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Design Strategies of Healing Environment in Dongheyan Area from the Perspective of Health

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Abstract In the new urban construction, the concept of healing environment is helpful to promote the physical and mental health of the urban public. By combing the relevant theories of health and environment, such as stress relief theory, attention recovery theory, biophilia design, evidence-based design, etc. and using field research methods, the functional layout, slow walking environment, public space, healing environment and healing architecture of Dongheyan area were analyzed, and the design strategies of healing environment were put forward for the slow walking environment and public space in Dongheyan area based on all aspects of problems and attributes of the area.

Keywords Perspective of health, Healing environment, Healing architecture
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At present, health problems are prominent, and the rapid development of urbanization has correspondingly brought health risks, and the relationship between environment and health has been paid more and more attention to. In the new urban construction, the concept of healing environment is helpful to promote the physical and mental health of the urban public.

In recent years, public health events have emerged one after another. SARS, H1N1 flu, COVID-19, H1N1 flu and other incidents have sounded the alarm for health, and reminded people of the importance of public health issues. In addition to health events, urban traffic congestion, deterioration of the living environment, lack of activity space and other problems also threaten the health of the public. At present, public health has become a common concern, and the public's medical and health care expenditures are increasing.

1 Related theories of health and environment

Looking back at history, Nightingale attached great importance to the impact of environment on health, and she stressed that the most important need of hospitals is to provide a treatment environment without any harm to patients, and believed that nurses should promote the recovery of patients by improving the environment in a ward[1].

1.1 Stress relief theory

According to the stress relief theory, individual stress responses involve psychological, physiological and behavioral levels, and are human responses to possible dangers or fears in the environment. The beautiful natural environment can relieve the mental pressure that people feel. When people are in a good natural environment, it can have a positive effect on emotions, so as to help people in a state of stress to restore their spirits. Stressed individuals feel significantly better after exposure to natural scenes than urban scenes lacking natural elements[2].

1.2 Attention recovery theory

Kaplan Rand Kaplan S came up with "attention restoration theory". According to the attention restoration theory, if an environment can be attractive to people and divert their attention[3], it can help people relieve physical and mental fatigue.

1.3 Biophilia design

In 1964, Erich Fromm first proposed the concept of "biophilia". Later, Edward Osborne Wilson proposed that human beings have the instinct to be close to nature, and biophilia is the desire to contact with other life forms[4]. Stephen Kellett added the concept of biophilia to the design, thus forming the current biophilia design, namely "striving to interpret the inherent connection between humans and nature and applying it to the design of the built environment"[5]. Biophilia design emphasizes the balance of life. In the fast pace of life, people often neglect the balance of physical and mental health. Biophilia design encourages people to value physical health, mental health and social health, so as to achieve life balance. Besides, it also emphasizes environmental protection. People's lives are closely related to the natural environment, and Biophilia design encourages people to pay attention to environmental protection and actively participate in environmental protection actions.

1.4 Evidence–based design

Evidence-based design promotes rigor and continuous optimization of the built environment design process by promoting rational search and use of existing scientific evidence and combining the professional experience of designers and users' feelings, which is an effective way to help make the best decision. Evidence-based design comes from evidence-based medicine. Archie Cochrane first proposed the empirical thinking of clinical practice based on rigorous research methods and reliable medical evidence. The *Landscape Outside the Window Can Affect Patients' Postoperative Recovery* published by Professor Roger Ulrich of Texas A&M University in the United States in 1984 is the beginning of the birth of "evidence-based design". In 2009, American architect D.K. Hamilton made a clear definition of "evidence-based design" in his book *Evidence-based Design*: *Evidence-based Design for All Kinds of Buildings*, and it has became the academic standard. That is, evidence-based design is a careful, accurate and wise design process, applies the best available evidence from research and practice, and works with informed clients to make key decisions for each specific project[6].

2 Survey on the current situation of Dongheyan area from the perspective of health

2.1 Research object

Dongheyan area is located in the northwest of Fengtai District and to west of Yongding River, is close to Beijing Garden Expo Park,

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borders Mentougou District and Shijingshan District in the north, and is adjacent to Wangzuo Town in the southwest (Fig.1). It is under the jurisdiction of Changxindian Town, Fengtai District, and is a typical hilly area.

