining, activities, care, and transportation. The height limit of the local policy for new construction stipulates that the eaves of the building at the project site should not exceed 12 meters, and the roof of the building should not exceed 15 meters. Therefore, the senior apartments can only be three stories above ground level.

The functional zoning of the senior apartment is as follows: the ground floor is mainly for parking, service space, and transportation space. Each of the three floors above ground contains living spaces (rooms or suites), common living rooms, service spaces (including nurses' stations, storage rooms, and public restrooms), and transportation spaces (including elevators and elevator lobbies, walkways, and corridors). Figure 127 shows the overall floor plan design.

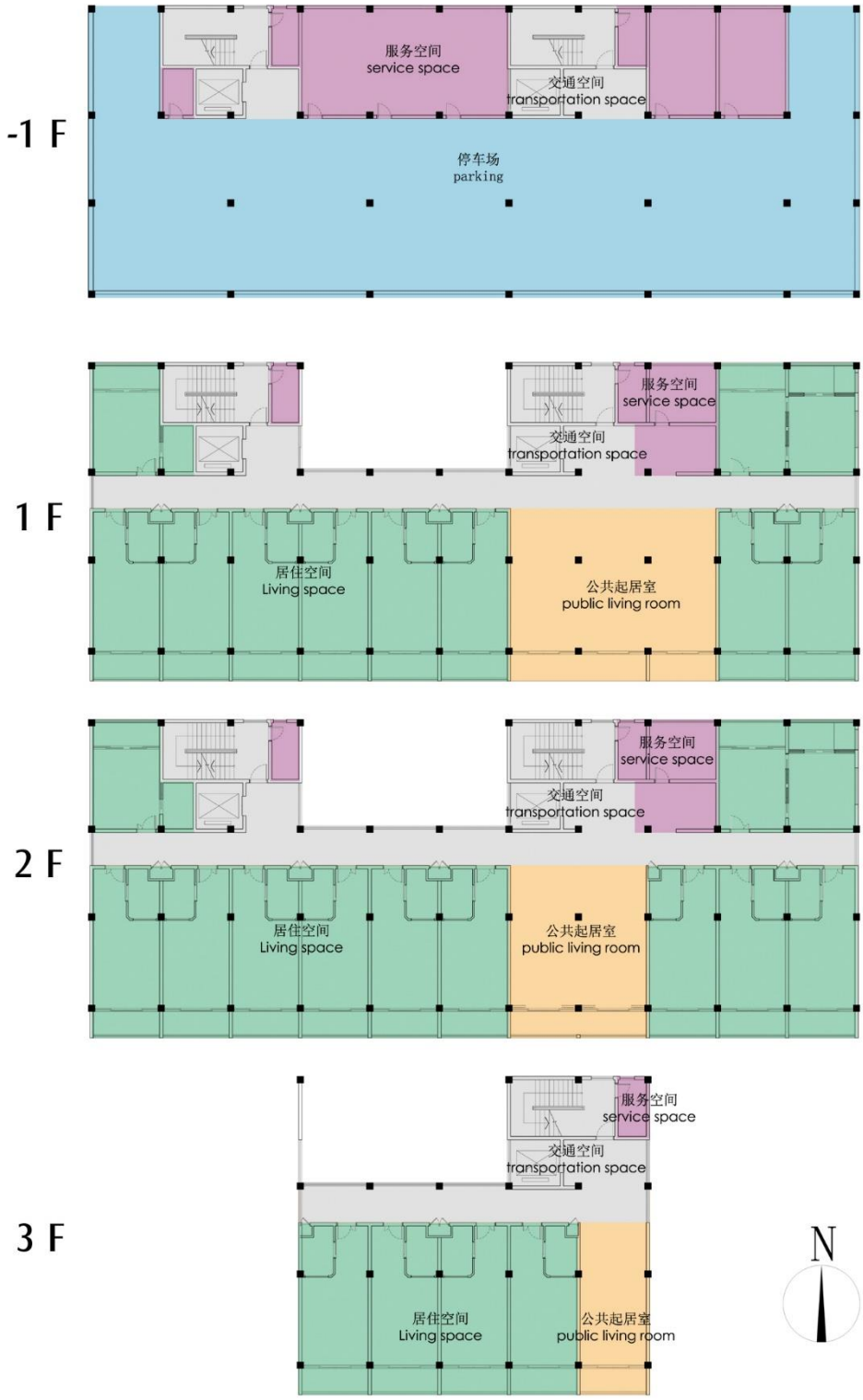

Figure 127. Overall Floor Plan Design of Senior Apartment

Source: Author (2023)

The floor plan design is divided into four stages: 1) floor plan layout selection; 2) determination of basic living unit size; 3) determination of the number and location of standard floor living units; 4) determination of the location of public living rooms, service spaces, and transportation spaces.

First, determine the floor plan selection. In mainland China, due to the strict restrictions of architectural design standards (Ministry of Housing and Urban-Rural Development of China, 2018), four types of selection are usually used for senior apartments: I type; L type; O type; C type (Zhou, Y. M., 2018b). Due to the small size of the project site, only the smaller "I" type can be used, and other types do not fit on the site (Figure 128).

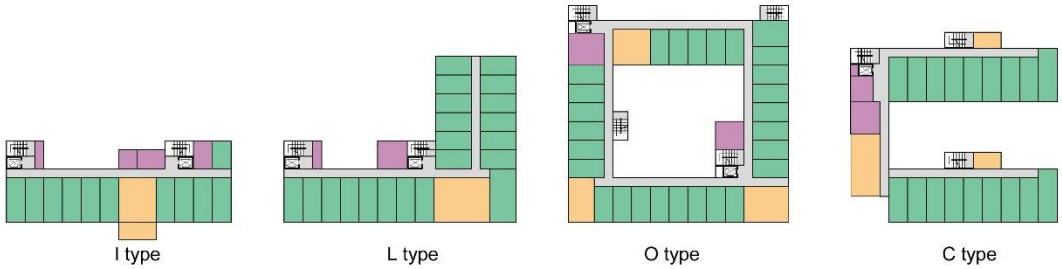

Figure 128. Floor Plan Selection

Source: Author (2023)

Next, the basic dwelling unit dimensions were determined. The positioning of this project is mid-range, and with the requirements of economic adaptability and site constraints, the basic dwelling units were designed in four options A, B, C, and D (Figure 129). Option A has a width of 3500 mm and a depth of 6600 mm; Option B has a width of 5500 mm and a depth of 7600 mm; Option C has a width of 4200 mm and a depth of 7600 mm; and Option D has a width of 4200 mm and a depth of 10000 mm. After expert evaluation, Option D was considered the best design direction with a balance of comfort, economy, and site compatibility.

Figure 129. Basic Living Unit Design of Senior Apartment

Source: Author (2023)

Again, the number and location of dwelling units per floor were determined. Considering the balance of service efficiency and quality, each independent living type cluster is about 10-12 rooms, and each Interventional living unit is 5-6 (Zhou, Y. M., 2018a). The building design code stipulates that the daylight hours of the dwelling units should not be less than 2 hours on the winter solstice; therefore, the dwelling units are mainly arranged in the area near the south direction. In addition, the easternmost unit of the building can also meet the sunlight requirements, so the dwelling unit was also designed. The second room to the east cannot meet the daylight conditions and cannot be used as a separate living unit, and is used as a lounge for nursing staff.

Finally, determine the location of the public living room, service space, and transportation space. The public living room is where older adults live every day, and the usual functions include dining, chatting, drinking tea, socializing, and so on. Therefore, it needs good sunlight, light, and ventilation. Therefore, it is best to be arranged it in the south. In addition, this location often gathers many older adults and needs to be close to a nursing station to facilitate care. The service space contains a nurse's station, a storage room, and a public restroom. Considering the efficiency of the service, it is reasonable to arrange the service space in the middle part of the floor. The service space is generally arranged in an area with insufficient daylight in the north.

Traffic space include elevators, elevator lobbies, staircases, walkways, etc. The traffic space is also placed in the north where the sunlight is not good or in the west where the sunlight is severe.

Through the above four steps, the first version of the standard floor plan was created (Figure 130). The expert review gave the following suggestions: 1) The room next to the elevator on the east side for staff does not meet the economic value and is recommended to be changed to a living room suite. 2) The movement lines near the nursing station are too complicated, interfere with each other, and must be re-optimized. 3) A room can be added next to the elevator on the west side to improve economic efficiency. Based on the expert tips, the second version of the standard floor plan was generated (Figure 131).

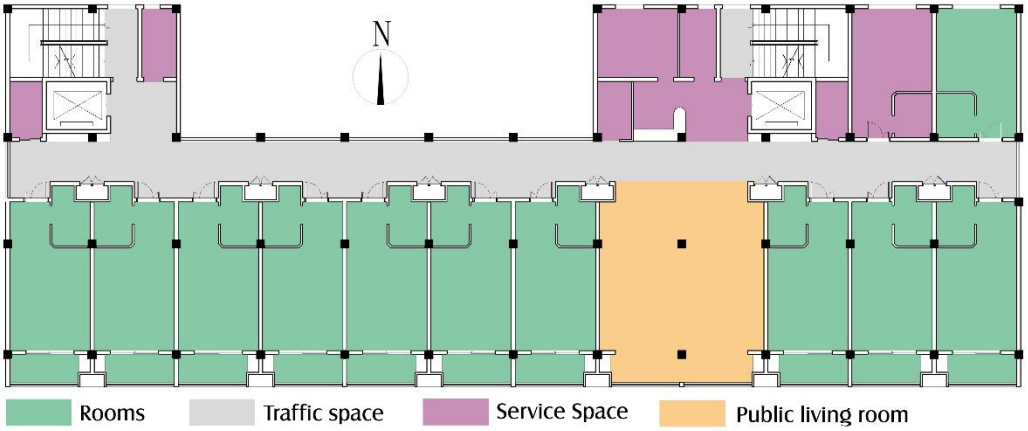

Figure 130. First Version of the Standard Floor Plan

Source: Author (2023)

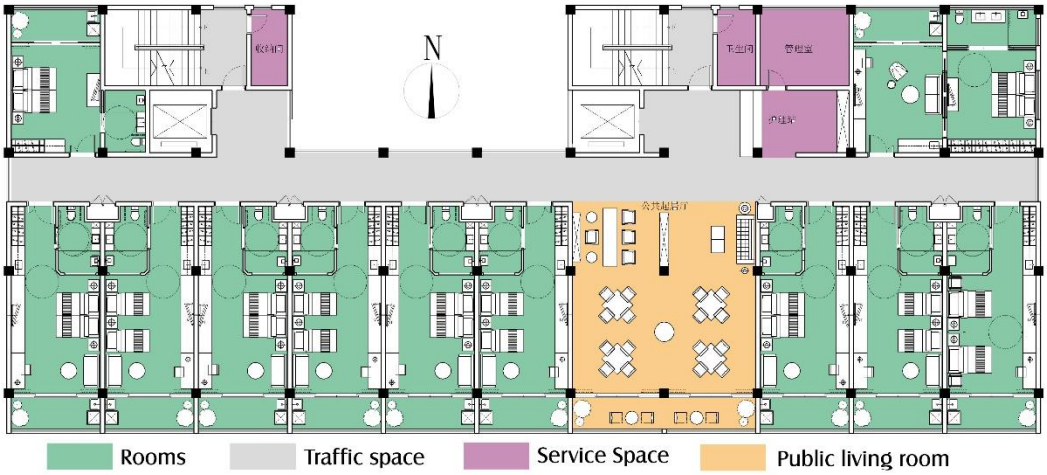

Figure 131. Second Version of the Standard Floor Plan

Source: Author (2023)

1) Space Generation Process (Figure 132)

The project site is small, so an "I" shaped overall layout is the only option; the local policy restricts the height of the building to no more than 12 meters at the eaves and 15 meters at the roof, which determines that the apartment can only be 2-3 stories above ground. 2) The service and traffic space are placed on the north side where the sunlight is insufficient. 3) The balcony is added on the south side for shading, viewing, and drying clothes. 4) The top surface is treated as a sloping roof, echoing the residential houses in the village. 5) The middle of the building is raised to form a hierarchical aesthetic and to increase the number of rooms. 6) More details are added.

