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Contents

Original Articles

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Discussion on Emergency Renewal Design of Indoor Space of Multi-Storey Residential Building under Public Health Emergency

Hongguo Ren, Xiaoyu Ji, Yuchen Liu

School of Architecture and Art, Hebei Engineering University, Handan 056038, China.

Abstract: In order to deal with public health emergencies, five residential areas in the main urban area of Handan were selected for on-the-spot measurement and questionnaire survey, and the survey data were sorted out and sequenced regression analysis. it is summarized that the main problems of indoor space in emergency are poor spatial independence, unreasonable layout, low flexibility and poor natural lighting effect. On the basis of this, the corresponding optimization strategy is put forward in order to help to update and improve the emergency design of interior space in multi-storey residential buildings.

Keywords: Public Health Emergency; Interior Space of Multi-Storey Residential Building; Emergency Design Update; Residential

Introduction

The outbreak of novel coronavirus at the beginning of 2020 has aroused great concern all over the world. However, due to the lack of objective understanding of epidemic prevention emergency design in traditional residential buildings, the emergency response ability of indoor space in the face of epidemic situation is poor. Therefore, it is very necessary to analyze the new demand of residential buildings under public health emergencies and to build an updated design framework to promote resilience and epidemic prevention.

1. Understanding Public Health Emergencies: From the Promotion of Resilience and Epidemic Prevention

1.1 Public Health Emergencies and Residential Indoor Space

In the face of this menacing epidemic situation, the epidemic prevention board of residential indoor space has gradually become a research hotspot, and family protection has become a feasible way to deal with the epidemic situation [1]. In view of how to improve the sanitary and epidemic prevention ability of residential indoor space, it is necessary to systematically put forward emergency measures of indoor space epidemic prevention combined with domestic and foreign residential health prevention and control experience, in order to provide reference for the improvement of residential indoor epidemic prevention ability under such public health emergencies.

1.2 New Requirements for Resilient Safety of Epidemic Prevention Support

In order to deal with public health emergencies, many countries have explored to improve the emergency response capacity of epidemic prevention [2]. For the United States to promote the construction of "disaster prevention community" throughout the country; Japan puts forward the concept of "public assistance + co-assistance + self-help", and strengthens the cooperative relationship of "public rescue + mutual rescue + self-help". Australia does not put forward the concept of "prepared community", which aims to formulate different emergency plans according to different types of public health emergencies, and update and improve each plan [3-5]

Generally speaking, in dealing with public health emergencies, the research from the perspective of residential buildings is less and less concerned, which leads to the lack of emergency capacity of indoor space in residential buildings.

Fund projects: * Research project on the development of social sciences in Hebei Province in 2021 (project category: youth project, project number: 20210301135)
First author: Ren Hongguo (1979.06 -), Dezhou, Shandong, male, professor, doctor, research direction: Living Environment and Health
Newsletter author: Ji Xiaoyu (1995.06 -), Taian, Shandong, female, student, master, research direction: Living Environment and Health

2. Reflection on Public Health Emergencies: the Concept of Resilience and Design Framework

2.1 the Connotation and Logic of Resilient Cities

Resilient city means that when a disaster occurs, the city can withstand the impact, respond and recover quickly, maintain the normal operation of the city function, and better deal with the disaster risk in the future through adaptation. With the continuous deepening and expansion of the study of resilient cities, the world has set off a new wave of resilient urban planning and practice, and this concept and strategy has been gradually applied to all kinds of unknown risk fields.

2.2 Resilient Residence

In the face of public health emergencies and complex environment, resilient housing is mentioned as an extension of resilient cities to form a complete resilient vertical system. With regard to resilient housing, first of all, the positive effect of spatial combination promotes the improvement of spatial resilience. That is, the arrangement of the space is based on the reasonable organization of the indoor streamline in order to improve the toughness of the space. Secondly, integrate the elements of indoor space from the perspective of epidemic prevention and emergency, and actively organize the indoor line of defense to deal with public health emergencies.

3. Analysis of Public Health Emergencies: Current Situation of Emergency Capacity of Residential Buildings

Select the main urban area of Handan City as the study area, select five representative communities for questionnaire survey, carry out digital visualization analysis of indoor space, and get the evaluation of residents' emergency ability of indoor space; and carry out sequential regression to analyze the differences of the impact of different indoor space areas on indoor epidemic prevention under public health emergencies. 250 questionnaires were distributed, 227 were valid, and the effective rate of the questionnaire was 90.08%.

3.1 Questionnaire Survey and Analysis

The construction age of the five communities from far to near is Luochengtou No. 4 Hospital, Railway Courtyard, Guangtai District, Guanghua Yuan North District and Asia-Pacific Century Garden. From the analysis, we can see that the residents' evaluation of the multi-storey housing built in different periods is different. And in the overall evaluation, the satisfaction of Asia-Pacific Century Garden is the highest, while that of Luochengtou No. 4 Hospital is the lowest.

According to the sequential regression of residents' evaluation of indoor space factors, it is found that porch space, kitchen space and toilet space have a significant impact on indoor epidemic prevention evaluation.

3.2 Summary of Indoor Space Problems

According to investigation and analysis, there are the following problems in residential indoor space in epidemic prevention emergency: mutual nesting of functional space, unreasonable layout, poor flexibility of functional space and poor quality of ventilation and lighting. Therefore, based on the update of emergency capacity, the following paper further discusses the update of epidemic prevention and emergency capability of indoor space in multi-storey residential buildings under public health emergencies.。

4. Dealing with Public Health Emergencies: Emergency Update Design Strategy

4.1 Enter the Household to form an Independent Space to Isolate the Source of Infection

In the household space, you can set up the garden and the porch space to form an independent space. In this space, functions such as changing, washing hands, placing things, hanging ironing and hanging receiving clothes are placed in the order of use, so as to meet the eliminate virus epidemic prevention process of residents entering the room from outdoor to indoor and the process of changing clothes from indoor to outdoors, so that residents can better complete the protection under the epidemic situation.

4.2 Optimize Indoor Layout and Improve Layout Flexibility

4.2.1 Bathroom Space Layou

As the residents pay more attention to the epidemic situation, the residents are more inclined to the arrangement of the two sanitary facilities. In the layout of the toilet, the multi-function is arranged in the same space, the dry and wet separation is not carried out, and the toilet is in a moist state for a long time and the utilization rate is low. In order to avoid conflicts among residents, the toilet layout needs to do dry-wet separation or three separation to facilitate the clean eliminate virus of the toilet space, and improve the epidemic prevention ability of residents at home.

4.2.2 Layout of Indoor Isolated Space

In case of public health emergency, residents can choose indoor near-end or far-end rooms as isolation space to reduce the streamline crossing between isolated and unisolated residents. In the layout of the isolated space, the needs of isolated residents such as rest, grooming and leisure should be met.

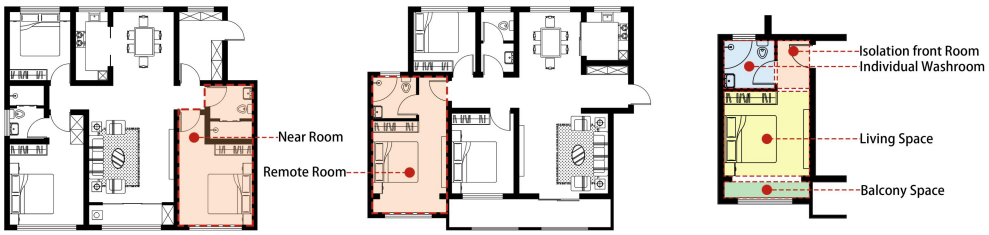

Fig. 1 Schematic Diagram of Isolation Space Design

4.3 Create Functional Composite Space and Improve Space Utilization

To improve the space utilization, it can be designed in both horizontal and vertical dimensions. In the horizontal direction, light partition can be used to complete the mutual transfer and borrowing of space, expand the living room space and form a closed porch to facilitate family epidemic prevention and meet the needs of residents. In the vertical direction, the near-ground space can use multi-functional furniture to complete the functional space conversion in different periods; in the indoor top space, more lockers are placed to increase the indoor storage space to meet the storage needs of residents under public health emergencies.