Dongheyan area belongs to Tengtui Village, and is in the transformation stage from a rural area to a city. The coexistence of rural and urban features is the "realistic slice" of urbanization development. The surrounding environment of Dongheyan area is good. It is adjacent to the West Fifth Ring Road in the east, and it takes about 18 min from the area to the West Fifth Ring Road. It is adjacent to the West Sixth Ring Road in the west, and it takes about 17 min from the area to the West Sixth Ring Road. Therefore, it has a good traffic environment. In addition, the area is close to Beijing Garden Expo Park, and is surrounded by Beigong National Forest Park, Shiji Forest Park, Yungang Forest Park, Yongding River Leisure Park and a large area of green space. There is a good green base around the area. Meanwhile, the area is close to the Yongding River, and has certain hydrophilic space (Fig.2). Dongheyan area has a good natural resource base and unique development potential for healing environment. Therefore, combined with the future development orientation of the area, it is necessary and advantageous to design a healing environment with health as the orientation and for the purpose of promoting people's physical and mental health in the area (Fig.3).

2.2 Slow driving environment

The main problem of restricting the healthy environment of slow traffic in Dongheyan area is the random parking of motor vehicles. In the whole area, there are many broken roads. They have become temporary parking lots for motor vehicles, and even the whole roads are filled with vehicles, so that they are temporarily unable to be used normally. On streets with non-motorized lanes, private motor vehicles are parked in the non-motorized lanes. As a result, people can only ride on the motorways, which increases people's safety hazard and the incidence of traffic accidents.

Due to the uneven ground of slow walking paths, most interviewees often sprained their ankles and even fell on the footpaths. Besides, the distribution of electric poles is irregular, and the height of electric boxes is uneven, blocking the footpaths. The trees beside the footpaths are not straight, and the branches are pressed on wires, which has serious high pressure hazard. Because the footpath are narrow, people can only walk on the roads if they want to avoid the footpaths, so there is a traffic hazard.

Many roads have no non-motorized vehicle lanes, so that people ride non-motor vehicles on the roads, increasing traffic hazards. In the area, the auxiliary facilities of the slow driving system are not perfect, lacking bicycle and electric vehicle parking areas, road lighting and so on, which will reduce the willingness of the public to travel slowly, and thus prevent people from exercising.

The streets in the area are mainly life-type and traffic-type streets, while the interfaces of these streets are mainly solid wall interfaces, and the solid wall interfaces are the most boring interfaces[6]. The commercial streets in the area have problems such as storefront separation, very low green vision rate, uneven roads, and lack of gray space. The streets lack multi-colored vegetation such as flowers and vertical green landscape. Moreover, the recreational facilities and convenient facilities distributed on both sides of the roads are insufficient, are general in quality, and lack integrated design. In addition, in the aspect of street landscape, there is a lack of cultural display, rest exchange and more distinctive commercial activity experience.

2.3 Public space

Although Dongheyan area is rich in woodlands, there are only three public parks near the built residential areas, one of which has not yet been completed. During the investigation of the current situation, it is found that there is no square for people to use at present, and people can only do outdoor leisure sports such as square dancing and shuttlecock kicking in small open spaces in front of buildings, which will cause disturbance to the residents and block roads, greatly reducing the enthusiasm of the public for outdoor activities and leisure. At the same time, in addition to the lack of public space for outdoor activities, the area also lacks play space for children and public space that meets the needs of the elderly. On the whole, the public space in Dongheyan area is in short supply and in urgent need of renovation.

2.4 Healing environment and healing architecture

In Dongheyan area, there are only medical healing buildings with medical and nursing services, and the demand and supply healing buildings are relatively rare. Therefore, when renovating and updating the design, the focus should be on the healing environment and the setting of buildings.

2.5 Water area

There is a water area in Dongheyan area, and it is connected with Daning Reservoir. The public mistakenly thinks it is a sewage river, and used to discharge waste water. It is full of weeds, has poor water quality, and is untended for a long time. Along the water area, there are only simple footpaths, and the design of the surrounding environment is lacking, so that the water are can not promote public health.