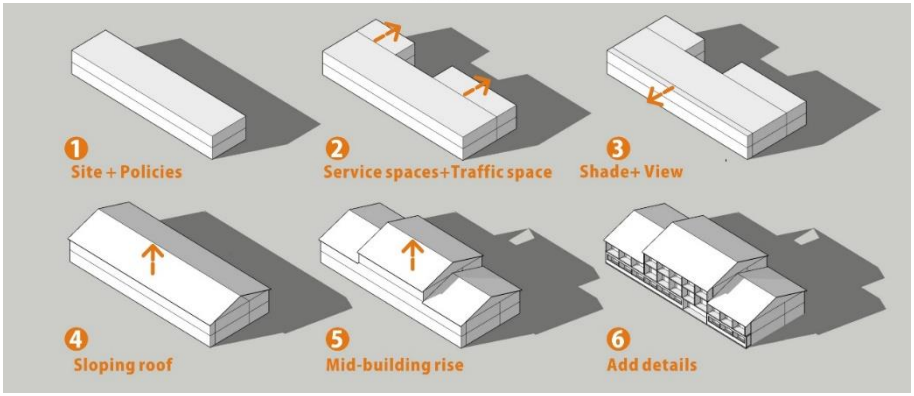

Figure 132. Space Generation Process of Senior Apartment

Source: Author (2023)

2) Building Adaptive Design Method

According to the results of the previous study, the approach of adaptive design of buildings consists of 1) adaptive design of light, 2) adaptive design of furniture and furnishings, 3) adaptive design of skin, 4) adaptive design of house type, 5) adaptive design of structure (Figure 133).

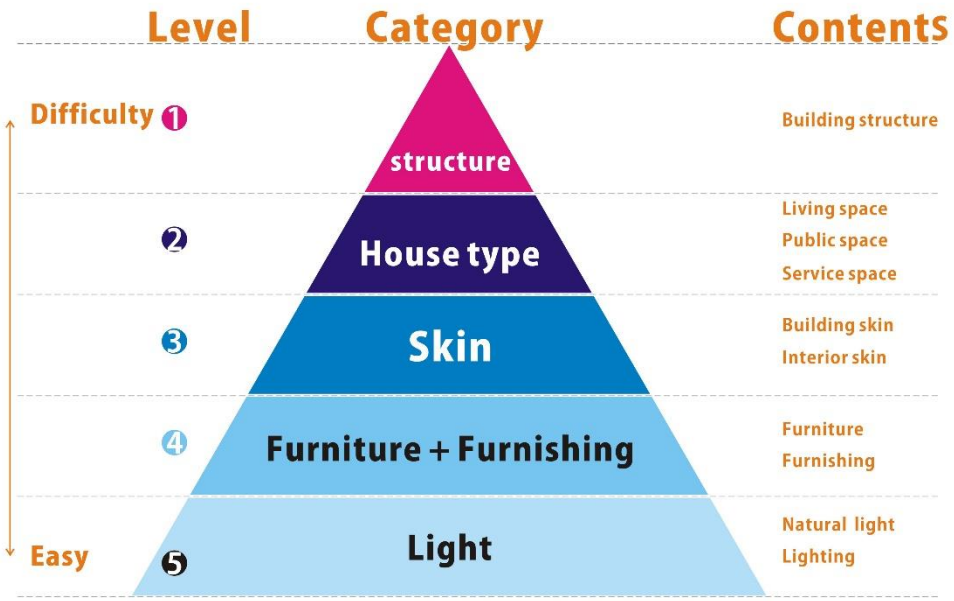

Figure 133. Building Adaptive Design Methods

Source: Author (2023)

3) Adaptive Design of the Structure

The adaptive design of the structure is mainly reflected in two aspects: firstly, the choice of building structure type, and secondly, the change of building structure. Figure 131 shows that the building adopts a frame type of structure. Its support system contains beams and columns; the walls only serve as space separators and are not used as load-bearing. This flexible structure provides convenience for future changes in the house type.

4) Adaptive design of Household Type

According to the preliminary study results, the household type's adaptable design is mainly determined by the financial ability of the user. Three basic house types in this project are in Figure 134: House type A has an area of about 45 square meters and is equipped with a sleeping area, a living area, a storage area, a separate

bathroom, and a balcony facing south. Good ventilation and sunshine conditions. The A house type can meet the needs of most young-old adults living independently and therefore has the most configurations. The B house type has an area of about 36 square meters, with a sleeping area, storage area, independent bathroom, and a balcony facing the park in the north. It has good ventilation and landscape conditions, slightly worse sunshine in winter. But for middle-income seniors who are concerned about value for money, the price is the lowest. House type C has an area of about 58 square meters, with a sleeping area, storage area, separate bathroom, separate living room, and balcony facing the northern park. With good ventilation, landscape conditions, and clear zoning, it suits seniors with good financial status.

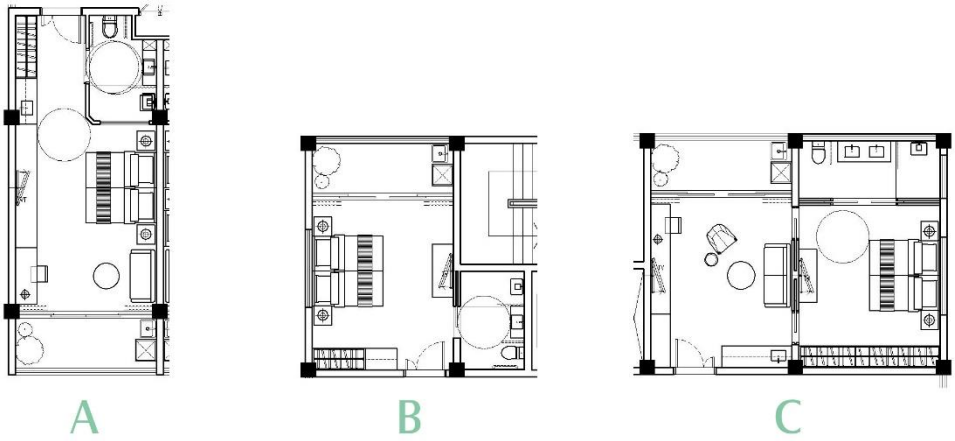

Figure 134. Basic House Type of Senior Apartment

Source: Author (2023)

5) Adaptive Design of the Skin

The adaptive design of the skin includes the exterior and interior skin of the building.

The exterior skin of the building includes the roof, exterior walls, and windows. The roof is made of black solar photovoltaic tiles, the form and color of which are close to the roofs of village houses. Solar photovoltaic tiles can well convert abundant solar energy into electricity. The exterior wall is made of Shell ashes, local building material in Chiu Chow, and stone, in line with the surrounding houses. At the same time, Shell ashes are white, which can reflect the radiation of sunlight well and

contribute to the energy saving of the building. The design of these building skins reflects the material and climatic adaptation of the design (Figure 135).

In the past, designers and investors determined the interior skin design of senior apartments. Investors should be more concerned with compressing the economic value of the design and build cycle. As a result, almost all interior skins are uniform and lack personality and a family atmosphere, resulting in low user satisfaction. In this design, the interior skins were designed using research, fully consulting the elderly and combining expert opinions, aiming to add the necessary personalization factors, enhance the family atmosphere, and ultimately improve user satisfaction. The skin designs for public areas and residential areas are different. Most of the walls in the public areas are covered with local shell ashes, with other art deco materials used as accents in localized locations. In the living area, the room floor is covered with light-colored wood flooring, which is bright and comfortable, catering to the local habit of being barefoot at home. In the bathroom, care was taken to choose non-slip tiles for the floor. The walls are decorated with simple faux fabric panels to avoid hospital-style pallor and indifference and to add home-like warmth. Moreover, the wall behind the bed can be adjusted to reflect individuality according to the user's needs (Figure 136). The ceiling is made with white latex paint for a simple and bright effect. These interior skins' design reflects the design's material and cultural adaptation.

Figure 135. Skin Adaptive Design of Senior Apartment

Source: Author (2023)

Figure 136. Skin Adaptive Design of Senior Apartment

Source: Author (2023)

6) Adaptive Design of Furniture and Furnishings

The results of previous studies have shown that the adaptation of spatial functions can be easily achieved by moving, combining, or Changing furniture. For example, in a room for seniors, the needs of seniors of different ages and different states of health can be met by changing the combined or separated state of the bed or by turning a standard bed into a nursing bed. Figure 137 shows two single beds combined in a queen-size bed, adapted for an elderly couple aged 60-65 in good health. Figure 138 shows two beds for healthy seniors aged 65-70 who need mutual assistance. Separating the two beds is intended to reduce interference between seniors. Figure 139 shows two nursing beds for the elderly aged 70-80 who need nursing care. Changing the furniture also allows the communal living space to be adapted from an everyday state to a party mode, movie mode, etc. (Figure 140). The adaptable design of the furnishings is reflected in the fact that users are encouraged to decorate the room with their unique furnishings, reflecting individuality and a family atmosphere.

Figure 137. Furniture Adaptive Design 1 of Senior Apartment
(For Healthy Elderly Couples)
Source: Author (2023)

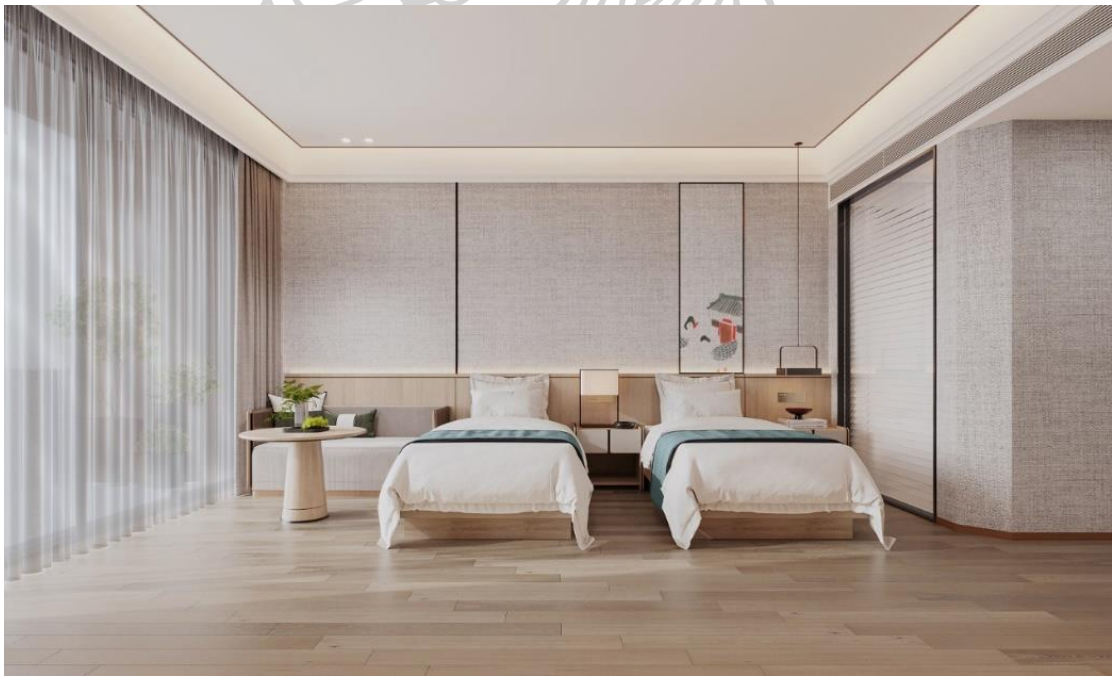

Figure 138. Furniture Adaptive Design 2 of Senior Apartment
(For Sub-healthy Elderly Couples)
Source: Author (2023)

Figure 139. Furniture Adaptive Design 3 of Senior Apartment

(For Nursing Care Elderly)