4.4 Improve Indoor Ventilation and Lighting and Improve Living Quality

In the event of a public health emergency, a reasonable form of natural ventilation can maintain the appropriate indoor temperature and humidity and contribute to the circulation and replacement of indoor air. In order to improve the quality of indoor ventilation, it can be considered from four aspects: selecting separate traffic core, setting suitable air inlet and outlet, selecting suitable air inlet form and window sterilization.

To improve the quality of indoor lighting, first of all, we can expand the building room to expand the building lighting surface, and at the same time facilitate ventilation. Secondly, to ensure the transparency of the windows, to ensure the normal use of windows and natural light to enter the room normally. Finally, window holes can be designed on the indoor lightweight partition to make natural light enter the space, and transparent but opaque glass walls or other material partitions can also be used to replace concrete walls to form a more transparent and bright indoor environment.

5. Conclusion

With the frequent occurrence of public health emergencies, the design and practice of emergency renewal of indoor space in residential buildings has become the focus of architectural research. Taking the present situation of the main urban area of Handan as an example, according to the analysis and summary, this paper puts forward the design to enhance the emergency ability and resilience of epidemic prevention in indoor space from four aspects: independent space, interior layout, functional compound space and daylighting ventilation. in order to provide a feasible basis for the improvement of indoor space emergency capacity of multi-storey residential buildings.

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Research on Practical Teaching of Railway Engineering Specialty Based on Temperature Test of Rubber Sleepers

Zixiao Shi, Zhiping Zeng*, Zhihui Zhu, Weidong Wang, Ping Lou, Bin Yan, Wendeng Qiao, Shunshun Zhang * Corresponding Author: Zhiping Zeng, Professor.

School of Civil Engineering, Central South University, Changsha, Hunan, 410075, China.

Abstract: Experimental teaching plays an important role in cultivating college students' innovative ability. This paper takes the practical teaching of the temperature test of the new rubber sleeper as an example to analyze the current situation and problems of the practical teaching of railway engineering. The specific measures of the new system of practical teaching of railway engineering are put forward: Build a practical teaching curriculum system, improve the practical teaching evaluation mechanism, and promote the sharing of school-enterprise resources, so as to cultivate outstanding railway engineering talents with engineering ability and innovative spirit.

Keywords: Rubber Sleepers; Temperature Test; Railway Engineering; College Students; Practical Teaching; Teaching Methods

1. Introduction

Driven by a new round of scientific and technological revolution and industrial revolution, the reform and transformation of the railway engineering industry is imperative, which puts forward higher requirements for the teaching of railway engineering in higher education[1]. Because railway engineering has the characteristics of strong applicability, it is of great educational and practical significance to improve the practical ability of college students in this major. The construction of a new system of practical teaching of railway engineering is conducive to improving the quality of practical teaching of railway engineering, so as to meet the training needs of railway engineering talents under the background of the new era[2].

Although most college students have innovative awareness and motivation, they generally lack practical ability and innovative thinking in the undergraduate education stage[3]. The professional practice of railway engineering needs to improve the students' operation ability as much as possible, and tap the students' own innovation potential. We need to guide students to think about problems in the process of practical teaching, which can train students' thinking ability and develop the habit of independent thinking. Knowledge comes from practice, and quality needs to be cultivated in practice. Practical teaching is the key to the growth of college students, especially those majoring in railway engineering.

2. Introduction of rubber sleeper and its inspiration to experimental teaching

In terms of environmental protection, plastic composite sleepers are a new generation of environmental protection and energy-saving green railway sleepers, which use non decomposable waste plastics, waste rubber and waste rubber as raw materials. Compared with traditional sleepers, composite sleepers have many advantages in material mechanical properties. At the same time, with the development of technology, it has great potential to improve.

Rubber sleeper is a new type of environmentally friendly sleeper developed by TIETEK company in the United States and made of waste plastic from old tires, but there are few domestic studies on it at present. Due to its outstanding characteristics, rubber sleepers have been laid on some heavy-haul railways in my country, but as a new type of sleeper structure, its theoretical research lags behind engineering practice, and the dynamic and static characteristics of rubber sleepers are still unclear, which hinders its further promotion and application in China.

In order to solve the problems existing in traditional practice teaching, the development direction of railway engineering practice teaching is to build a relatively perfect new system of practice teaching[4]. Therefore, taking the practical teaching of "Mechanical Characteristics Analysis and Optimal Design of Plastic Rubber Sleeper Tracks" in this major as an example, the main measures of the new system are explained in detail, in order to provide reference for the training of talents in related fields.

The main work of the undergraduate research project is to analyze and optimize the mechanical properties of the plastic composite track, including calculation software and mathematical analysis. Through theoretical analysis and experimental research, the technical data of the new type of composite sleeper is preliminarily established, which provides a reliable basis for market development, and further promotes the development of urban transportation track in the direction of environmental protection, energy saving, green and other national initiatives.

3. Specific implementation method

3.1 Constructing a practical teaching curriculum system

According to the teaching law of "theory-practice-re-theory-re-practice", both theoretical teaching and practical operation are emphasized. We also need to formulate independent teaching plans, carefully design teaching plans, and standardize class time requirements and standards[5]. At the same time, we also need to increase the opening of laboratories for undergraduates, and encourage students to learn and innovate independently.

Take this practice as an example: before the practice is carried out, the teacher team conducts the analysis of the mechanical properties of the plastic composite track and the optimization design, including the calculation software and mathematical analysis research. Through theoretical analysis and experimental research, the technical data of the new type of rubber sleeper are initially obtained, and a scientific theoretical teaching syllabus and practical guidance scheme are established.

During the experiment, the students walked into the laboratory of our school many times for practical operation. Students obtain static analysis data through theoretical analysis and modeling. According to the predetermined plan, each experimental part was completed in batches, and the experimental results were recorded and compared and analyzed. Finally, comprehensive theoretical analysis and experimental operation are carried out to study the applicability of plastic rubber sleepers.

3.2 Promote school-enterprise resource sharing

The design of practical courses should be close to the actual engineering, give full play to the role of practice and training bases inside and outside the school, continue to develop contacts and cooperation with enterprises, cultivate a double-qualified teaching team, and establish diversified cooperative education.

Take this practice as an example: in the course of the practice, the student team also continuously collects the latest research materials and engineering applications in this field at home and abroad[6]. This process is supported by the enterprise, and students can learn the latest application information of rubber composite track efficiently.

3.3 Improve the evaluation mechanism of practical teaching

Establish a scientific practical teaching evaluation mechanism, change the single evaluation method based on practical reports, and conduct inspections from multiple dimensions such as practical performance, practical gains, and innovation ability and team ability.

Take this practice as an example: in the practice summary part, the student team completed two parts of theoretical analysis and experimental operation according to the predetermined technical route, and obtained relevant data and analysis theory accordingly. The team finally sorted out and perfected a practice report[7]. According to the practical teaching evaluation mechanism, the subject has achieved good results.

4. Analysis of the application effect of the new system of practical teaching

4.1 Effectiveness of the new system

The practical teaching system allows students to deeply understand the basic process of engineering practice and scientific research, and learn the basic methods of scientific research in railway engineering. Students said that through this

course, they deeply realized the charm of practice and scientific research, and learned from it a rigorous scientific research attitude, perseverance research spirit, and practical courage to dare to innovate.

According to the judging mechanism under the new system, the student team combines the knowledge learned with practice, and initially has strong innovation ability. Its subject has been supported by the Hunan Provincial Project of the Innovation and Entrepreneurship Training Program for College Students, and has achieved good teaching results.

4.2 The new system is insufficient

During the initial establishment of the system, the practical part was overemphasized, and the importance of theoretical knowledge was underestimated. Due to the lack of knowledge of students and the unfamiliarity of modeling procedures, the progress of the previous projects was relatively slow.

Teachers and student teams summarize their own problems and adjust their learning methods. Under the guidance of teachers, students gradually exercise their ability to discover and solve problems, so that the practice project can be carried out smoothly, and finally the expected results can be achieved. This also prompts us to optimize the new system and combine theoretical knowledge with practical operations.