2.6 Future planning

In this design, Dongheyan area is chosen as the study object, including the west I area of Fengtai Science Park, which is planned in the future of Fengtai District. The park is located on the west bank of the Yongding River, adjacent to the Expo Park, and is an important node of the Yongding River cultural belt, with a total land area of 167 hm^2. Its planning positioning is a high-tech industry research and development area with rail transit industry research and development and technical services as the leading and aerospace as the characteristics, as well as a urban functional area with comprehensive supporting facilities.

3 Design strategies of healing environment in Dongheyan area from the perspective of health

3.1 Design strategies of healing environment in slow walking environment

The construction quality of the residential community itself has little influence on the public's fitness intention and activities, while the location and the accessibility of fitness resources around the community are important factors affecting their fitness intention and activities[7].

3.1.1 Design strategies of fitness trails.

(1) Design principles of fitness trails. ① Security: the design of fitness trails must meet safety standards in terms of road surface materials, road slope and curvature, so as to ensure that users will not be injured during exercise. ② Diversity: fitness trails should provide a variety of equipment and exercise to meet the needs of people of different ages, genders, abilities and fitness goals. For example, equipment can include sit-ups, dumbbells, walkers, push-pull machines, etc. ③ Naturalization: the surrounding area of fitness trails should pay attention to the application of natural elements and Biophilia design techniques, and natural elements can include plants, terrain, sky, etc., while landscape types include forests, rivers, gardens, etc. ④ Being easy to maintain: the design of the fitness trails should take into account the cost of maintenance, including cleaning and equipment maintenance. Equipment should be easy to maintain to ensure the safety

and functionality of equipment. ⑤ Sustainability: fitness trails should take into account the impact on environment, such as the use of renewable energy, water conservation and waste reduction. ⑥ Convenience: fitness trails should be convenient and accessible in location, connected with surrounding facilities such as toilets, drinking fountains, etc., so that users should be able to easily access and use equipment. ⑦ Meeting diverse needs: fitness trails should provide different exercise items and equipment for people of different ages and different exercise levels, including aerobic training, gravity training and stretching training. ⑧ Expandability: fitness trails should have expandability, so that they can be updated and improved in the future according to demand. For instance, new equipment and sports or more areas can be increased to attract more users.

(2) Supporting facilities of fitness trails. Fitness trails are a facility that provides outdoor recreation and fitness, which is of great significance to promote public health, encourage green travel and slow traffic, and reduce exhaust emissions. In order to ensure the use effect of the trails and safety performance, several points should be paid attention to. Firstly, the smooth and beautiful surface of roads should be maintained, and a thin layer of plastic road surface can be used because of its high wear coefficient and good anti-skid effect. It can improve the ground's anti-skid performance and safety, has good water dispersion performance, and can reduce noise. Secondly, the needs of the public's night running should be considered, and lighting equipment should be equipped along the trails to ensure the comfort and safety of night jogging. The lighting system is mainly set in the main line of the trail, the entrance and exit, the runway, the sign system and other areas. These details need to be paid attention to, so as to better improve the experience and safety of the trails.

3.1.2 Design strategies to enhance street healing. After purposeful planning and design, streets can also become a healing environment. In the studies on the healing environment of urban public space, most of them pay attention to the impact of green parks and adjacent water places in a city[8].

(1) Sidewalk width. A proper sense of scale is a prerequisite for streets to provide healing. Sidewalk is the most used space carrier by walkers, and its size directly affects the spatial experience of walkers. When a sidewalk is too narrow, pedestrian will have a sense of inconvenience, may collide with others, thus affecting their walking experience. As a sidewalk is too wide, the boundary sense of paths is weakened, resulting in the sense of emptiness of streets. It is necessary to choose the appropriate sidewalk width according to the environment of the space to avoid negative impact on pedestrians.

(2) Aspect ratio of streets. Designers can choose the social quality of the square to obtain the best vertical proportion relationship (H/D = 1/6, 1/4 and 1/3), and then use buildings, landscape and street furniture for secondary enclosure to create a small-scale enclosure space as far as possible. The vertical proportion relationship of the secondary enclosure should be 1/3 (vertical angle of view of the square = 18°, H/D = 1/3). In addition, other ways to optimize the spatial quality are used to improve the spatial quality of the square[9]. The ideal aspect ratio should be between 1 and 2. Based on this theory, when the size and shape of streets and surrounding buildings cannot be adjusted, the aspect ratio of streets can be improved by planting trees, thus improving the healing effect of space. This approach can enhance the public's sensory experience of space without changing streets and building structure.