Source: Author (2023)

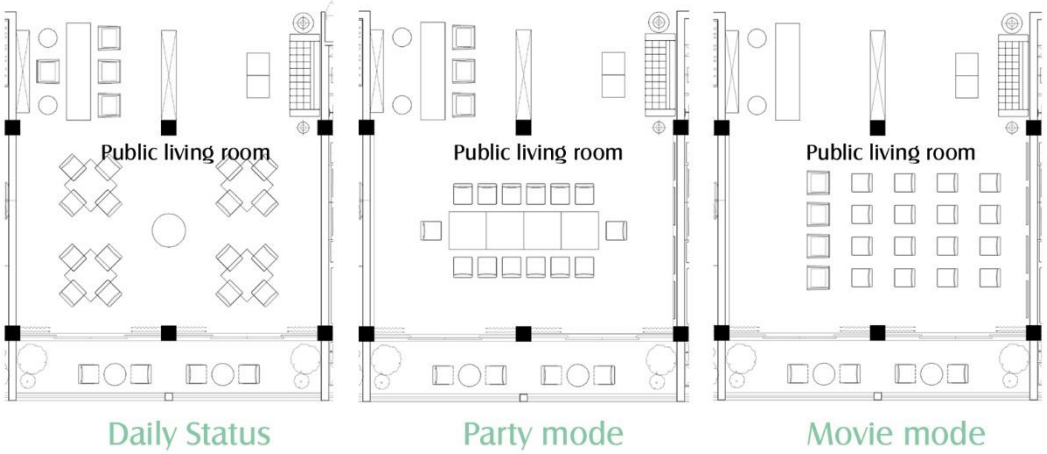

Figure 140. Furniture Adaptive Design 4 of Senior Apartment

(For Public Living Room)

Source: Author (2023)

7). Adaptive Design of Light

The results of previous studies show that the change of space function and space atmosphere can be quickly achieved through the control and change of light. Light includes natural lighting or artificial lighting. Natural light is an essential factor in

architectural design, and ensuring good lighting and daylight is a crucial design index for senior apartments. The project is located near the Tropic of Cancer, with sufficient sunlight. Shading is the primary issue of natural light control. The sunlight is controlled by designing the eaves that are picked out and increasing the balcony: in winter, the solar elevation angle (solar elevation angle) is low, about 43° at noon on the winter solstice, and the sunlight can reach more than 2 meters in the bedroom, making the interior full of sunlight in winter. In summer, the solar elevation angle (solar elevation angle) is high, close to 90°, and blocked by the eaves, so the interior does not shine with sunlight, and the light is soft (Figure 141). In addition, conventional curtains and gauze are used to control natural light (Figure 142).

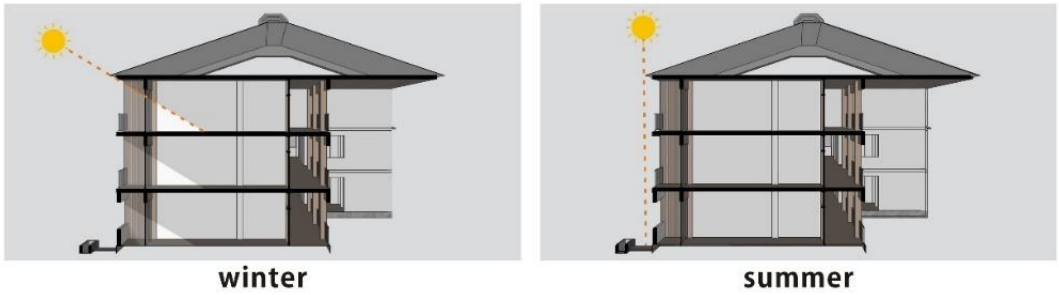

Figure 141. Light Adaptive Design 1 of Senior Apartment

Source: Author (2023)

Figure 142. Light Adaptive Design 2 of Senior Apartment (Natural Light)

Source: Author (2023)

The adaptive lighting design in senior apartments is mainly reflected in the rooms and shared living spaces. The lighting design in the rooms is primarily functional. The leading lights in the rooms are ceiling lights, and the auxiliary fixtures are spotlights, hidden strips, and other partial lighting.

Figure 143 shows the state of daily activities: The main and auxiliary lights are on. Because of the declining vision of seniors, high illumination levels are used in the space to ensure safety. In addition, the overall color temperature is 4000K, which is close to natural white light, bright and comfortable. Figure 144 shows the bedtime mode: the leading light is off, the auxiliary light is on, and the illumination value is reduced. The overall color temperature is 3000K, maintaining a warm and peaceful atmosphere. Figure 145 shows the "night mode": Only the night light from the bedside to the bathroom is turned on, and the brightness is about 5%. It avoids the discomfort caused by the intense light when seniors suddenly turn on the leading light.

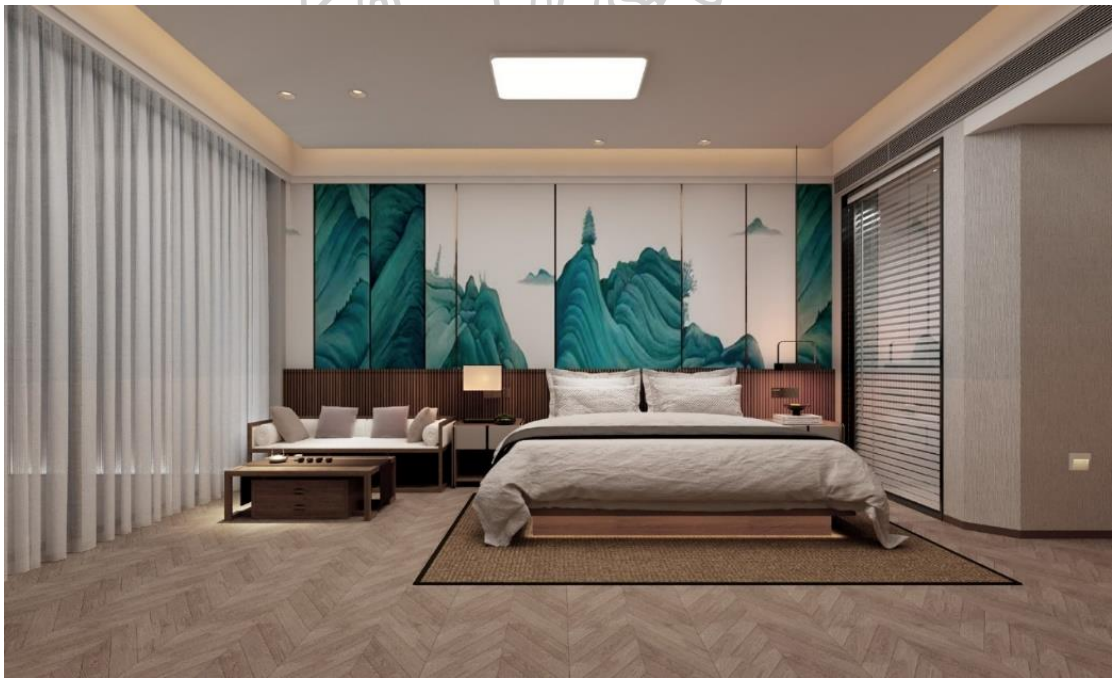

Figure 143. Light Adaptive Design 3 of Senior Apartment (All Lights on)

Source: Author (2023)

Figure 144. Light Adaptive Design 4 of Senior Apartment (Bedtime Light)

Source: Author (2023)

Figure 145. Light Adaptive Design 5 of Senior Apartment (Night Mode)

Source: Author (2023)

The lighting design of the public living space should first meet practical use and create a unique atmosphere. Figure 146 shows the main fixtures (ceiling line lights, spotlights) and the auxiliary lights (wall washer lights, floor lamps, pendant lights) are on. The color temperature is 3000K, and the atmosphere is relatively warm, suitable for the daily state in winter. Figure 147 shows that the color temperature is 4000K, and the atmosphere is refreshing, suitable for the daily state in summer. Figure 148 shows

that the leading light is turned off, the ceiling line light is adjusted to blue, and the light of the wall washer lamp is dispersed from the bottom up. The overall illumination is reduced, and the local warm pendant lights and hidden light strips create a relaxing and casual atmosphere.

Figure 146. Light Adaptive Design 6 of Senior Apartment (Winter light Mode)

Source: Author (2023)

Figure 147. Light Adaptive Design 7 of Senior Apartment (Summer Light Mode)

Source: Author (2023)

Figure 148. Light Adaptive Design 8 of Senior Apartment (Bar Mode)

Source: Author (2023)

Elderly housing is another kind of living space in this project, mainly for the local elderly, and the object of renovation is the relatively well-preserved old residential houses. The original dwellings are relatively old, and the layout has not adapted to the modern way of life of the elderly so an adaptive design strategy can be used for renovation. Since the layout of the units of local residential houses and the basic needs of the elderly are relatively close, three typical dwellings are selected for renovation, which can serve as a model for future renovation of the villagers.

The first is a typical Chaoshan dwelling with a 4.5-meters broad face and approximately 5-meters deep interior with a sloping roof shape and lacking a bathroom (Figure 149). The renovation's design strategy was to expand to add a separate bathroom (Figure 150). The specific plans for the renovation are as follows: 1) change the building structure and enlarge the windows to increase light and ventilation; 2) re-plan the floor plan; 3) renovate the interior skin and try to take local materials, such as shell ashes; 4) rearrange the lighting, partially using hidden light strips and spotlights to enrich the lighting effect; 5) furniture and furnishings are specified by the users according to their habits. For example, the tea table (Figure 151).

Figure 149. Senior Housing 1 Original State

Source: Author (2023)

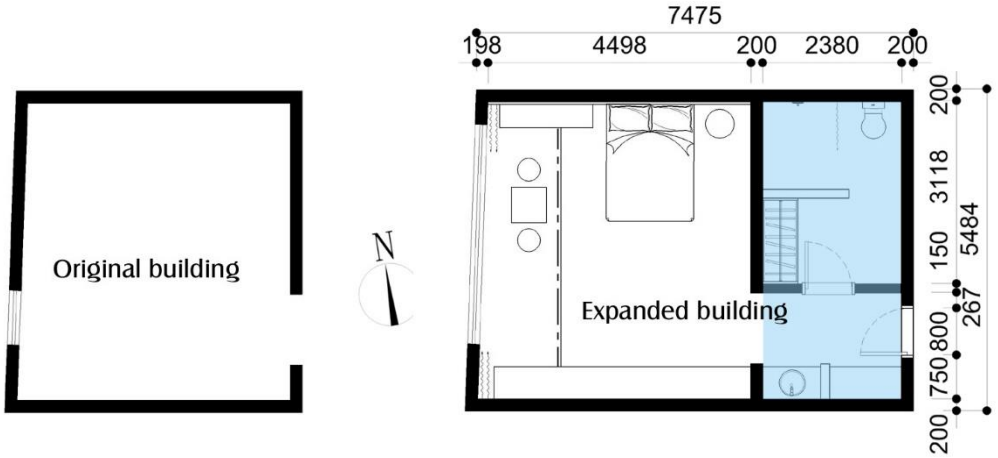

Figure 150. Senior Housing 1 Original and Expanded Floor Plan

Source: Author (2023)

Figure 151. Senior Housing 1 Design

Source: Author (2023)

The second one is also a typical Chaoshan dwelling, with a width of 4.5 meters, a depth of about 5.4 meters, and a lack of a bathroom (Figure 152). The Building Adaptive Design Strategies and Methods are the same as the first (Figure 153, Figure 154).