5. Conclusion

In order to achieve the goal of transforming railway engineering professional education from "extensive" training to "excellence" training and creating outstanding engineers in railway engineering, we must not only pass the theoretical teaching, but also work hard in practical teaching. The new system of practical teaching for railway engineering majors is based on the construction of a practical teaching curriculum system, the improvement of the practical teaching evaluation mechanism, and the promotion of school-enterprise resource sharing, and has achieved good results in specific topics. This research inspires educators to constantly reflect on teaching methods, improve the teaching system, and ensure that the talent supply structure for training matches the talent demand structure of the society.

This research can inspire educators to constantly reflect on teaching methods, improve the teaching system, and ensure that the talent supply structure for training matches the talent demand structure of the society.

Acknowledgment

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Research on the Complexity Characteristics of Urban Metro Network Based on Complex Network Theory

Jiakun Wu, Xiaohong Yin

College of Economics and Management, Liaoning University of Technology, Jinzhou 121001, China.

Abstract：It is to provide decision support for later planning of metro network. Firstly, the space-L method is used to model the metro network topology. Secondly, four different indicators are used to analyze the complexity of metro network. The results show that the degree of metro network nodes in Xuzhou is generally low, and the degree distribution and power distribution are quite different. The network has no scale network properties. In Xuzhou metro network, the path between random station pairs is long, and the degree of node aggregation is low. There is a positive correlation between degree and betweenness, which can make more accurate importance assessment of the site.

Keywords：Complex Network; Metro Network; Scale-Free Network

Introduction

In recent years, subway traffic has attracted more and more cities to start the construction of subway traffic facilities because of its characteristics of safety, speed and price. It has also attracted many domestic and foreign scholars to carry out a series of studies on urban metro network. LATORA[1] studied the characteristics of Boston metro network. Based on the reliability theory, GAO[2] established a reliability model based on the simulated rail transit network, and systematically evaluated the invulnerability of the network structure. YE[3] quantitatively analyzed the vulnerability characteristics of Chongqing rail transit network, and identified key subway stations according to the quantitative results. YUAN[4] believed that the interference of the external environment will also increase the complexity of the metro network. DENG[5] found that Nanjing rail transit network has the characteristics of scale-free network and small world network. WANG[6] analyzed the vulnerability of rail transit network by removing subway stations. Based on three different indicators, Zhang[7] made a comparative analysis of the evolution process of metro network complexity in Shanghai, Beijing and Guangzhou. LAI[8] verified that Fuzhou metro network is a scale-free network based on the complex network theory, and the network satisfies the related properties of the small-world network. ZHENG[9] verified the complex characteristics of Shanghai metro network according to the parameters such as node degree, average shortest path of network and clustering coefficient.

In summary, the research on metro network is of certain significance, but there are few studies on Xuzhou metro network. Under this background, this paper analyzes the complexity of Xuzhou metro network, which can provide reference for the planning and maintenance of Xuzhou metro network.

1. Construction of Urban Metro Network Model

1.1 Metro network topology modeling

According to the theory of complex network, the structure of urban metro network is abstracted to form a simple and clear two-dimensional graph. At present, the main topology is space-L, space-P, space-R and so on. In order to better reflect the connection and structure between urban subway stations, this paper uses the space-L method to construct the structural topology of urban subway traffic network.

1.2 Statistical parameters of metro network complexity

1.2.1 Degree indicators

The degree index of complex network refers to the scale of the direct connection between the node and other nodes, which can also be defined as the number of neighbors of the node. The more neighbors of the node, the greater the degree.

The degree can directly reflect the importance of the node in the network, and there are also indicators such as average degree and cumulative degree. The definition of degree is as follows:

$$k_i = \sum h_{ij} \qquad \text{* MERGEFORMAT (1)}$$

In the formula: when h_{ij} values 1, the representative node is the neighbor of the node, otherwise 0.

According to the degree index data of all nodes in the network, the average degree index value can be further calculated, which is expressed as follows:

$$\langle k \rangle = \frac{\sum_{i=1}^{N} k_i}{N} \qquad \text{* MERGEFORMAT (2)}$$

The cumulative degree index is the probability that a node in the network is not less than a certain degree value, which can reflect the degree distribution of nodes in the network and is a global index. It is defined as follows:

$$P_k(K > k) = \sum_{k_t > k}^{\infty} p(k_t) \qquad \text{* MERGEFORMAT (3)}$$

In the formula: $p(k)$ is the distribution probability of nodes when the degree value is k.

1.2.2 Shortest path index

Among the multiple routes between node pairs, the route with the least number of edges is the shortest path d_{ii}, and the corresponding number of edges is the length.

1.2.3 Intermediaries

In the network, the larger the betweenness, the more can reflect the influence of the relevant network nodes. The size of the betweenness depends on the size of the shortest path on the corresponding node. The specific calculation formula is as follows:

$$B_i = \sum_{\substack{t \neq j \neq i \\ t < j}} \frac{N_d^{tj}(i)}{N_d^{tj}} \qquad \text{* MERGEFORMAT (4)}$$

In the formula: molecules and denominators are the shortest path number between nodes and without nodes.

1.2.4 Clustering coefficient index

In order to reflect the distribution of nodes in the network, the clustering coefficient index is used to evaluate the closeness of links between network nodes, which is defined as follows:

$$C_i = \frac{2E_i}{k_i(k_i - 1)} \qquad \text{* MERGEFORMAT (5)}$$

In the formula: where k_i is the number of neighbors of node i and E_i is the number of edges connecting node i to all neighbors at present.

According to the clustering coefficient index data of all nodes in the network, the average clustering coefficient index value of the network can be further calculated, which is expressed as follows:

$$C = \frac{\sum C_i}{N} \qquad \text{* MERGEFORMAT (6)}$$

2. Complexity analysis of Xuzhou metro network based on space-L model

2.1 Metro network topology modeling

According to the recent subway planning scheme of Xuzhou City, six subway lines will be completed, namely, Lines 1–6, among which Lines 1–3 have already realized actual operation. According to the recent planning of Xuzhou subway project, this paper selects subway lines 1–6 to construct the subway traffic network, and uses the space method to construct the two-dimensional topology of Xuzhou metro network, as shown in Figure 1. According to the node size of Xuzhou metro network, 100×100 adjacency matrix can be constructed.

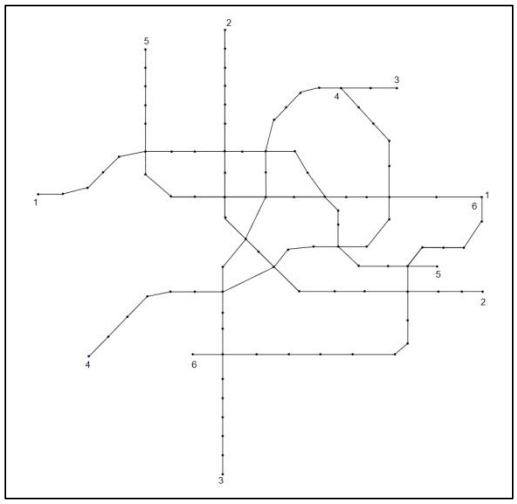

Fig.1 Topology of Xuzhou Metro Network

Description of topology modeling of Xuzhou metro network structure:

1) Xuzhou metro network is under construction. This paper takes the recent planning of Xuzhou metro network as the analysis object.

2) Without considering factors such as operation flow, train number and train type, only the structure of metro network itself is studied.

3) Although in the actual subway operation, the train in the line runs two-way, but taking into account the two-way symmetry of passenger flow, so the metro network to deal with the direction, the establishment of undirected network.

2.2 Subway complexity analysis

2.2.1 Degree distribution

By statistics, Xuzhou metro network contains 100 different stations, with 212 network edges, Figure 2 statistics the distribution probability of different degrees. There are more than 85 % of the nodes whose degree value is not higher than 3. Among them, the degree of 9 sites is 1, the degree of 76 sites is 2, the degree of 3 nodes is only 1, and the degree of 4 nodes is 14. The overall average degree of the network is 2.2.