(3) Green looking ratio. Green looking ratio refers to the proportion of green plants in a person's visual field. Studies have shown that streets are most healing when green looking ratio is between 24% and 34%. When the green looking ratio of street space exceeds 34%, its stress-relieving effect on walkers is reduced[10]. The control of green looking rate can be realized through the management of greening in the later stage. As the green looking ratio of streets is too low, it can be improved by increasing the green plants in street space. When it is too high, trees need to be pruned to ensure that the pedestrian's view is not obstructed by green plants[11].

(4) Street space color. Color is usually measured in three dim-ensions: hue, lightness and chroma. The use of warm colors in streets can create a lively and intimate atmosphere, while cool colors are more calm. The higher the chromaticity of the color, the stronger the visual stimulation of people, and the long-term gaze will cause visual fatigue and boredom. Too low color will reduce the recognition and spatial interest. The use of low brightness color can make the space have higher quality, and high brightness color can make space more vivid. In general, the collocation of spatial color should be coordinated and unified to improve healing.

(5) Transparency of side interfaces. The transparency of living street interfaces can be divided into solid wall interface, grille interface, fully transparent glass window and partially transparent glass window according to the degree of public eye penetration. If the interfaces are too solid, there will be a dull feeling, which will weaken the publicity of street space and induce the negative emotions of walkers. All-transparent glass interfaces will make pedestrians feel monitored in the street environment, and are easy to cause walkers to feel uncomfortable.

(6) Plant abundance. Plants meet people's biophile needs and promote their mental health. However, most studies only focus on the green looking ratio of street space, and ignore the influence of plant richness on walkers. It is needed to choose the plant type structure in line with Beijing's climate, and enrich the plant types of streets in the area.

3.2 Design strategies of healing environment in public space

3.2.1 Design strategies of systemic healing of park green space. Based on the future planning of Dong-heyan area, the open space of street green space and green space adjacent to water can be used to build a recuperation park. By introducing different specific therapies and improving appropriate specific treatment facilities, the healing environment can be played to meet the health needs of the public and promote their physical and mental health.

Healing parks can be planed to special healing parks with different functions or plant types according to different sensory factors in the healing environment, such as vision, hearing, smell, taste, touch, etc. Different healing parks are divided into different sensory themes to achieve better healing effects. They are connected with each other by fitness trails to further create an integrated healing system in the area.

Recuperation parks have higher requirements for plant landscape design in terms of rich seasons and diversity of plant species. For the natural landscape of visual healing parks, natural terrain and vegetation can be made full use of to create rich and diverse landscape, such as mountains, lakes, lawns, gardens, etc., and create a pleasant natural environment. Besides, artificial landscape, such as pools, stone bridges, rockeries, pavilions, etc., can be built to create a unique style of gardens, increase people's viewing and interactive fun. For auditory healing parks, music therapy can be adopted, and music therapy areas are set up in the parks, such as outdoor music rooms, forest large stages, etc., providing various types of music therapy and physical relaxation exercises with related devices and facilities, such as speakers, natural sound

collectors, etc. The plants in olfactory healing parks should be scented or aromatic plants, such as cloves, directional sage, jasmine, etc., as well as volatile plants, such as platycypress, cedar, etc. They can emit fendolamine and produce bactericidal and antibacterial effects. Combining the planting of edible plants, taste healing parks can be equipped with an open kitchen containing faucets, operating tables, tables and chairs, so as to facilitate people's use and promote public participation and social interaction. Tactile healing parks allow visitors to touch tree trunks and leaves with different senses for tactile stimulation, and touch devices of different materials should be set in the parks, such as stones, wood, slate, etc. In addition, flowing pools and other landscape devices can be designed.

3.2.2 Design strategies of hydrophilic space healing. The green space near the water can be combined with water, mainly promoting the auditory and tactile sensory system through sensory therapy, creating a sensory system for users, and planting plants in a targeted manner.