Figure 152. Senior Housing 2 Original State

Source: Author (2023)

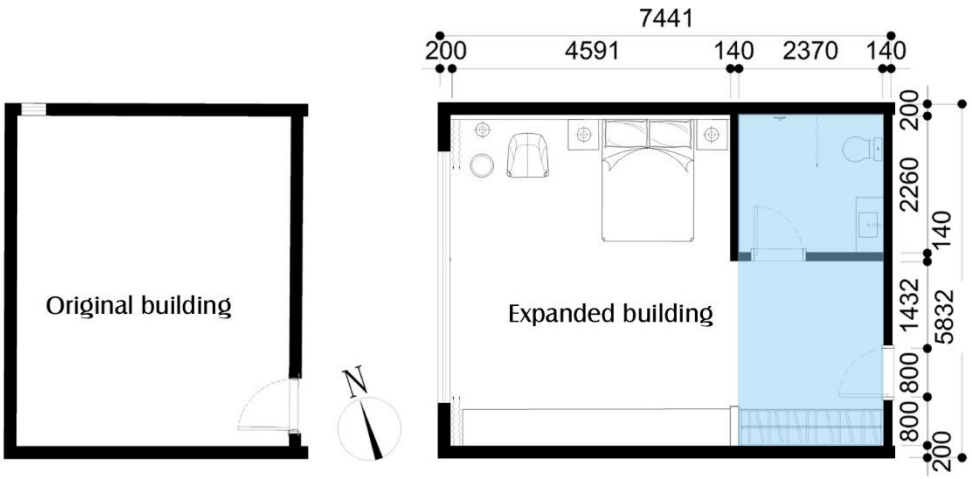

Figure 153. Senior Housing 2 Original and Expanded Floor Plan

Source: Author (2023)

Figure 154. Senior Housing 2 Design

Source: Author (2023)

The third case is a residential house adjacent to a park with a width of 4.6 meters and a depth of about 6 meters, which also lacks a bathroom (Figure 155). The design strategy for the renovation was to extend (Figure 156). This residential house has an excellent landscape location and is a scarce resource, so it is considered the highest-end residence in this project. The specific plans for the renovation are as follows: 1) change the building structure and expand the windows to increase light and ventilation; 2) re-plan the floor plan to add a bathroom and outdoor terrace; 3) renovate the interior skin and use wood finishes, wall coverings, and other materials to make a modern luxury; 4) re-arrange the lighting to accommodate a variety of lighting scenario

patterns; 5) furniture and furnishings are specified by the users according to their habits (Figure 157).

Figure 155. Senior Housing 3 Original State

Source: Author (2023)

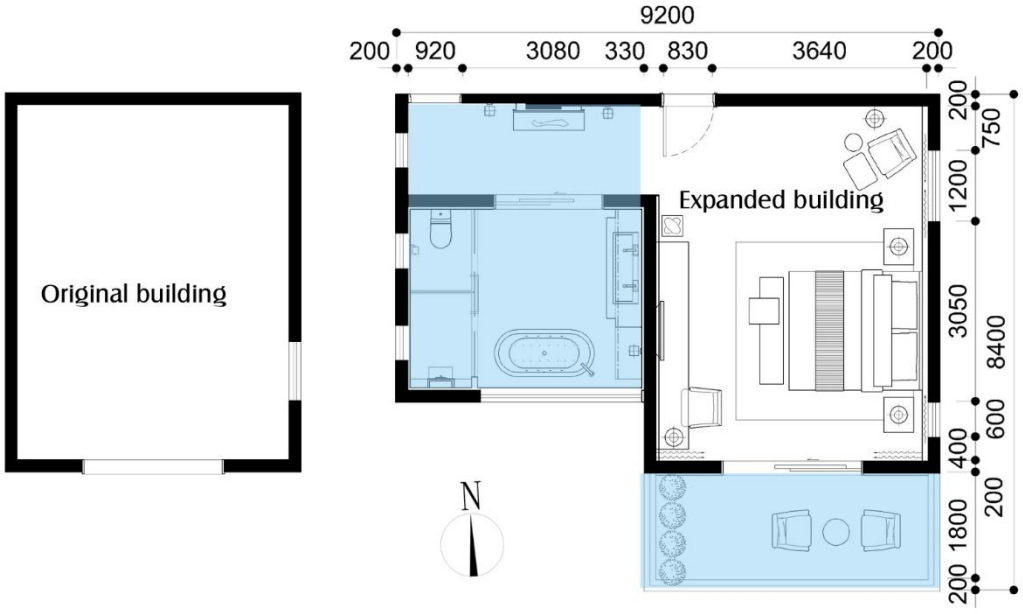

Figure 156. Senior Housing 3 Original and Expanded Floor Plan

Source: Author (2023)

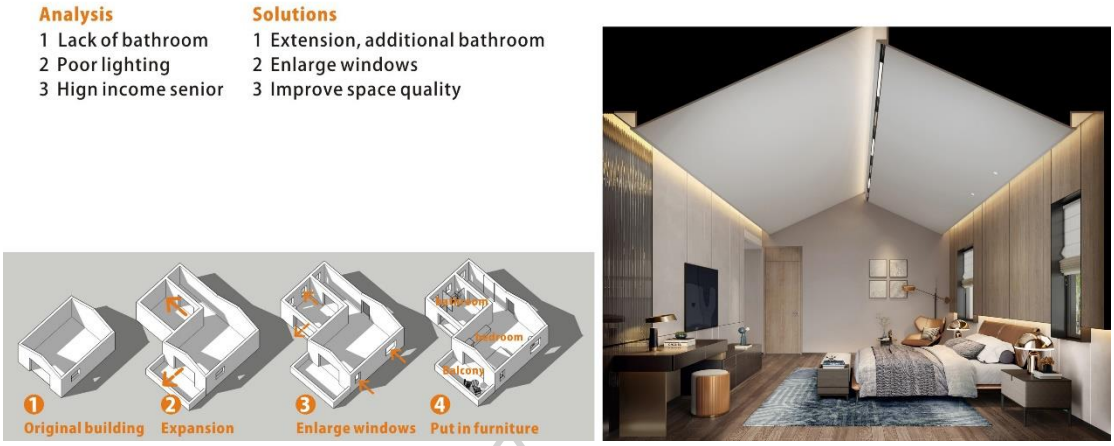

Figure 157. Senior Housing 3 Design

Source: Author (2023)

4. Medical Space Design

The medical space contains clinics and hospitals. The best local central hospital is only 2200 meters from the project, and the village also has a clinic, there are sufficient medical resources. This project only needs to optimize the clinic design.

5. Social + Leisure Spaces

Social and leisure spaces are also the focus of the design for this project. Figure 158 shows the top ten needs for social and leisure activities. Tea tasting and food are the most critical needs, and both will be emphasized in the design of the space. The park's circular walking and hiking paths meet the need for walking. The need for swimming should also be met, and it reflects the attributes of a vacation.

In traditional design, different functional spaces are built to meet different functional needs. However, this will inevitably lead to high costs and low usage efficiency. According to the preliminary research, users have different needs with relative regularity at different periods. Therefore, this project proposes the concept of shared space, which presents different application scenarios in the same space using different times, corresponding to the multiple needs of users. The shared space adopts an adaptive design strategy to create different application scenes by changing lighting, furniture, and skin. In this way, the project will significantly reduce the building cost while meeting users' needs.

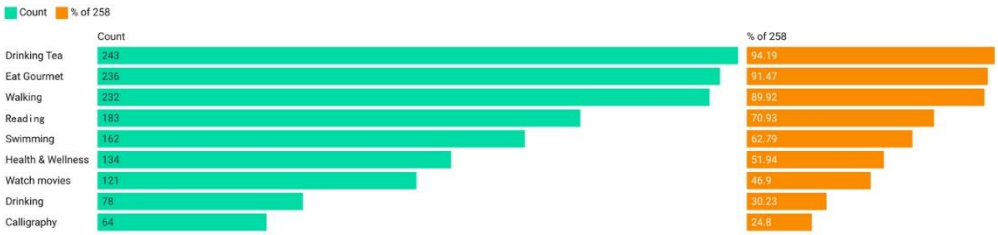

Figure 158. Social and Leisure Top 10 Needs

Source: Author (2023)

When planning the tea-drinking space, three scenarios were developed: a newly built tea room, a tea room converted from an old building, and a tea-tasting area designed in combination with the outdoor landscape.

The newly-built tea room is near the park, with rich landscape resources and lush greenery. In order to maximize the use of the surrounding landscape, large floor-to-ceiling glass windows are used all around. Motorized louvers to adjust the light, sunlight filtered through the louvers and spilled onto the floor and furniture, the light and shadows moving over time. The poetic space, accompanied by the fragrant tea, is a high-class enjoyment (Figure 159).

Figure 159. New Construction of Tea Room

Source: Author (2023)

The teahouse transformed from the old building retains the texture of the original building: the mottled walls, the vicissitudes of the old wooden beam ceiling,

and the rustic concrete floor. These textures are the historical marks of the building and reflect the spirit of the place. The walls are arranged with long vertical windows to improve the light and bamboo curtains to regulate the light. The folding door on the left is patterned with the landscape painting commonly used in local folk houses. The backdrop display case shows local handmade teapots, teacups, and Phoenix Mountain tea, reflecting the culturally adaptive design (Figure 160).

The concept of shared space is realized by changing the scene mode of the tea room through adaptive design: opening or closing the partition wall between the tea rooms allows switching the small tea room (Figure 161) and the large tea room (Figure 160) as needed; changing the lighting and furnishings allows switching the tea room into a painting and calligraphy room (Figure 162) and a private restaurant room (Figure 163).

Figure 160. Merged into a Large Tea Room
Source: Author (2023)

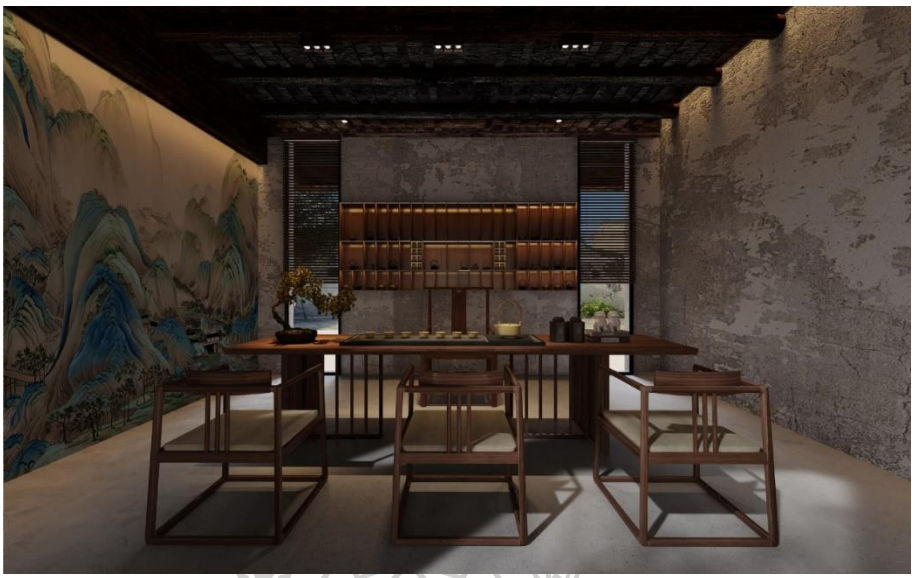

Figure 161. Old Building Converted into Tea Room

Source: Author (2023)

Figure 162. Calligraphy and Painting Room

Source: Author (2023)

Figure 163. Restaurant Private Room

Source: Author (2023)

The outdoor tea-tasting area by the pool is also exciting for drinking tea (Figure 164). It consists of three sets of circular seats arranged in the shape of the Chinese character "Pin," representing tea tasting and quality, signifying a good life. It is also derived from the shape of three tea cups placed by locals when drinking tea. The color matching of golden pillows and green cushions comes from the local loquat and leaves; the golden color symbolizes wealth. One of the circular seats has a ramp entry for the elderly who need an accessible design. Due to the hot local climate, the pool creates an excellent microclimate for the seats, reflecting the adaptive design of the climate.