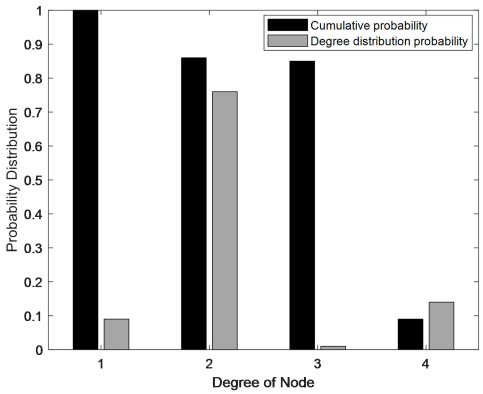

Fig.2 Statistics of probability distribution of node degree

In the study of complex networks, it is considered that if the node degree distribution of the network is similar to the power distribution, it has the property of scale-free network[10]. Therefore, the function fitting experiment is carried out on the cumulative degree distribution of metro network nodes in Xuzhou City. The results show that the fitting degree of Gaussian function is the highest, $R^2 = 0.8212$, and the fitting effect of power function is the worst, and R^2 is only 0.4953. The reason may be that in the site selection of subway stations, due to the influence of objective factors such as environment and economy, it cannot be carried out preferentially, so it does not have scale-free network characteristics.

2.2.2 Distance distribution

Figure 3 shows the distribution of the shortest path of Xuzhou metro network. According to the data in the figure, the longest and shortest path length passed between the two stations in Xuzhou metro network is 22 connections, which indicates that the diameter of the network is 22. According to MATLAB calculation, the average shortest path of the network is 9.1523, which has a large gap with the network diameter. In addition, 54 % of the shortest path length is lower than the average shortest path, which reflects the low traffic convenience of Xuzhou metro network.

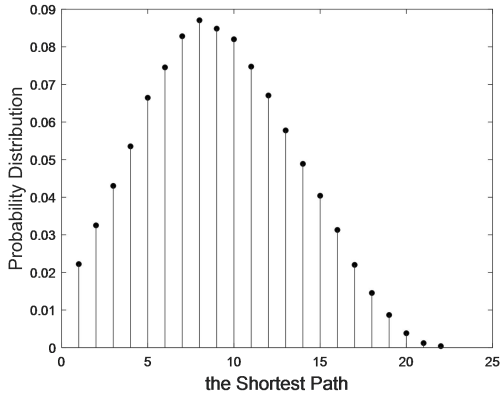

Fig.3 Statistical chart of shortest path probability distribution

2.2.3 Cluster analysis

When analyzing the clustering degree of metro network, it is found that the clustering coefficient of Xuzhou metro network is 0, and the distribution of nodes in the network is loose and the degree of aggregation is low. In order to analyze the aggregation degree of network nodes more accurately, the connectivity index is introduced, which is defined as follows:

$$z = \frac{E}{3(n-2)} \qquad \text{* MERGEFORMAT (7)}$$

In the formula: z is connectivity, molecular and denominator are the number of edges and maximum achievable edges of the metro network.

Through calculation, the connectivity of Xuzhou metro network is 0.7211, indicating that its connectivity level is high. In addition, the network data is imported into pajek software analysis, and it is found that Xuzhou metro network contains multiple circles, each circle structure contains at least four different subway stations, as shown in Figure 4. The triangle structure formed between nodes is beneficial to improve the stability and operation efficiency of the network[11]. Therefore, in the construction of Xuzhou subway, the existing circle structure can be adjusted to improve the connectivity and aggregation of the network.

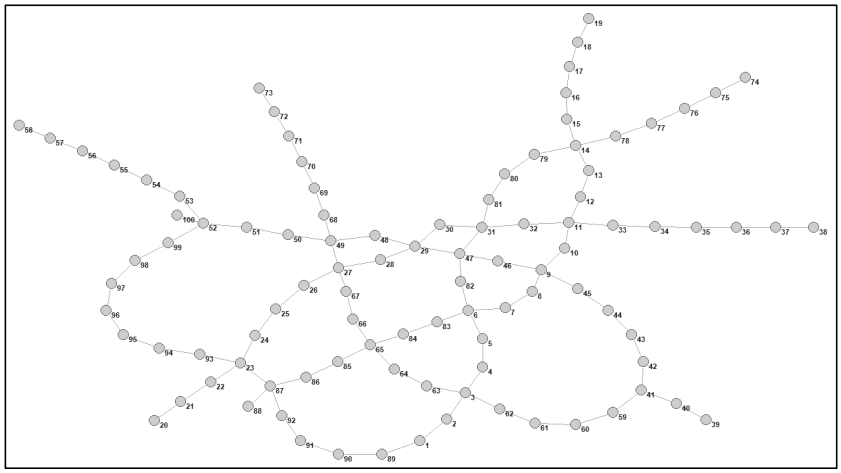

Fig.4 Node distribution map of Xuzhou metro network based on pajek software

2.2.4 Intermediary distribution analysis

The medians of Xuzhou metro network nodes are normalized and summarized in Table 1 below. The results show that 32% of the stations in the network fluctuate between 0-0.02, including 9 metro stations with medians of 0. Most of these nodes are far away from the central area of the metro network. 34% of the nodes fluctuate between 0.02-0.04, and 16% of the stations are in the interval of 0.04-0.06, There are only 5 nodes with an intermediate number of more than 0.1, and the proportion of nodes in the interval of 0.06-0.08 is the lowest, only 4%.

Table 1 Summary statistics of betweenness distribution

Betweenness	Node ratio	Betweenness	Node ratio
0-0.02	0.32	0.06-0.08	0.04
0.02-0.04	0.34	0.08-0.10	0.11
0.04-0.06	0.16	below 0.10	0.05

Figure 5 compares and analyzes the distribution of betweenness under different node degrees in Xuzhou metro network. It is found that the higher the degree value of the node, the higher the starting point of the corresponding betweenness. In addition, Figure 6 shows the data fitting curve of betweenness and degree. It can be seen that there is a positive correlation between the degree index and betweenness index of Xuzhou subway station, which reflects that the node degree and betweenness have certain similarity in the evaluation of metro network stations, and the comprehensive use of the two indicators can more objectively screen out key stations.

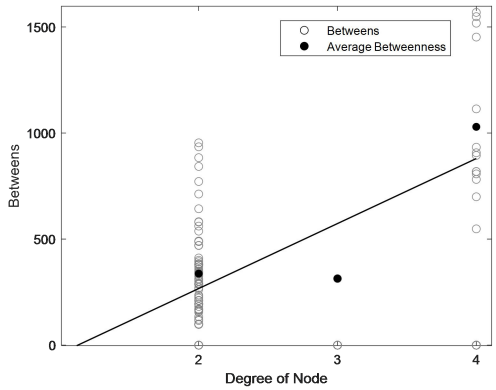

Fig.5 Intermediary Distribution Statistics under Different Degree Indicators

3. Conclusion

Based on the complex network, this paper analyzes the complexity of Xuzhou metro network. The results show that the degree of Xuzhou metro network does not meet the requirements of power distribution. From the data, Xuzhou metro network has no scale-free network characteristics. Xuzhou metro network has multiple circular structures, but each contains more stations, so the network structure has larger optimization space. With the continuous construction of subway engineering, the structure of metro network will become more and more complex. The study of metro network structure can provide reasonable reference information for subway planning.

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Research on the Difficulties and Countermeasures of Small-City Cultivation Towns in Urban Construction-- Taking H Town as an Example

Ting Ge

China Jiliang University, Hangzhou 310018, China.

Abstract: Compared with general towns, the economic development level is higher, the functions are increasingly richer, and the management level is stronger in small-city cultivation towns. After experiencing small-city cultivation, mega towns have developed rapidly, while some difficulties also emerged in urban construction, such as unreasonable planning, insufficient urban functions, low quality of infrastructure, inadequate level of urban management, etc. With the unceasing development of urbanization, it is urgent to promote reforms in planning and construction from a high starting point, high-intensity investment and financing, high-standard construction projects, high-performance management, etc.

Keywords: Small-City Cultivation; Urban Construction; Countermeasure

1. Introduction

In 2010, Zhejiang took the lead in carrying out the strategic decision of small-city cultivation pilot in China. By focusing on industrial agglomeration, population concentration, function integration and resource intensification, and adhering to the principle of people's livelihood and ecology first, it has carried out two rounds of reforms to expand the power of strong towns successively, at the same time, a primary financial system was innovated and established, and a number of diversified small-city cultivation towns were formed.