In the sense of hearing, local fountains and small waterfalls are set in the intercepted water area to stimulate people's hearing. In terms of touch, a flowing pool for people to touch and walk barefoot can be built, thereby enhancing people's tactile experience. Visually, a local circular pool can be selected to reflect the sky, trees and other natural landscape. A teahouse workshop can be set up in the hydrophilic space, where the process of extracting pure water such as water distillation is set up, and the activities such as making tea can give people a taste experience. A planting experience area can be set up in the hydrophilic space, and people can get olfactory stimulation through soil and other smells in irrigation and other experiential activities.

3.3 Design strategies of healing architecture

3.3.1 Design strategies of improving high-rise office healing. The future planning direction of Dong-heyan area is the research and development area of high-tech industry, and there are high-rise office buildings in high-density areas. It is expected to establish high-density areas and high-rise office buildings. However, such buildings are usually made of concrete walls or glass curtain walls, brings monotonous working atmosphere to employees, and can not meet the needs of employees to get close to nature and relieve pressure. Therefore, it is necessary to carry out internal or external renovation design, so that employees can be close to nature, enjoy

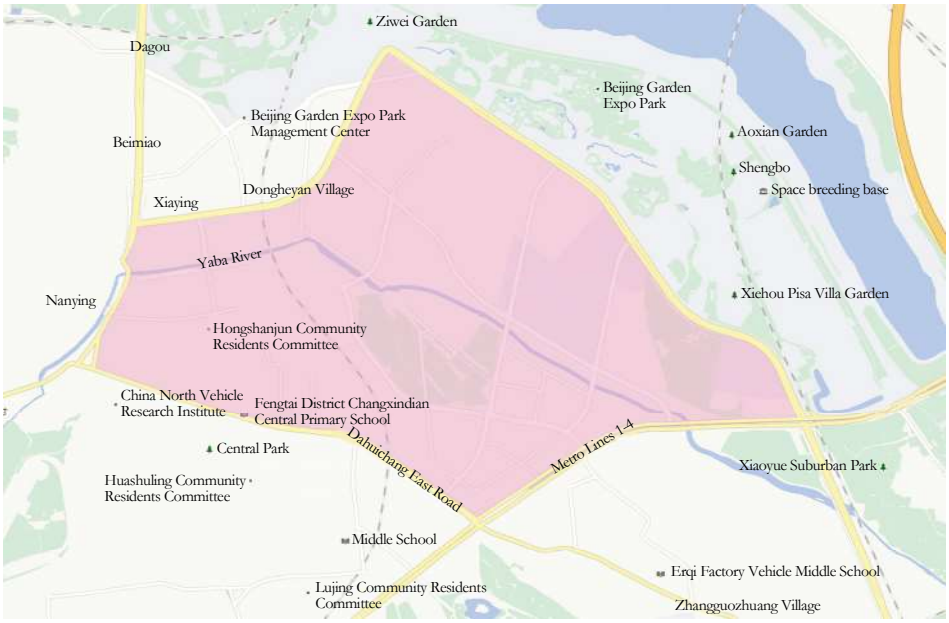

Fig.1 Dongheyan area

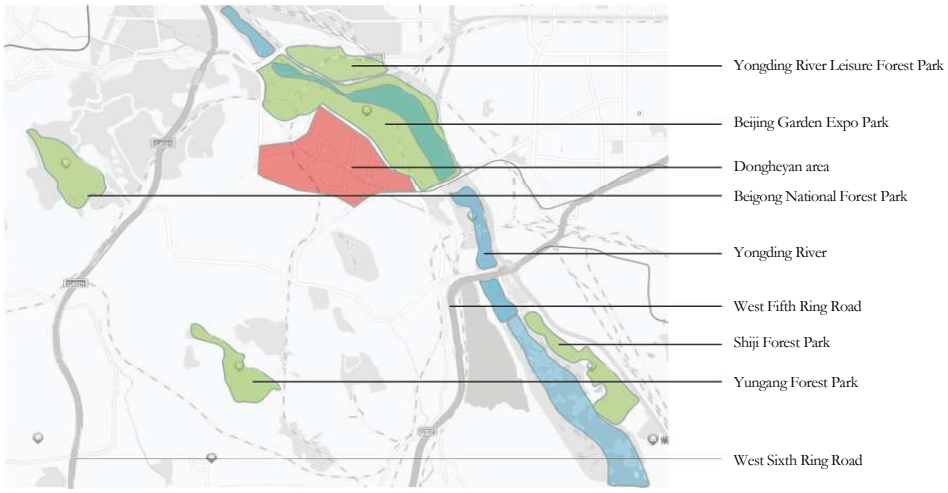

Fig.2 Surrounding situation of Dongheyan area

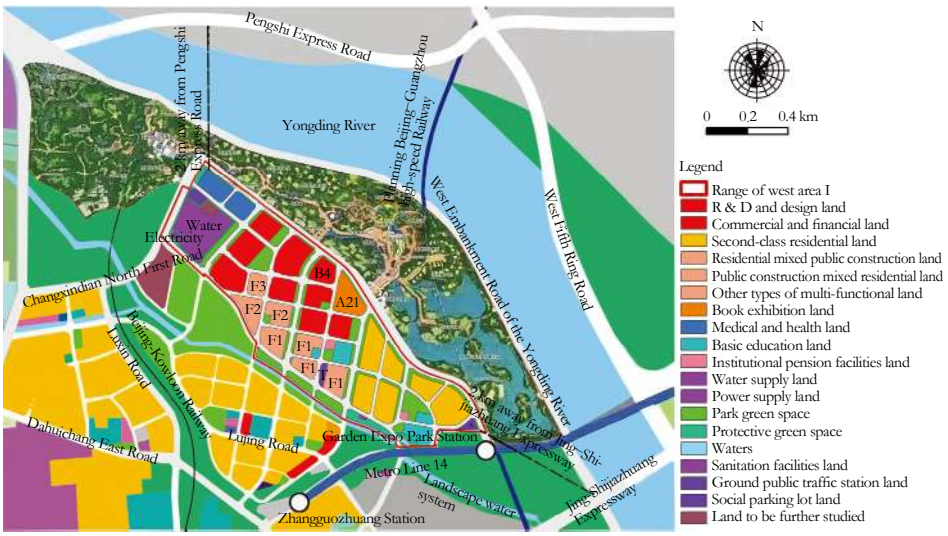

Fig.3 Future planning of Dongheyan area

health healing, and reduce work stress. According to relevant theories, the healing effect of high-rise office buildings can be improved in the following three ways: increasing vertical greening on the surface of building, adding healing nodes in the plan layout of building floor, and planting green plants inside buildings.

(1) Vertical greening. In order to improve the monotonous building facade of high-rise office buildings, improve the work efficiency of staff, and relieve their work pressure and negative emotions, appropriate vertical greening can be added to the walls or external components. It will not only improve the visual effect of the staff looking out from the interior and increase their imagination, creativity and productivity, but also enhance the greening of buildings.