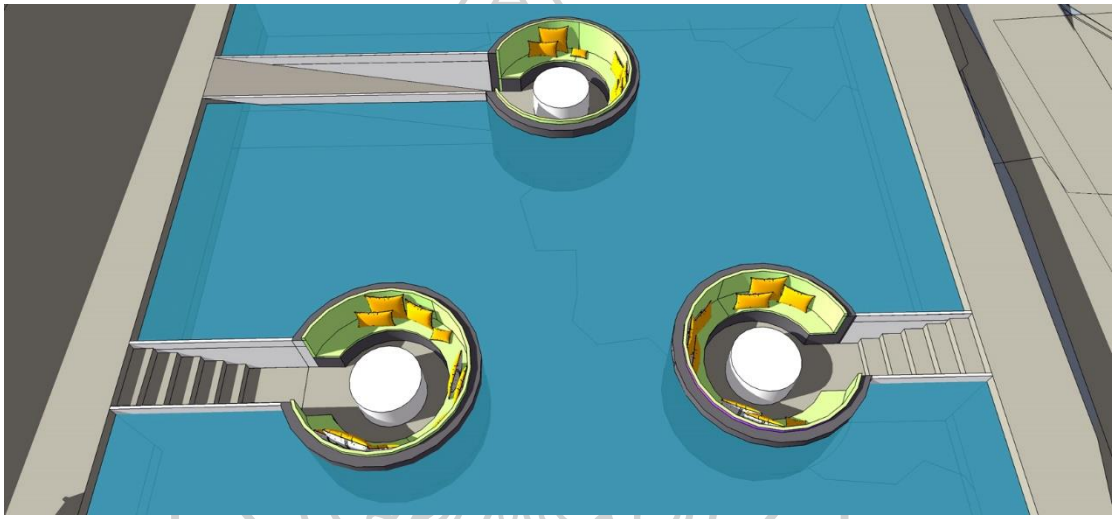

Figure 164. Water Pool Tea Tasting Area

Source: Author (2023)

Another critical social and leisure space is the dining space. We change the lighting, furniture, and furnishings through adaptive design to integrate multiple scene modes such as Restaurant, Book- bar and Bar to achieve space sharing. The researcher has selected nine representative modes to be shown on the floor plan (Figure 165):

1) Restaurant mode, 2) Book bar mode, 3) Bar mode 20:00-24:00, 4) Banquet Mode, 5) Seminar Mode, 6) Movie mode, 7) Conference/Classroom Mode, 8) Ball Mode, 9) Concert Mode. It is worth mentioning that the whole LED screen is installed on the west wall to switch different playback contents according to different scenes.

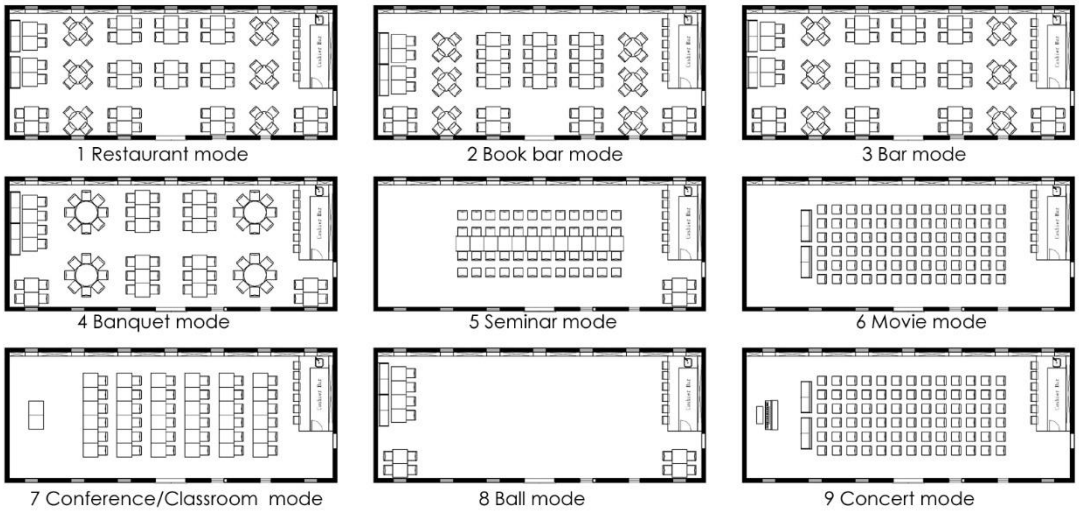

Figure 165. Nine Typical Modes

Source: Author (2023)

The key to spatial integration is to study the schedules of most older adults (Figure 166), analyze their main behaviors at certain times of the day, derive the required spaces based on their behaviors, and finally, integrate these main functional spaces into one space.

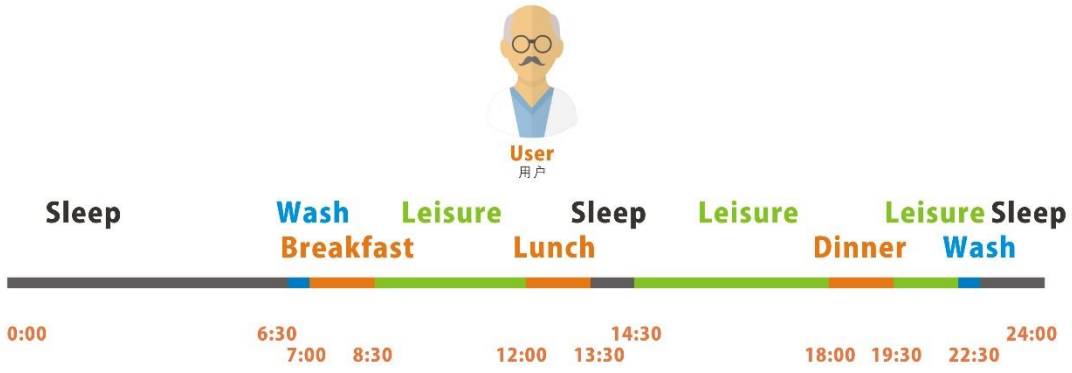

Figure 166. Woshicun Seniors' Schedule for Each Day

Source: Author (2023)

Restaurant mode (Figure 167) has three-time slots, 7:00 - 8:30, 12:00 - 13:30, and 18:00 - 19:30, corresponding to the users' meal times. The interior design continues the design idea of the tea room: The wooden beam structure, walls, and floor of the original building is retained. The floor of the original building is red clay tiles with local characteristics. The wooden frame tables and chairs can be easily

moved, and the chair backs are woven with rattan, which is breathable and suitable for the local climate. Book bar mode has two-time slots, 9:00 - 11:30 and 14:00 - 17:30, corresponding to the users' morning and afternoon leisure time. Restaurant mode is separated from book bar mode by half an hour for cleaning and moving the furniture. Outside of Book bar mode, the wall of books on the right side can be used as furnishings.

Figure 167. Restaurant Mode

Source: Author (2023)

Bar mode (Figure 168) is available from 20:00-24:00, which corresponds to the evening leisure time of the elderly. The bar is quiet to avoid disturbing the seniors' rest. The blue waterfall on the LED screen has a dream-like effect, so meet friends and family, have a few drinks by candlelight and the sound of flowing water.

Figure 168. Bar Mode

Source: Author (2023)

Banquet mode (Figure 169). This mode is usually scheduled during the holiday season. To get a strong festive atmosphere and increase the sense of ceremony, a video of the banquet theme is shown on the screen, ambient star lights are hung from the ceiling, and large round tables are used to reflect the traditional concept of "reunion."

Figure 169. Banquet Mode

Source: Author (2023)

Movie mode (Figure 170). It is usually scheduled on weekends or during festivals. A small cinema is created by removing the dining table, rearranging the chairs according to the movie mode, and keeping the wall and line lights of the bookcase at a low light level. The use of adaptive design to make a space present a variety of functions often requires the conversion of furniture. So the proximity of service spaces (storage rooms) is necessary to facilitate staff operations, reduce labor intensity, and save time and costs (Figure 171).

Figure 170. Movie Mode

Source: Author (2023)

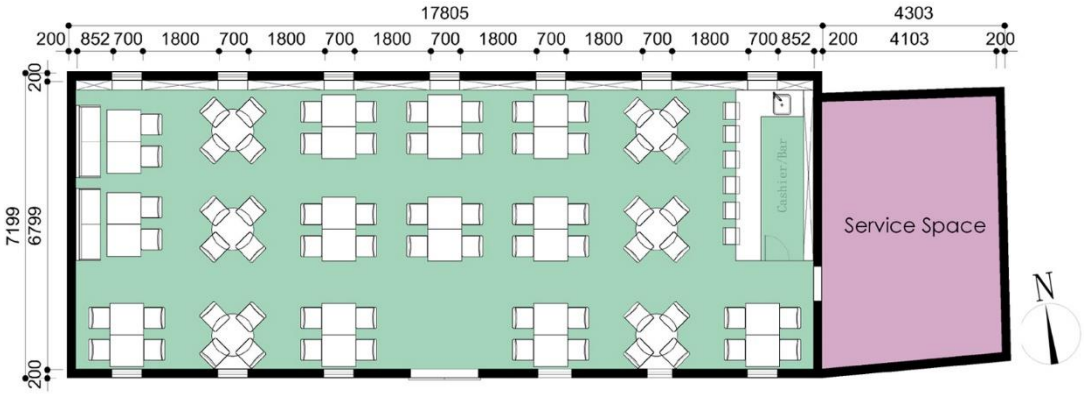

Figure 171. Service Space

Source: Author (2023)

6. Children's Space Design and Field Space Design

The purpose of having children's spaces in Vacation-Type Retirement Communities is to make children more willing to stay in Vacation-Type Retirement Communities and to increase the companionship of children and older adults. Children's spaces include learning spaces and play areas. The learning space is embodied in a book bar model or a book and drawing room. Play spaces are mainly outdoors and integrated with landscape design. The research results show that the needs of children's spaces include a children's pool, slide, sand pool, and small vegetable garden (Figure 172). The slide design extracts the features of local residential architecture, reflecting the adaptability of the human environment (Figure 173, Figure 174). The upper cabin of the slide uses stained glass windows, and the shape and position of the openings are diverse. In the daytime, the sunlight shines into the interior. With the movement of the sunlight, the interior shows a thousand kinds of light and shadow effects; at night, the interior light is cast through the stained glass to the surrounding area, changing infinitely. The children's play facility becomes a landscape art installation as people walk on the walkway. This also reflects the adaptive design approach of light. The sandpit is positioned near the slide and is a classic children's facility in line with adaptive design: versatile, suitable for many ages, and inexpensive.