Reform is a kind of institutional change, which is driven by exogenous and endogenous dynamic factors[1]. H town is in the middle of Zhejiang Province, which is one of the first batch of small-city cultivation pilot towns in Zhejiang with the characteristics of 'industrialization, film and television, tourism'. In the process of small-city cultivation, urban construction in H town has entered a new stage of development, investment has intensified, infrastructure facilities have been improved, traffic network has been initially formed, urban management has been gradually standardized, comprehensive strength has been rapidly improved, and it has opened the road of transformation and development from town to city.

Over the years, the economic and social construction has developed too rapidly, especially the ultra-convention development of the film and television industry, which has brought some difficulties while giving a strong boost to urban construction.

2. Urban construction difficulties of small-city cultivation towns

2.1 Unreasonable planning

According to the construction requirements of small cities, urban roads, government business enterprises, trade facilities, industrial parks, residence communities need have reasonable layout, and guide the movement of population, achieve precision management through planning layout. For a long time, adhering to the principle of 'efficiency first', like other countries in China, H town focuses on economic development and construction speed, pays little attention to planning layout, or even has no time to plan, let alone the planning management, therefore, there are many defects and deficiencies against city standards.

2.2 Insufficient urban functions.

Urban infrastructure construction is comparatively lagged behind, public environmental facilities are insufficient, the number of sewage networks, parking facilities and landscaping is less, greening rate and greening grade in towns don't match up with film and television, and tourism.

2.3 Low quality of infrastructure.

The road frames are mostly urban sprawl type construction with low construction level, some are not even constructed according to engineering specifications. The construction of commercial service facilities is lagged behind and the management level is low, moreover, farm product markets, supermarkets and shopping centers are not uniformly planned, which are still at the level of township development.

2.4 Inadequate level of urban management.

On the one hand, there are very few managers. The economic aggregate of H town has exceeded one third of that of the city, and the township of H town is equivalent to the urban areas of the city ten years ago, but urban management officers, traffic polices, market regulation officers are seriously inadequate, and there are few professionals in municipal facilities and institutions such as landscaping and street light management. On the other hand, the implementation of systems is not in place. Due to shortage of personnel, low professional level, force of habit and low standards, the management is not well and effective. The relevant departments often carry out centralized and special rectification, but long-term-effect management is lack after rectification and the overall scene of town has not been greatly improved.

3. Breakthrough in urban construction difficulties of small-city cultivation towns

3.1 Planning and construction from a high starting point.

Planning is positioning, is the wealth of urban construction and foundation of sustainable development. Promote integrated planning, enhance the resource complementarity between towns and urban areas, conduct scientific site selection for high speed railway station lines and intercity rail transit facilities with high-speed transportation network as the link, promote the urban integration of towns and urban areas. Make a control planning, form reasonable urban spatial structures, make clear the layout of individual land use of residential land, industrial land, land for public management and public service facilities, and land for commercial and business facilities, to provide the basis for legal construction.Refine construction planning. Carry out systematic planning for road surfaces, plantings, sidewalks, street facades and street lamps, letting each node and each building to make a contribution to the improvement of overall image of the towns. Accumulate small victories into big victories. Improve the special planning of road traffic. Improve the frameworks of urban external transportation network, construct internal and external traffic circles, improve the traffic network in the towns.Pay attention to the organic renewal planning of old towns. Carry out the organic transformation of the early residential areas, prevent large-scale demolition or construction, reduce the building density moderately, improve environmental quality, and retain the texture of traditional neighborhood layouts and rural features as much as possible. Renovate the rivers and plantings, protect and restore the original water system patterns. Build green space in the streets, riverside greenbelts and petty street gardens according to the local conditions, improve the greening rate of old towns. Protect the ancient buildings with historical and artistic values, make historic buildings better integrated into the towns.

3.2 High-intensity investment and financing.

Government agencies achieve effective coordination and integration through full communication and cooperation among organizations[2]. Give full play to the ‘three-in-one’ role of ‘government leading force, enterprise main force, market foundation force’, raise the construction fund by striving for a part from the superior departments, getting a part from the government investment, financing a part from the market and borrowing a part from banks. Deepen and improve the government investment and financing system. Strengthen the financing construction management of government-funded projects, establish and improve the government’s standardized financing mechanism. Promote the construction of public services and infrastructure projects with PPP and other models. Strive for projects and funds from the superior departments to relieve the pressure of government finance. Establish a private investment guidance mechanism. Demonstrate, guide and encourage private capital investment in urban construction, promote the film and television cultural tourism service projects with short cycle and fast recovery such as characteristic urban blocks, characteristic industries, characteristic villages, accommodation industry, renovation of old industrial areas, to improve cultural taste and image of the towns while bringing reasonable return to social capital.

3.3 High-standard construction projects.

High-standard construction is adhering to the principle of ‘quality first’. Before the project implementation, display the planning and design schemes to the public, widely solicit and adopt opinions from the general public, experts, scholars and all sectors of society; During the project implementation, the design standards need to be strictly abided by, the construction specifications need to be strictly implemented, and the project supervision needs to be strictly carried out in materials, construction, beautification, visual pollution remediation and vegetation restoration; Before the projects are completed and opened, organize the experts and indigenous representatives in different fields to ‘find faults’, so as to make every project able to stand the test of citizens, experts and history, let them become the good projects affirmed by experts and the public. On the premise of respecting the planning, establish the symbolic cultural buildings such as conference and exhibition centers, libraries, science and technology exhibition halls, museums, cultural centers, theatres, coach centers and schools that serve the entire region and reflect regional cultural characteristics, to enhance the cultural function of towns. In the reconstruction of characteristic rural blocks and villages, integrate more film and television cultural tourism elements to make them become the landmarks and symbols of the towns and enhance the influence of the towns.

3.4 High-performance management.

Conduct strict management in accordance with the laws, integrate law enforcement forces, establish and improve the joint law enforcement and supervision system based on coordinated administrative law enforcement and market supervision. Improve urban administrative laws and regulations, carry out examination and approval, management, supervision and punishment according to the laws. Strictly regulate, investigate and handle key issues in urban management, including construction land, planning management, traffic order, administration of road, sanitation and cleaning, public security, etc, to benefit more citizens. Refine quality management. Deepen the refined management of societal grids, apply management to services, subdivide public management and service objects, achieve the pattern of four layers in each network, provide humanized and personalized public services with high quality and efficiency. People-based long-term management. Promote and improve urban management system and mechanism, build a platform for public participation in management, expand channels for people to participate in management, create new ways for people to participate in management, make the services more targeted, and make each management method long-term and dynamic.

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Research on Spatial Optimization of Shopping Center under the Background of Epidemic Situation : A Case Study of Weilaishi Shopping Center in Handan

Hongguo Ren, Tianyu Ma*

Hebei University of Engineering, Handan 056038, China.

Abstract: In the current social background of frequent epidemics, shopping centers, as commercial buildings with a large number of people, it is very important to reduce the risk of environmental infection. This paper takes the Weilaishi Shopping Center in Handan as an example, summarizes the epidemic prevention status of five types of spatial nodes through field investigation, and analyzes the shortcomings of the existing emergency design of the Weilaishi Shopping Center. Based on the analysis results, this paper puts forward the optimization strategy from the spatial level, which provides a certain reference value for the research on the improvement of shopping center space environment emergency capability.

Keywords: Epidemic Prevention and Control; Shopping Center; Spatial Optimization

1. Introduction

In the current era of normalization of COVID-19 epidemic prevention and control, the epidemic has had a far-reaching impact on people's consumption habits and lifestyle, and catalyzed consumers' strong demands for health protection. Consumers put forward higher requirements for the design of physical space in shopping centers. During the epidemic, shopping centers in domestic cities at all levels responded positively to consumer demand through measures such as the eliminate virus maintenance of hardware facilities and the reservation of corresponding epidemic prevention space. The safety and health of the shopping environment will become the primary consideration for the future development of shopping centers. The characteristics of shopping centers with traditional closed design may change, and consumers' fear of dense space will be enlarged unprecedentedly. Shopping centers urgently need to make changes in the spatial layout and the organization of the flow of people.