Beijing has a temperate monsoon climate, and it hot and rainy in summer, cold and dry in winter. It is a cold region. These climatic conditions have an important impact on the three-dimensional greening of buildings. Hence, plants with strong drought, cold and wind resistance should be used for outdoor vertical greening in Beijing according to the characteristics of buildings and design needs.

(2) Plane layout. The needs of employees are diverse, and high-rise office buildings also need to provide more functional spaces for the needs of employees. In addition to the basic office function attributes, the office floor also needs to provide employees with a variety of functions such as socializing, resting and healing. Therefore, the perfect spatial function configuration of graphic design is also crucial. The diversified design of spatial functional attributes is the key to relieve staff's work pressure and improve office efficiency. Employees should be provided with the most suitable relaxation space to relieve work pressure and relax .

(3) Planting green plants. Planting green plants is an effective measure to increase the healing effect in high-rise offices. Green plants can filter indoor air, increase indoor air humidity and soften indoor space, and add vitality to indoor environment to improve indoor comfort. According to the Evaluation Standards of Healthy Buildings, every 50 m^2 of indoor should be equipped with at least one green plant, and potted plants are a first choice. In order to achieve a better effect, attention should be paid to the diversity of potted plants, and plants with slight fragrance should be chosen. This can enable employees to get healing stimulation from both sight and smell, enhance the multi-sensory experience of employees and the natural environment, and improve the healing effect of nature. Therefore, planting green plants indoors is a very beneficial behavior, and can improve the indoor environment and improve the work efficiency and physical and mental health of employees.