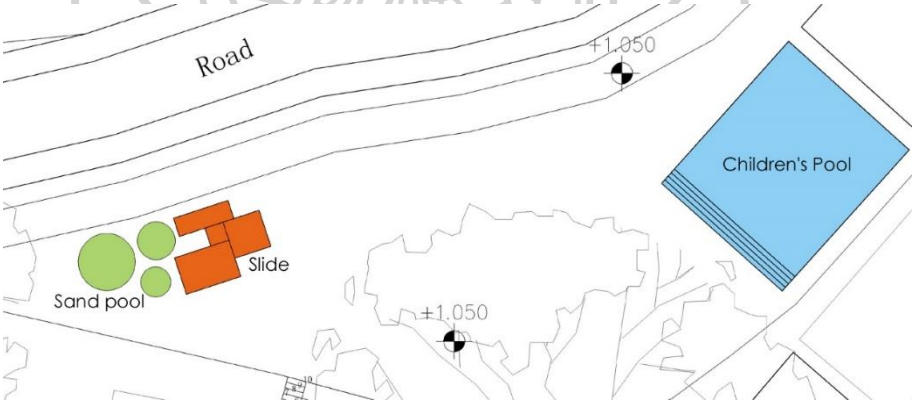

Figure 172. Children's Space

Source: Author (2023)

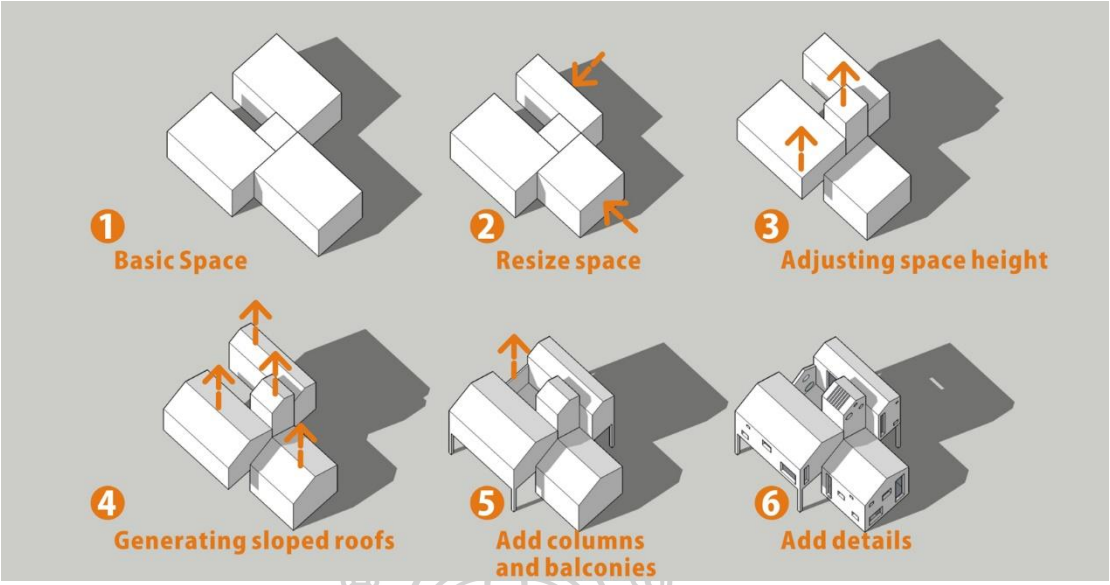

Figure 173. Tiny House Design Generation Process

Source: Author (2023)

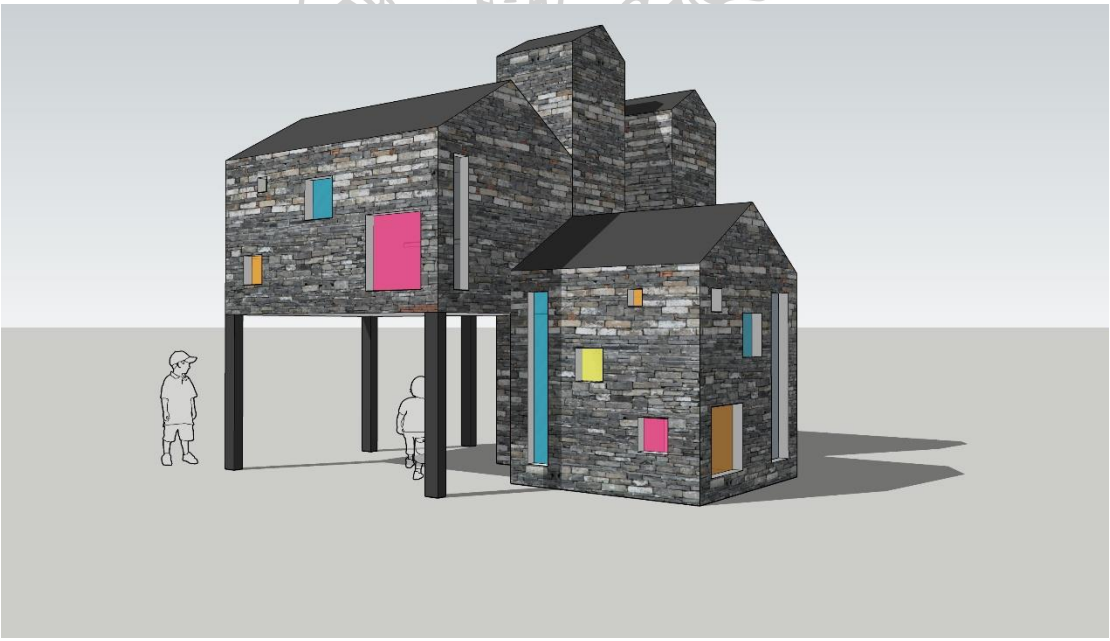

Figure 174. Tiny House Design

Source: Author (2023)

The general idea of the design of the field space is to respect the original state, use adaptive design, adapt to the local conditions, put in recreational facilities, and enhance the quality of the space. The design divides the site into planting and grass recreation areas (Figure 175). The planting area is divided into a small vegetable garden

experience area and a vegetable base. The promenade and tea room are placed around the field, which can be used for resting and sheltering from the rain between work and viewing the garden scenery. Part of the promenade is erected on the pond, facing the water on three sides for fishing or viewing the scenery. The north corner has a bathroom, which is convenient to use nearby. The grass recreation areas are designed for different scenarios according to different needs: camping; gatherings; picking festivals, etc.

Figure 175. Field Space Design

Source: Author (2023)

5.3 Summary

5.3.1 Discussion

1. Expert evaluation

After the completion of the program, a presentation was made online in 2022, and the following feedback was received from experts at Khon Kaen University and Silpakorn University: 1) Vacation retirement communities should meet the needs of the user group, especially the seniors in the area. The researcher must show their lifestyles and incomes and summarize the design best suits their needs. 2) More case studies and a methodology suitable for your project are needed. 3) Design requires and applies design research results, which guide design practice.

Table 7 Shows feedback from experts in the Chiu Chow design practice. Overall, the design achieved the desired results. The results indicate that Natural Villages can be transformed into Vacation-Type Retirement Communities through Building Adaptive Design. In terms of Stakeholders, User-related design scored 4.57; Operator-related design scored 4.29, a high score. Investor-related designs scored 4, which is relatively low, and the importance of Investors needs to be increased in the follow-up study. For Environment, the design related to Natural Environment scored 4.43, and the design related to Human Environment scored 4.14, which is a high overall score. This means that experts recognize the designs related to environmental factors. The overall score of the designs related to Buildings is higher. However, the score related to Good Condition is lower, and experts believe that specific intervention measures should be taken for buildings in Good Condition.

Table 7. Expert Recognition Score of Building Adaptive Design Results

Category	Type	Score
Stakeholders	User	4.57
	Operator	4.29
	Investor	4
	Government	4.14
Environment	Natural Environment	4.43
	Human Environment	4.14
Buildings	Completely Damaged+ Severe Damage	4.57
	Moderate Damage + Slight Damage	4.29
	Good Condition	3.86

Note. The score done on a Likert scale. Very low recognition 1, low recognition 2, moderately recognized 3, high recognition 4, very high recognition 5.

2. Key Findings

The design practice was guided by the theory obtained from the previous research to validate and refine the Vacation-Type Retirement Communities. Table 8 shows the key findings of the design practices. Overall, the design practices verified the feasibility of the theory. It is worth mentioning that the design practices revealed that the adaptive ventilation design in Vacation-Type Retirement Communities is essential, which was neglected in the original theory and needs improvement.

Table 8 . Key Findings from Design Practices

Design Projects	Category	Type
Workshop 1	Key Design Elements	Stakeholder: Users, Government; Natural Environment
	Space Needs	living space, Social Space,Leisure Space
	Design Strategies	New Construction
	Design Methods	Light, Ventilation ,Furniture, House Type
Workshop 2	Key Design Elements	Stakeholder: Users, Government; Natural Environment, Human Environment; Original Building
	Space Needs	Living Space, Social Space, Leisure Space
	Design Strategies	Addition, Renovation, Expansion
	Design Methods	Light, Ventilation ,Furniture, House Type
Design Practice in Chiu Chow	Key Design Elements	Stakeholder: Users, Operators, Investors, Government; Natural Environment, Human Environment; Original Building
	Space Needs	Living Space, Medical Space, Social Space, Leisure Space, Children's Space, Farm Space, Spiritual Space
	Design Strategies	New Construction, Expansion, Alteration, Renovation, Maintenance
	Design Methods	Light, Ventilation ,Furniture, Furnishing, Skin, House Type, Structure

3. Comparison with Previous Research

Several scholars have studied the design of retirement communities. The research mainly focuses on planning and design, architectural design, landscape design, and interior design of retirement communities. Chen, Y. H. and Wu, K. (2008) analyzed the critical factors of planning and designing retirement communities using a project in Nanjing as a case study. Zhou, Y. M. (2018b) conducted systematic research on retirement communities' architectural design, landscape design, and interior design and summarized the design essentials of public areas, guest rooms, logistics areas, and aging-friendly design. It summarizes the design essentials of public areas, guest room areas, logistic areas, and the aging-friendly design of retirement communities. He, J. et al. (2018) used measurement technology to study the spatial accessibility of senior

living facilities in urban communities. Campbell, N. M. (2014) studied the social space of retirement communities, and the study found that the design methods of activating retirement communities focusing on social function areas in the floor plan, using home-based social function areas, adopting home and leisure design styles, and using durable decorative materials. Zhou, J. J. (2018) studied in-depth cases of retirement communities worldwide, summarized the relevant principles and design methods of planning and designing retirement communities, and finally applied them to the design practice activities in Pingxiang. Liao, L. J. (2017) analyzed the typical case of the all-age retirement community, combined with the residential level control system under the concept of all-age, and discussed the specific design points of the retirement community from the three levels of residential unit, residential group, and residential area. Compared with this study, the similarity is that the research object is to study the spatial design of retirement communities; the difference is the perspective: This research starts from Building Adaptive Design, while other scholars' studies start from the traditional spatial design.

There are fewer studies on the design of Vacation-Type Retirement Communities. Yu, B. (2019) conducted detailed research on the elderly and came up with the principles of landscape design, landscape design requirements, and landscape design mode of Vacation-Type Retirement Communities and then, based on the analysis of the previous research, carried out a detailed design of the landscape of the vacation-type retirement communities in Zhangjiakou. Chen, W. Z. (2022) optimized the spatial layout from the optimization of spatial layout, perfected the public space organization form, and combined regional characteristics and culture, constructed the design method of rural residential retirement public space, and carried out the design practice in the retirement of Fushanchang Village in Yichang. Thesis of Chen, W. Z. (2022) supports the hypothesis of this research: Transforming a natural village into a Vacation-Type Retirement Community.

4. Significance

As of June 2023, the researcher has reviewed mainstream literature databases and has yet to find any design case where Buildings Adaptive Design was used as a guide to transform a Natural Village into a Vacation-Type Retirement Community.

Therefore, this design practice has some original creativity. This design case brings inspiration for the future transformation of natural villages into resort-based retirement communities.

5. Limitations

Due to the limitations of the research scope, the design practice is restricted to the Guangdong Province of China, which is somewhat limiting. Therefore, subsequent design practice need to be further expanded to other regions to continue refining the theory of Building Adaptive Design in Vacation-Type Retirement Communities.

5.3.1.2 Conclusions

Based on the design practices and discussion, the following conclusions are drawn.

1. The key design elements of Building Adaptive Design, the hierarchy of spatial needs, the design strategy, and the theory of design method are reasonable and can effectively guide the design practice.

2. Building Adaptive Design can transform Suitable Natural Villages into Vacation-Type Retirement Communities.

3. Due to the diversity of natural villages, Building Adaptive Design needs to be applied flexibly according to local conditions.

Chapter 6 Conclusions, Discussion, and Recommendations

6.1 Conclusions

6.1.1 Innovations in Research

The innovation of this research contains the following aspects:

1. The innovation of perspective

The proposed Building Adaptive Design approach innovatively combines the two major problems of population aging and rural revitalization. Many scholars have studied the problems of population aging or rural revival separately, while few have combined the two. By using Building Adaptive Design to transform Natural Villages into Vacation-Type Retirement Communities, we can not only activate Natural Villages but also solve the problem of insufficient supply of Vacation-Type Retirement Communities (Figure 176).

Figure 176. Hypothesis
Source: Author (2023)

2. Theoretical innovation

We have created a complete theory system for Building Adaptive Design: 1) The basic theory model, 2) the user pace requirement model, 3) the design strategy model, and 4) the design method model. This theoretical system has both fundamental theories and design methods. It has a certain theoretical depth and a vital role in guiding design practice.