2. Investigation

2.1 Study Area

The Weilaishi Shopping Center is located in the south of the main urban area of Handan City. As an urban life enjoyment center, it embraces 31 communities within 3 kilometers of the surrounding area, creating a fashion mecca for local residents. Through the method of on-the-spot investigation, this study fully understands the spatial organization form and plane drawings of the Weilaishi Shopping Center, and focuses on observing and recording the epidemic prevention and emergency situation of the important space nodes.

2.2 Result Analysis

In this paper, the spatial emergency research of the Weilaishi Shopping Center is mainly analyzed from five types of spatial nodes: foyer space, atrium space, rest space, corridor space and vertical traffic space. The results are as follows:

(1) Foyer space: The Weilaishi Shopping Center has a total of four halls, of which the south foyer is the largest, but nearly half of the space in this area is occupied by shopping carts, resulting in a great reduction of consumers' activity space. This can easily cause congestion among consumers. Once there is an infected person, the probability of transmission of the disease will rise rapidly. The area of the west foyer is smaller than that of the south foyer, but the number of consumers

passing through here is relatively small. The two foyer spaces on the north side exist as passageways, and consumers often walk in a clear direction, which can basically maintain the epidemic prevention distance between pedestrians.

(2) Atrium space: There are three rectangular atriums in the Weilaishi Shopping Center. From the perspective of functional layout, the main atrium is used for publicity of daily activities, and the phenomenon of instantaneous crowd gathering often occurs in this area during the holidays. With the main atrium as the central axis, the two sub-atriums are symmetrically distributed on both sides of the main atrium. Sometimes the two sub-atrium spaces are used as commodity display areas, which greatly improves the utilization rate of atrium space to a certain extent. In addition, pedestrian congestion rarely occurs in the atrium space, and the environmental safety of the area is relatively high.

(3) Rest space: There are several rest areas in the Weilaishi Shopping Center, which have two main characteristics in distribution: one is to arrange rest seats according to the pedestrian line, so that consumers can easily reach the rest space, avoiding the feeling of crowding and clutter, thus realizing the possibility of keeping a safe distance for pedestrians under the epidemic. The second is to create a characteristic landscape in the rest space, creating a comfortable and pleasant atmosphere, but also using plant configuration to reduce the spread of the virus to a certain extent.

(4) Corridor space: The corridor space of the Weilaishi Shopping Center is very rich in form and layout, with multiple corridors set up between different spaces in addition to the main passageway, and the internal moving lines are flexible and transparent. In addition, a number of open nodes are interspersed in the corridor space, resulting in a natural transition between the corridor space and other auxiliary areas. However, the functions of these open nodes are relatively simple, and the functional settings combined with epidemic prevention are not taken into account.

(5) Vertical traffic space: The vertical traffic inside the Weilaishi Shopping Center is mainly escalators and elevators, which are arranged near the three atriums. During the research, it is found that some staff regularly clean and disinfect the escalator handrails, which can effectively reduce the probability of virus transmission in these spaces to a certain extent.

3. Spatial optimization strategy

3.1 Foyer space

The foyer space is the intersection of the indoor and outdoor environment of the building, which not only has the transitional function of dispersing pedestrians, but also represents the first impression of consumers on the shopping center[1]. Under the requirements of epidemic prevention and control, health detection function has been added to the space, and consumers need to show personal health codes, itinerary codes and measure body temperature in cooperation with epidemic prevention work after entering. As a result, the original scale and streamline organization of the space can no longer meet the needs. In addition, considering that there are basically only two kinds of reverse pedestrian streamline in the foyer space, the frequency of contact between pedestrians is higher, and the risk of virus transmission is also higher.

3.2 Atrium Space

Atrium space as the gathering area of shopping center, reducing the sense of space congestion during the epidemic will be the focus of emergency design optimization. First of all, it is necessary to flexibly divide the atrium space from other functional spaces in order to reduce the retention of pedestrians in some areas. Secondly, an electronic partition that can monitor the body temperature of pedestrians can be set up in the connecting area between the atrium and the escalator, and the atrium space can be divided into inner and outer areas. Among them, the inner area can meet a variety of consumer activities, while the outer area is mainly used as a supplement to the traffic space to guide pedestrians up and down the stairs in an orderly manner. In addition, we can also consider setting eye-catching guide signs in the connection area to make consumers clear about the space attributes they are about to face and reduce the residence time in the connection area[2].

3.3 Rest Space

Rest space as an important auxiliary space of the shopping center, its location and the form of seats will become an important consideration for epidemic prevention and control. According to the research, the distribution location of rest space can be divided into two types: one is the mixed type which is arranged in combination with other functional spaces. Due to the lack of spatial boundary sense, a large number of pedestrians crossing is easy to form a dangerous area of prevention and control. The optimization of this kind of rest space should mainly start with the establishment of regional boundary sense, and use partition or green plants to flexibly divide the rest area without changing the main structure of the building. The second is the independent type placed separately, this type of rest area can provide a more comfortable environment for consumers in the region. The optimization of this kind of rest space should mainly start with adjusting the form of seat placement, and realize the possibility of maintaining a safe epidemic prevention distance between people.

3.4 Corridor Space

The corridor space is a road that connects various commercial stores on the same floor of the shopping center, carrying a large flow of people all the time[3]. In this regard, we should start with balancing the flow of people in each region, adjust the scale of the corridor and the form of corner, and transform some over-stiff acute angle space into a moving line transition smooth obtuse angle space. As a result, the reaction time of pedestrian corner is increased, so that it is convenient for pedestrians to plan the route in advance, avoid the opposite pedestrians, reduce pedestrian conflicts and reduce the probability of contact.

3.5 Vertical Traffic Space

The vertical traffic space of shopping centers is mostly arranged in combination with the atrium space. After fully considering the needs of consumer behavior, it is found that most of the pedestrians who take the elevator are used to stay in the traffic area, which can easily lead to the phenomenon of crowd detention in the traffic area. In view of this situation, buffer space can be set up in traffic areas with more people, such as the transfer platform area of escalators, so as to increase the pedestrian movement space. At the same time, it can also be considered to configure a disinfection spray device combined with the buffer space to facilitate the work of eliminate virus in the event of an epidemic.

4. Conclusion

At the stage of regular prevention and control of the epidemic, the research on improving the emergency response capacity of shopping centers conforms to the development background of the times. Emphasize the multiple relationships among "business environment", "consumer" and "city", adapt to the changes of social environment, and provide reference for the renewal and optimization of shopping centers. At the same time, it also provides new ideas for the healthy development and long-term vitality of the city in the future.

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Construction of Emergency Adaptability Evaluation Index System for High-Rise Residential Buildings Based on Major Public Health Emergencies

Hongguo Ren, Guangchao Hong, Ruili Wang

School of Architecture and Art, Hebei University of Engineering, Handan 056038, China.

Abstract: With the continuous variation and increasing infectivity of novel coronavirus, people are forced to stay at home for a long time, and their lives and lives are constantly threatened by the virus. In order to provide scientific basis for evaluating and optimizing the epidemic prevention and control capability of high-rise residential buildings under public health emergencies, the evaluation index system of emergency adaptive performance of high-rise residential buildings is constructed. First of all, this paper uses Delphi method to consult experts in the form of questionnaire survey, and determines the framework of evaluation index system through two rounds of index screening process. Then use the analytic hierarchy process to determine the weight value of the evaluation index system, and finally check the consistency of the index weight. As a result, the emergency adaptation performance evaluation system of high-rise residential buildings under public health emergencies is obtained.

Keywords: Public Health Emergency; High-Rise Housing; Delphi Method; Analytic Hierarchy Process

Introduction

From the beginning of the outbreak in Wuhan to the complete closure of Shanghai today, there is still a phenomenon of large-scale spread of the epidemic all over the country[1]. The outbreak of novel coronavirus had a great impact on people's life and life safety,because of the wide spread and strong infectivity of the epidemic[2], people were forced to start a long life of home isolation. High-rise housing is one of the important living forms in the urban development of our country. How to improve the adaptability of high-rise residential buildings under public health emergencies has become an urgent problem to be solved[3].