3.3.2 Design strategies of healing single building sites. A large number of demand supply and medical service healing buildings, such as water bars, health halls, etc., should be built to provide the public with places of emotional attachment and spiritual pursuit, thereby enhancing the cohesion and sense of belonging of the community. It is also a good choice to build spiritual healing buildings near residential areas. This can arouse people who are tired of coping with the pressure of life to pay attention to and explore the spiritual world, so as to obtain self-repair and comfort. Buildings and services are given the healing function of spiritual exploration, refreshing the mind, and escaping stress to guide the public to visit and experience temples and spiritual and edifying healing buildings. This can not only enrich the cultural life of the public, but also improve the spiritual and cultural quality of the public, so that the public will pay more attention to and care about community development. In the construction process, it is necessary to choose the appropriate architectural design and greening scheme according to different types of healing buildings and regional functions. This can ensure the integration of healing buildings with the natural environment, and enhance the quality of life and well-being of the public. Ultimately, the construction of these healing buildings can not only improve the physical and mental health of the public in the community, but also promote the cultural, social and economic development of the community, and achieve comprehensive sustainable development of the community.

Libraries can be built in Dongheyan area to use "reading therapy" to heal the public. Reading therapy, also known as reading therapy or book therapy, takes literature and books as important tools to achieve the effect of adjuvant therapy through reading activities[12]. By reading books, the information content in the books are accepted, understood and comprehended, and readers' physical and mental health can be restored. Its essence is to re-educate people's spirit and intelligence through reading activities, and help people recover their ability to adapt to social life. The roles of reading in mental health care and adjuvant therapy has been widely recognized since ancient times, and there is also a wealth of empirical research support in modern society. Hence, the libraries built in Dongheyan area can provide a good reading environment for the public, and help them maintain physical and mental health through reading activities.

4 Conclusions

Dongheyan area has a good natural resource base, has a unique development potential for healing environment, and the public in the area has a large demand for their own health. Therefore, combined with the future development orientation of the area, it is necessary and advantageous to design a healing environment with health as the orientation and for the purpose of promoting people's physical and mental health in the area.

Dongheyan area carries the daily behavior of residents, which also constitutes important external landscape. By using the whole of relevant health and environment theories, the current situation of Dongheyan area is studied, which can reflect the problem of restraining public health in Dongheyan area to a certain extent. Corresponding strategies are proposed for the problems of slow walking environment, public space and architecture, which are helpful to the overall environment of Dongheyan area.

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streets" is actually a reflection of the demand for Yangzhou's local lifestyle experience. To maintain the individuality of each district, it is recommended to adjust the proportion of local residents' living space to business and other innovative formats. Moreover, the four districts should form a coherent tour system, unified with the overall style of Yangzhou and the Yangzhou section of the Grand Canal, to make "districts tour" one of the first choices for visitors.

5.2 Introducing innovative cultural activities

The research shows that the public's perception of the types of activities relying on historical and cultural districts is limited, only visiting and eating. The deep-seated cultures such as settlements, gardens, and historical figures behind historical districts are missed. Because the attractiveness of cultural display forms to the public is lacking. The activities combined with holidays should be promoted and formed a tradition such as Dragon Boat Festival Folk Culture Festival in Renfengli.

Additionally, digital media can be used to disseminate the information of the heritage landscape, such as VR technology to introduce and reproduce the folk culture and traditional festival activities of the historical districts. A tourism brand including Dongguan Street with historical and cultural characteristics, Nanhexia with salt business culture, Wanzi Street with market folk characteristics and Renfengli with riverside activities can be built, instead of only walking through Dongguan Street.

5.3 Improving the district format and paying attention to the needs of indigenous and surrounding residents

To improve the public's tour and consumption experience, district managers should continuously enhance the district format and public space positioning. It is crucial to consider the needs of both tourists and indigenous and surrounding residents[14]. The protection of the authenticity of life should be maintained, and public life should become a part of the district cultural rather than being overshadowed by business. This way, the historical and cultural districts can become the best carrier for the renewal of the ancient city.

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