3. Methodological innovation

In addition to the conventional qualitative and quantitative research methods, this research also applied some new methods: First, the literature was examined using

bibliometric methods. Using VOSviewer to analyze thousands of related literature, we discovered the research lineage and trends in related fields, came up with relatively objective results and conclusions, and found the Research Gap. Second, in theoretical research, we used interdisciplinary methods. Using the Mutually Exclusive Collectively Exhaustive (MECE) rule and the 80/20 Principle in management, we could ensure the study's comprehensiveness and identify the key factors.

6.1.2 Achievement of Research Objectives

Three research objectives were identified for this research, all of which were achieved.

1. The first research objective: Develop a theoretical framework for Building Adaptive Design for Vacation-Type Retirement Communities.

The first step was to develop the underlying theoretical model. Through literature research, the researcher found that the Human-Machine-Environment theory (Long, S. Z. & Huang, D. S., 2004) matched well with this research. And developed a Stakeholder-Buildings-Environment theoretical model based on the Human-Machine-Environment theory. The Stakeholder-Buildings-Environment theoretical model was presented and revised to mentors and experts in multiple rounds and finally took shape (Figure 177).

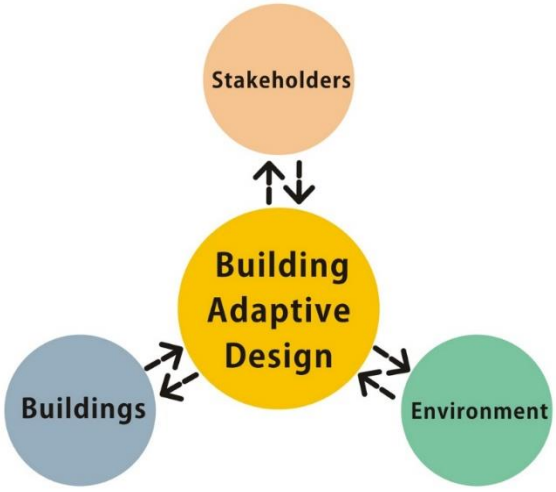

Figure 177. Theoretical Model of Building Adaptive Design

Source: Author (2023)

The second step was to build a stakeholder needs model. The research found that the stakeholders' core is the user, so the research focused on the user needs model. The researcher used Maslow's needs theory model (Maslow, A H, 1943) as the basis, combined with research data and expert opinions, to generate the User Space Needs Model for Vacation-Type Retirement Communities (Figure 178).

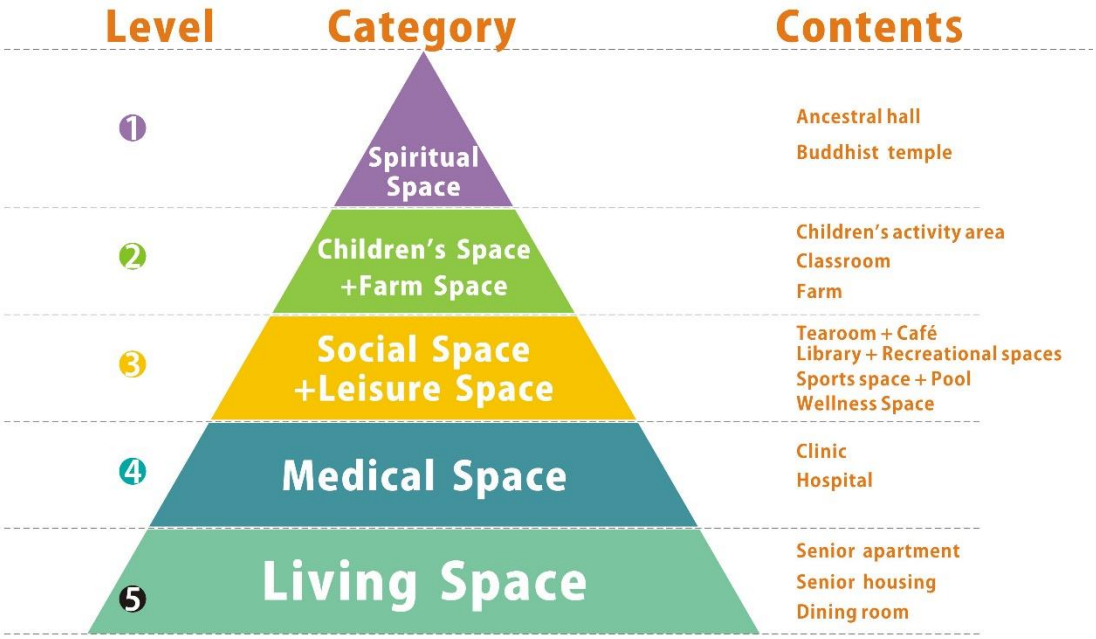

Figure 178. User Space Needs Levels

Source: Author (2023)

In the third step, the Building Adaptive Design Strategies model was established. The Building Adaptive Design Strategies model was obtained through fieldwork and literature research. In the later stage, the model was also presented and revised to the supervisors and experts for several rounds and finally took shape (Figure 179).

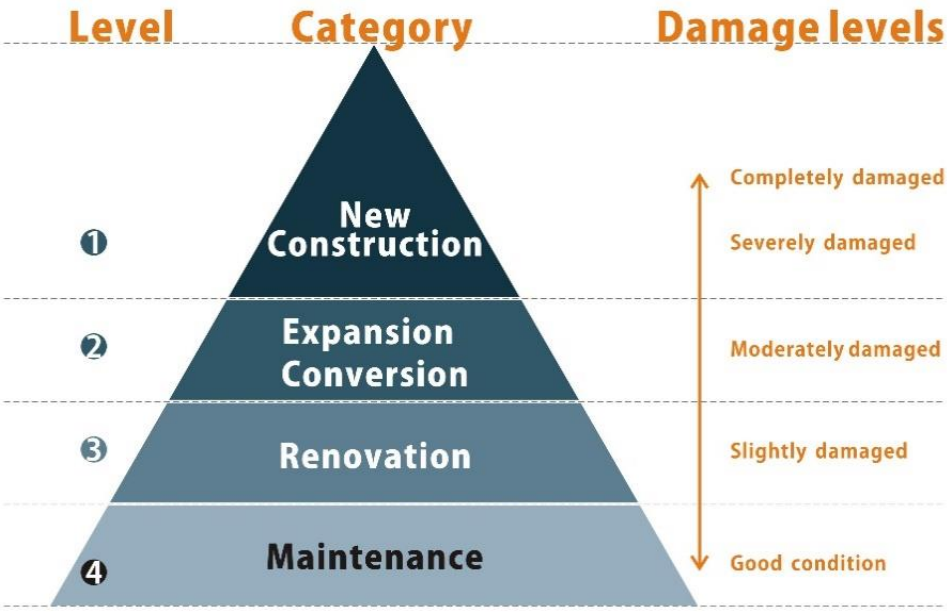

Figure 179. Building Adaptive Design Strategies

Source: Author (2023)

In the fourth step, the environmental factors were modeled. The environmental factors were divided into the Natural Environment and the Human Environment. According to the scoring of experts, the key factors of the natural environment include: Climate, Natural landscape, Air quality, Terrain, and Local materials, and the critical factors of the Human Environment include: Local culture, Lifestyle, and Religious beliefs (Table 9).

Table 9. Environment and Building Adaptive Design Strategies

Category	Type	Contents
Natural Environment	Climate	Light, Temperature, Wind, Precipitation
	Topography	Mountains, Plateaus, Plains, Hills, Basins
	Local Naterials	Stone, Wood, Rammed Earth, Sand, Brick
	Natural Landscape	Mountains, Hills, Rivers, Lakes, Seas, Biological Resources
Human Environment	Local Culture	Custom, Building Style, Folk Art, Fengshui
	Life Style	Living Habits, Food Habits, Recreational Activities, Social Behavior, Values
	Religious Beliefs	Religious Rituals, Religious Festivals

2. The second research objective: Establish a Building Adaptive Design approach for Vacation-Type Retirement Communities. In the first step, the researcher found the current mainstream Building Adaptive Design methods through literature research. In the second step, the theoretical framework of the previous research was combined to propose a Building Adaptive Design approach. In the third step, the researcher reported to the advisor and experts and iterated until it took shape (Figure 180).

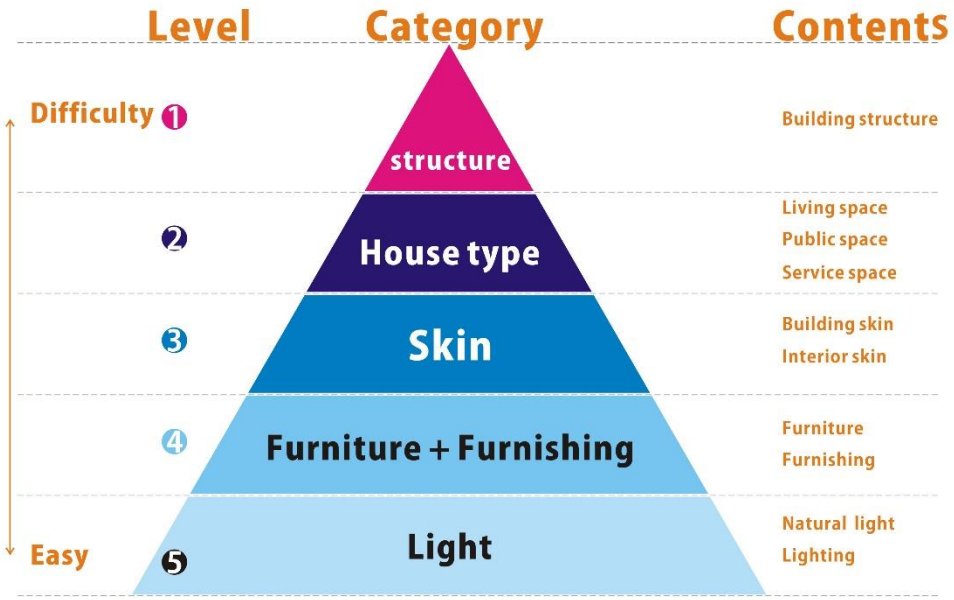

Figure 180. Building Adaptive Design Methods

Source: Author (2023)

3. The third research objective: Design practice for Vacation-Type Retirement Communities in Guangdong.

Step 1: Selected a site for the project. The site selection required a combination of group, city size, topography, and location. Step 2: Design Workshops 1, focused on terrain, climate, and policy adaptation. Step 3: Design Workshops 2, focused on the design of local cultural adaptation and adaptive reuse of the building. Step 4: Carried out the design of the Vacation-Type Retirement Community program in Chiu Chow. Step 5: Carried out the design summary and ensured the design has achieved the expected effect.

The research showed that idle Natural Villages can be transformed into Vacation-Type Retirement Communities through building adaptation design. The results showed that the hypotheses presented in Chapter 1 can be realized.

6.2 Discussion

1. Theoretical Mode and Theoretical Basis

This research useed the theoretical model of Building Adaptive Design: Stakeholders, Buildings, and Environment. It was developed based on previous authors' Human-Machine-Environment theoretical model (Long, S. Z. & Huang, D. S., 2004).

The Human-Machine-Environment theoretical model, a classic of Ergonomics, which emphasizes the interactions and influences between man, machine, and environment. In the Human-Machine-Environment model, the human refers to the user, the machine refers to the designed product, and the environment refers to the indoor and outdoor environments. This research expands the term "Human" to “Stakeholders” (Friedman, A. L. & Miles, S., 2006). For three reasons: 1) Stakeholder theory is mature and recognized by academia and business; 2) Stakeholders are suitable for products or services with complex interests. Vacation-Type Retirement Communities are complex products and services. 3) Through literature research, case studies, and interviews, the researcher found that many failed projects were due to the failure to balance stakeholders' interests. In addition, this research changed the word "Machine" to “Buildings”. Corbusier said that a house is a machine for a living (Corbusier, L., 2013).