1. The characteristics of high-rise residential buildings and the restrictive factors under the epidemic situation

After entering the 21 century, China began large-scale urban construction, and the number of high-rise residential buildings is also growing rapidly[4]. High-rise residential building is one of the effective ways to solve the contradiction between human and land. According to the Code for Housing Design： 7-9 floors are medium-and high-rise residential buildings, and 10 floors and above are high-rise residential buildings[5]. High-rise residential buildings generally adopt the structure of frame shear wall, which is usually divided into two types: plate type and tower type. Among them, the plate high-rise residence is long from east to west, short from north to south, and the plane is rectangular, which is composed of a number of units and each unit is provided with stairs and elevators. Tower high-rise housing mainly refers to the shared stairs, elevators as the core, around the public transport space layout of multiple high-rise residential buildings.

Although high-rise housing can solve the contradiction between people and land, it has become a malpractice during the epidemic because of the large population. Due to the high population density and the single mode of travel, the residents can only enter and leave the house through the narrow elevator space or corridor space, which makes the virus more likely to cross-infect in the interior space of the house.In addition, the ventilation, lighting and other deficiencies in the building environment of high-rise residential buildings make it become a restricting factor for people's epidemic prevention and control, life safety and health during the epidemic.

2. Selection process of emergency adaptation performance evaluation index system for high-rise residential buildings

2.1 Hierarchical framework of index system

Based on the development characteristics of high-rise residential buildings and the influencing factors under the epidemic situation, the evaluation index system framework of emergency adaptation performance of high-rise residential buildings based on major public health emergencies is established according to the hierarchical structure：

1) Target layer: the overall evaluation of emergency adaptation performance of high-rise residential buildings based on major public health emergencies, indicating the impact of index factors on high-rise residential buildings.

2) Criterion layer: through the induction and summary of recent literature through literature analysis, the index experience is pre-selected, which is preliminarily divided into three levels: intelligent design, residential environment and space design.

3) Index layer: according to the design principle of the index and the setting of the criterion layer, the influence intensity of the influencing factors in each operation stage is evaluated.

2.2 Comprehensive evaluation and screening system for expert consultation

This study selected 10 experts from universities and design institutes, as well as 5 high-level residents with university degree or above who worked in related industries to form an expert group.

Table 1 Basic information of experts

Project	classification	Numberof people	Constituent ratio（%）
Gender	Male	9	60
	Female	6	40
Age	30-40	3	20
	41-50	9	60
	Above 51	3	20
Degree	Undergraduate course	5	33
	Master's degree	7	47
	Doctoral graduate student	3	20
Engage in the field	Design of high-rise residential buildings	3	20
	Fine design of residence	2	13
	Building physical environment	2	13
	Research on architectural technology	2	20
	Architectural design and research institute	2	13
	Construction aspect	4	27

3. Screening results of emergency adaptation performance evaluation system for high-rise residential buildings

3.1 Determination of the framework of index system

In the first round, 15 questionnaires were sent out, 15 were recovered, 15 were valid, and the recovery rate of valid questionnaires was 100%. The situation of the second round of the questionnaire is the same as that of the first round. Then the results of the previous and second surveys were analyzed and sorted out and fed back to 15 experts for reference. The effective recovery rate of the questionnaire is in accordance with the statistical law. According to the results of expert

consultation, the framework of emergency adaptation performance evaluation system of high-rise residential buildings under sudden public health is finally determined.

Table 2 Index framework of evaluation system

Evaluation system of emergency adaptation performance of high-rise residential buildings				
Total target layer A	Criterion layer B	Sub-rule layerC	Index layer D	Index description
Emergency adaptation performance Evaluation of High-rise Residential buildings	Health and epidemic prevention	Indoor hygiene of residence	Indoor disinfection facilities	Perfect disinfection equipment, equipped with alcohol and other tools
			Domestic garbage	The garbage is hidden and the transportation streamline is independent
			Locker	Masks, clothing, shoes
			Hand sink	Porch, kitchen, bathroom
		Public area health	Publicdisinfection facility	The facilities in the corridor and elevator are perfect
			Public dustbin	Garbage cleaning and disinfection speed, garbage disposal streamline
			Exhaust degree	Adequate ventilation equipment
		Hygiene at the bottom entrance	Disinfection facility	Perfect disinfection equipment at the entrance
			Public mailbox	Disinfect regularly and pick up mail in different periods
			Public handrail	Regular disinfection to reduce direct contact
			Sundries	Less sundries and open space
	Space design	Applicability of public areas	Entrance and exit space	Set up a canopy
				Entrance setting platform, ≧1500mm
				The door is opened in a non-contact manner
				Have good light

			Aisle space	The wheelchair turning space is set up in the node and near-end position
				Corridor width≧1200mm
			Vertical traffic void	At least one elevator size≧1500mm*1600mm,Clear width of car door≧900mm,Can hold stretcher
				The elevator is equipped with ventilation equipment
				Net width of stair run≧1100mm、Platform width≧1200mm
		Applicability of condom space	Functional integrity of condom	Lying, kitchen, bathroom are complete
				Set up other functional spaces such as porch, storage, balcony
			The rationality of the layout in the suit	The condom contains the transition space for entering the home
				The spatial layout is compact and the streamline is reasonable
				At least one bedroom contains a bathroom
				Bathroom dry and wet separation setting
				The bathroom is arranged near the bedroom
				Water seal depth of "reverse bend" of floor drain and water supply and drainage≧5cm
			Practicability of functional space	The shape of the functional space is reasonable and the ratio of the length to the short side of each space≦1.8

				Rational distribution of functional space area
				The internal design of the functional space is reasonable
		Flexibility of condom space	Temporary isolation space	It can be closed as a separate isolation space during the emergency period
			Removable space	There is space for temporary transformation to meet the needs of the family
				Has a transformable independent porch space
	Physical environment	Public space environment	Public area light environment	Natural lighting is good artificial lighting and local lighting are good
			Air environment in public areas	Good natural ventilation and good ventilation
		Indoor environment	Indoor light environment	Good orientation,ratio of living room to bedroom window to floor≧1/7
				Have good natural lighting and sunshine
			Indoor thermal environment	The heating and air conditioning system has good performance
				Local heating equipment is installed in shower room
			Indoor air environment	The natural ventilation in the sleeve is good
				The kitchen has natural lighting and is equipped with mechanical ventilation and check valves, and bathrooms are equipped with mechanical ventilation and check valves

				Set up fresh air system and air quality monitoring and purification equipment
			Indoor visual environment	Avoid line of sight interference, good field of vision
	Intelligent design	Intelligent design of public area	Entrance hall	Cell door face recognition is opened to reduce contact
				Intelligent temperature measurement and body condition detection at home
			Public aisle	Artificial lighting intelligent turn on
				Set up mechanical exhaust system
			Vertical traffic	Artificial lighting intelligent turn on
				The elevator is equipped with intelligent voice to open and reach the floor to reduce contact
				Independent ventilation system is installed inside the elevator to monitor the air quality intelligently
		Indoor intelligent design	Doors and windows	Intelligent opening of door-to-door face recognition to reduce contact; intelligent detection of body temperature data
				Windows open intelligently to meet the daily needs of natural ventilation and sunshine
			HomeAppliances	Artificial lighting intelligent voice or induction control, household appliance

				intelligent control system
				Intelligent Design of Independent fresh Air system
			Furniture	Intelligent design of furniture to meet the diverse needs of family life and increase spatial variability

3.2 Determination of Index weight and consistency Test by Analytic hierarchy process

By using the analytic hierarchy process, the elements of each level are compared, and the questionnaires of each expert are summarized to obtain the evaluation matrix of each level, so as to find out the weight of each level and determine the scoring weight of each expert. and the average value of the same index is calculated, and for quantitative decision-making, the 1-9 scale method is used to determine the importance of each element. According to the judgment matrix, the vector $\overline{W}i$ of the matrix is calculated, and the vector $\overline{W}i$ is normalized to get the eigenvector, that is, the index weight .

$$\overline{W}i = \sqrt[n]{\prod^{n} Aij} \qquad \overline{W}i$$

In order to prevent the weight deviation caused by the inconsistency among the factors in the judgment and evaluation, the change of the eigenvalue of the matrix is used to detect the consistency among the factors. Through weighted calculation, the maximum eigenvalue of the matrix is obtained λmax, the consistency index CI is obtained, and the relative consistency index CR is obtained. if $CR \leqq 0.10$, the matrix is reasonable, there is no contradiction in the scoring process, and the weight result of the index in the matrix is established. If $CR > 0.10$, the consistency test of the matrix fails, and experts need to re-score and repeat the above process until $CR \leqq 0.10$. Through the calculation and statistics of the data of each expert, the average value of all the data of the same index is calculated, and the final weight of the index is obtained.