Based on Maslow's hierarchy of needs theory (Maslow, A H, 1943), the researcher obtained a theoretical model of user space needs of Vacation-Type Retirement Communities through literature research, expert interviews, and questionnaires, and after several rounds of revisions.

2. Discussion of Key Results

The four key results of this research were distributed to seven experts. The seven experts include a user research expert, an operations expert, an investment expert, a government official, two design experts, and an environmental expert. Table 10 shows the expert recognition score of the research results. The experts recognized the theoretical model, the Building Adaptive Design strategies model, and the Building

Adaptive Design methods model of this research. The user space needs model was also recognized overall, but there were doubts about Children's Space and Farm Space.

Children's Space and Farm Space was obtained through interviews and research. These two spaces were beyond the perception of some experts and were unexpected needs. The following sound logic exists regarding the need for these two types of spaces: 1) Children's Space has always existed but has not been taken seriously. Seniors especially like to have children visit them, but School-age children attend school Monday through Friday and need to attend hobby training or organized outdoor activities on weekends, spending little time with seniors. Therefore, setting up hobby training classes and children's play facilities in Vacation-Type Retirement Communities can vastly increase the opportunities for children to visit seniors and enhance the happiness of senior living. 2) Natural Villages have a specific area of Farm Space. Most seniors in Guangdong have experience living in rural areas and have a deep affection for the Farm Space. They are happy to use field farming as a physical activity. A more important reason is that seniors still want to contribute to society after retirement. Gaining a sense of value by growing vegetables and providing produce for their families will benefit the physical and mental health of the elderly.

The theoretical model of this research has been modified several times. In the early version, the researcher designed a very detailed model framework. Later, the researcher found that the more detailed the theoretical framework, the more limitations it had. One of the keywords in this research is Building Adaptive Design, which emphasizes flexibility. Therefore, in the later theoretical model improvements, the details were simplified to maintain the adaptability of the theoretical model of this research. For example, in the case of Vacation-Type Retirement Communities, the stakeholders usually comprise users (seniors), operators, investors, and the government. In terms of importance, the user usually comes first. The ranking of the latter will then be very flexible and defined based on the specific project. If the project is large and the investment capital is enormous, then the importance of the investors is evident, and the focus should be on the needs of the investors. Sometimes, the project is biased toward the public nature and led by the government. Then, the government is ranked second only to the users.

Table 10. Expert Recognition Score of the Research Results

Category	Type	Score	Average Score
Theoretical Model	User Research Expert	5	4.29
	Operations Expert	4	
	Investment Expert	4	
	Government Official	4	
	Design Expert 1	5	
	Design Expert 2	4	
	Environmental Expert	4	
User Space Needs Model	User Research Expert	5	3.71
	Operations Expert	4	
	Investment Expert	3	
	Government Official	3	
	Design Expert 1	4	
	Design Expert 2	4	
	Environmental Expert	3	
Building Adaptive Design Strategies Model	User Research Expert	4	4.14
	Operations Expert	4	
	Investment Expert	4	
	Government Official	4	
	Design Expert 1	5	
	Design Expert 2	4	
	Environmental Expert	4	
Building Adaptive Design Methods Model	User Research Expert	4	4.43
	Operations Expert	5	
	Investment Expert	5	
	Government Official	4	
	Design Expert 1	5	
	Design Expert 2	4	
	Environmental Expert	4	

Note. The score was done on a Likert scale. Very low recognition 1, low recognition 2, moderately recognized 3, high recognition 4, very high recognition 5.

The researcher divided environmental elements into natural environmental elements and human environmental elements. Shanghai Jiao Tong University (2022) proposed 15 evaluation indicators for Vacation-Type Retirement Communities that

supported this research's classification of environmental elements. The natural environment was more critical for Vacation-Type Retirement Communities. However, in some cases, the importance of the human environment became apparent. There were influences from lifestyle habits, such as the importance of tea culture for older adults in Chiu Chow. There were also influences from traditional cultures, such as the critical influence of Fengshui theory.

Regarding Building Adaptive Design strategies, most scholars were interested in building energy retrofit. Hashempour, N. et al. (2020) provided a comprehensive summary of the existing literature on building energy optimization, discussing decision models, measures, and software tools. Jradi, M. et al. (2018) proposed a holistic and systematic approach to building energy retrofit assessment, implementing energy retrofit analysis and evaluation in four buildings in Denmark to improve their energy performance. In previous studies, no scholars have studied Vacation-Type Retirement Communities from the perspective of Building Adaptive Design. Therefore, this research is original.

The Building Adaptive Design strategies in this research are based on transforming Natural Villages in Guangdong into Vacation-Type Retirement Communities. To achieve this, it has to make full use of the buildings in the Natural Villages. Therefore, the Building Adaptive Design strategies in this study are based on the damage to the buildings in the Natural Villages. Based on the damage, the researcher proposed five strategies: New Construction, Expansion, Conversion, Renovation, and Maintenance. Broekhuizen, D. et al. (2020) argued that the adaptive design of buildings typically employs four strategies: Conversion, Expansion, Renovation, and Adaptive Reuse. Of these, Conversion, Expansion, and Renovation, support the conclusions of this research. Unlike previous studies, the design strategy proposed in this research includes "New Construction." For severely deteriorated original buildings, "New Construction." is an appropriate strategy considering the interests of users, operators, investors, and the government of Vacation-Type Retirement Communities.

The researcher also investigated Building Adaptive Design methods to enhance the operability of Building Adaptive Design strategies. These methods were divided into

five tiers, ranging from the adaptive design of lighting to the adaptive design of structures. Each project can choose one or more methods as needed. The feedback from experts showed that the Building's adaptive design methods were highly accepted. Duffy, F. C. (1974) studied commercial buildings' interior space and divided them into four layers according to their life cycle: Shell, Service, Scenery, and Set. Brand, S. (1995) developed Duffy, F.C.'s theory of layers, which proposed six levels: Site, Structure, Skin, Service, Space Plan, and Stuff. Of these, Structure and Skin support the conclusions of this research. In addition, Zhou, Y. M. (2018b) also focused on the importance of adaptive design of household types for retirement communities, and her findings support the conclusions of this research. Different from previous studies, the Building Adaptive Design proposed in this research includes adaptive design for light. Many scholars and architects have been studying the light design of buildings. Unfortunately, scholars in the field of Building Adaptive Design have neglected the adaptive design of light. However, the adaptive design of light is the easiest and most economical method of Building Adaptive Design. Therefore, in this research, the researcher considers light adaptive design as the most dominant design method.

3. Limitations

The geographical scope of this research is restricted to Guangdong Province, which is not statistically generalized. In addition, the age range of older adults in this research was predominantly 60-69 years old, with a balance of 70-79 years old. There were no studies of older people aged 80 and over, which was a limitation. Therefore, subsequent researchers need to expand the scope of the research.

6.3 Recommendations

Research on the Building Adaptive Design for Vacation-Type Retirement Communities needs to be stronger, and relevant academic research results are limited. This study synthesizes the findings and conclusions to provide the following recommendations to inspire subsequent researchers.

1. The proposal of the research scope.

Based on the theoretical framework of this research, the necessary adjustments are made according to the selected geographic scope of the study to reflect the adaptability and objectivity of the study. In addition, this research shows the Building

Adaptive Design with Vacation-Type Retirement Communities as the research object. However, the theoretical framework and design methods derived from this study are extensible, and subsequent researchers can use this basic theoretical framework and methods as a basis to carry out adaptive design for other spatial types of buildings.

2. The proposal of research application.

This research has established a basic theoretical framework and design methodology, tested in Workshops and design solutions, and has good operability. Therefore, users, operators, investors, governments, and design firms related to Vacation-Type Retirement Communities and Natural Villages can apply this study's theoretical framework and design methods to their needs.

3. The proposal of research methodology.

Building Adaptive Design can improve buildings' variability and flexibility while reducing resource waste and contributing to sustainable human development. This study has applied some interdisciplinary methods and achieved specific results. However, the research methods need to be further expanded: for example, new methods such as BIM, parametric design, AI algorithms, and artificial intelligence are introduced.

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APPENDICES

Expert Scoring Table

Table 1. Importance Score for Stakeholders in Vacation-Type Retirement Community

Category	Type	Score	Ranking
Stakeholder	User		
	Operator		
	Investor		
	Government		
	Medical Institution		
	Designer		
	Builder		
	Material Suppliers		
	Service Providers		
	Community Volunteer		

Note. The score was done on a Likert scale. Not important at all 1, Not important 2, Important 3, More important 4, Very important 5.

Table 2. Environmental Elements Score in Vacation-Type Retirement Communities

Category	Type	Score	Ranking
Natural Environment	Climate		
	Natural Landscape		
	Air Quality		
	Terrain		
	Local Materials		
	Land Resources		
Human Environment	Local Culture		
	Life Style		
	Religious Beliefs		
	Folk Art		
	Cultural Landscape		
	Educational Resources		

Note. The score was done on a Likert scale. Not important at all 1, Not important 2, Important 3, More important 4, Very important 5.

Table 3. Site Selection Score for Vacation-Type Retirement Communities

Category	Type	Score
Natural Villages in the Citys	Landscape	
	Climate	
	Quiet and Comfortable	
	Vacation Facilities	
	Medical Facilities	
	Traffic Conditions	
	Living Facilities	
Natural Villages in the Suburbs	Landscape	
	Climate	
	Quiet and Comfortable	
	Vacation Facilities	
	Medical Facilities	
	Traffic Conditions	
	Living Facilities	
Natural Villages in the Countryside	Landscape	
	Climate	
	Quiet and Comfortable	
	Vacation Facilities	
	Medical Facilities	
	Traffic Conditions	
	Living Facilities	

Note. The score was done on a Likert scale with a minimum score of 1 and a maximum score of 5.

Table 4. Buildings Damage Levels and Building Adaptive Design Strategies

Versions	Village Buildings Damage Levels	Building Adaptive Design Strategies
1	Completely Damaged	
	Severely Damaged	
	Moderately Damaged	
	Slightly Damaged	
	Good Condition	
2	Completely Damaged	
	Severely Damaged	
	Moderately Damaged	
	Slightly Damaged	
	Good Condition	
3	Completely Damaged	
	Severely Damaged	
	Moderately Damaged	
	Slightly Damaged	
	Good Condition	

Table 5. Environment and Building Adaptive Design Strategies

Category	Type	Contents
Natural Environment		
Human Environment		

Note. Depending on the level of importance, write the items in the "Type" of the Natural Environment and Human Environment and fill in the details in the "Contents. "

Table 6. Expert Recognition Score of Building Adaptive Design Results

Category	Type	Score
Stakeholders	User	
	Operator	
	Investor	
	Government	
Environment	Natural Environment	
	Human Environment	
Buildings	Completely Damaged+ Severe Damage	
	Moderate Damage + Slight Damage	
	Good Condition	

Note. The score was done on a Likert scale. Very low recognition 1, low recognition 2, moderately recognized 3, high recognition 4, very high recognition 5.

Table 7. Expert Recognition Score of the Research Results

Category	Type	Score	Average Score
Theoretical Model	User Research Expert		
	Operations Expert		
	Investment Expert		
	Government Official		
	Design Expert 1		
	Design Expert 2		
	Environmental Expert		
User Space Needs Model	User Research Expert		
	Operations Expert		
	Investment Expert		
	Government Official		
	Design Expert 1		
	Design Expert 2		
	Environmental Expert		
Building Adaptive Design Strategies Model	User Research Expert		
	Operations Expert		
	Investment Expert		
	Government Official		
	Design Expert 1		
	Design Expert 2		
	Environmental Expert		
Building Adaptive Design Methods Model	User Research Expert		
	Operations Expert		
	Investment Expert		
	Government Official		
	Design Expert 1		
	Design Expert 2		
	Environmental Expert		

Note. The score was done on a Likert scale. Very low recognition 1, low recognition 2, moderately recognized 3, high recognition 4, very high recognition 5.

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