Table 3 Calculation result of weight of evaluation system

Totaltarget layerA	Criterion layerB	BWeight	Sub-rule layerC	C Weight	Index layerD	DWeight
Emergency adaptation performance Evaluation of High-rise Residential buildings	Health and epidemic prevention	0.4176	Indoor hygiene of residence	0.2776	Disinfection facility	0.1236
					Domestic garbage	0.0339
					Locker	0.0177
					Hand sink	0.0639
			Public area health	0.0958	Disinfection facility	0.0522
					Public dustbin	0.0128
					Exhaust degree	0.0308
			Hygiene at the bottom entrance	0.0441	Disinfection facility	0.0213
					Public mailbox	0.0072
					Public handrail	0.0128
					Sundries	0.0029
	Space design	0.2520	Application of public areas	0.0295	Entrance and exit space	0.0039
					Aisle space	0.0054
					Vertical traffic space	0.0101
			Applicability of condom space	0.1495	Functional integrity of condom	0.0842
					The rationality of the layout in the suit	0.0341
					Practicability of	0.0312

					functional space	
			Variability of condom space	0.0730	Temporary isolation space	0.0589
					Removable space	0.0141
	Physical environment B3	0.2164	Publicspace environment	0.0419	Public area light environment	0.0201
					Air environment in public areas	0.0219
			Indoor environment	0.1745	Indoor light environment	0.0388
					Indoor thermal environment	0.0309
					Indoor air environment	0.0864
					Indoor visual environment	0.0184
	Intelligent design	0.1141	Intelligent design of public area	0.0361	Entrance hall	0.0110
					Public aisle	0.0054
					Vertical traffic	0.0196
			Indoor intelligent design	0.0780	Intelligent doors and windows	0.0378
					Intelligent household appliances	0.0273
					Intelligent furniture	0.0130

4. Conclusion

In this study, on the basis of literature review and summary of the characteristics of high-rise housing and the restrictive factors under the epidemic situation, the Delphi method is applied to construct the system. The emergency adaptive performance evaluation system of high-rise residential buildings under public health emergencies constructed by this method is scientific and practical, and can be used to evaluate the degree of health and epidemic prevention, spatial design, physical environment and intelligent design of high-rise residential buildings. in order to provide some help to the transformation and optimal construction of high-rise residential buildings under the epidemic situation. The goal of the next stage of this study is to use the constructed system to score some high-rise residential buildings under the epidemic, to divide the safety degree of residential buildings under the epidemic situation in a gradient, and to verify the scientificalness and feasibility of the indicators.

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Fund project: Research on risk identification and emergency management of residential buildings from the perspective of COVID-19

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Study on Emergency Reconstruction Design of Industrial Buildings Based on Major Public Health Emergencies

Hongguo Ren, Xiaoyue Yu*

Hebei University of Engineering, Handan 056038, China.

Abstract **:** The repeated sweeping of COVID-19 's epidemic situation has brought severe tests to the medical facilities in various places. Whether the patients can be treated completely by medical facilities has a significant impact on the prevention and treatment of the epidemic. In order to improve the emergency transformation efficiency of industrial buildings in response to major public health emergencies, the feasibility of industrial buildings in emergency transformation is clarified. When the original use nature of industrial buildings is transformed into medical treatment, the needs of medical use should be analyzed, the transformation templates of each functional space should be constructed and different types of streamline should be planned.

Keywords **:** Major Public Health Emergencies; Industrial Building; Emergency Transformation; Reform and Design

Introduction

The global outbreak of the COVID-19 epidemic has prompted people to update the medical treatment system. In order to quickly improve the efficiency of admission and control the number of infections, measures were adopted to transform the existing buildings in the city into square cabin hospitals. As one of the existing building types in the city, industrial buildings are also taken into consideration, and the "Technical Guide for the Construction and Operation of Industrial buildings into Square Cabin Hospitals (trial)" has been issued. It is used to strengthen the guidance for the transformation and new construction of the treatment facilities for COVID-19 patients, so as to further improve the efficiency of the practical application of the guidelines. This paper puts forward a reference for the basic configuration of the epidemic prevention unit in the emergency transformation of industrial buildings, so as to quickly determine the number of people who can be treated after the transformation and quickly determine the composition of each functional zone.

1. The concept of emergency reconstruction of industrial buildings

The emergency transformation design of the industrial building is to change a series of functional properties such as production, transportation and storage originally undertaken by the industrial building into a treatment place with the nature of medical treatment, with the characteristics of rapid transformation and a large number of treatment.

2. Design strategy for emergency reconstruction of industrial buildings

For the specific division and allocation of the interior space of the emergency transformation of industrial buildings, it is necessary to integrate many influencing factors, although the transformation requirements of each section and the corresponding strategies are emphasized in the Guide, however, the space proportion of each zone after the transformation and the space area required for each functional space under it are not put forward. This paper takes "three zones and two channels" as the core design principle of interior space division. According to the relevant provisions of indoor functional zoning design in the Guide and relevant codes and regulations, and combined with the above influencing factors and the relevant dimensions in ergonomics, the composition of the basic functional units of each functional space is put forward. and get the basic unit configuration of epidemic prevention in the clean area, polluted area and semi-polluted area corresponding to doctors and patients.

2.1 Configuration strategy of epidemic prevention unit for emergency reconstruction of industrial buildings

2.1.1 Contaminated Area

For the configuration of the group in the contaminated area, it is mainly divided into two blocks: the patient living area and the medical treatment area, plus the storage auxiliary area and the equipment room, as the name implies, the patient living area contains all the living activities of the patient during the isolation and treatment period; the medical treatment area is the main treatment place equipped with professional medical equipment, medical means or preparation work. The storage auxiliary block is mainly used for the storage of bedding, temporary storage of dirt and storage of patients' personal belongings.

2.1.2 Clean Area

The clean area is mainly for the medical staff to live, rest and work, and contains the area of material operation, so it is divided into the medical living area and the material guarantee area.

2.1.3 Half-contaminated Area

The half-contaminated area is the buffer zone connecting the clean area and the contaminated area, providing medical staff with access to the two blocks, and providing medical staff with space for wearing and removing protective equipment, self-cleaning and disinfection, including buffer zone, dressing cleaning area and storage auxiliary area. among them, the buffer zone is closely related to the contaminated area, and the dressing cleaning area provides perfect disinfection and cleaning supplies for medical staff. The storage space of cleaning and dirt shall be placed in the corresponding position respectively. And for the streamline planning of this area, the incoming and outgoing streamline must be set up separately, do not interfere with each other, and it is best for men and women to be set up separately.

According to the basic functional space of emergency transformation proposed in the Guide and relevant rules and regulations, it is applied to the early design of the interior space of industrial buildings, and the article only considers the most basic operation and use space. in the actual emergency transformation design, the area of each functional space needs to be changed flexibly according to the actual situation.

2.2 Basic configuration of epidemic prevention unit

Taking 50 beds as a ward group, assuming that there are 20 male patients and 30 female patients, the functional spaces of each block in the polluted area are arranged according to the relevant norms and regulations. According to the fact that 1000 patients are 1000 beds, it is necessary to allocate at least 2000250 doctors and 200,000 nurses, it is concluded that the 50-bed ward needs 100.13 doctors and at least 10 nurses, and the number of medical staff in the same shift is determined by the shift time of three shifts, so as to determine the use area of medical staff in the clean area, and combined with the personnel area quota of each functional district in the above three districts. Summarize and draw a basic configuration map of the epidemic prevention unit serving a ward group, in order to form an integrated spatial form, this diagram discharges only 48 beds, as shown in figure 1.

In the functional distribution of this configuration map, the plane layout is based on the common rectangular shape of industrial buildings, and the integrated layout is classified and integrated according to the cleaning properties of each functional zone.

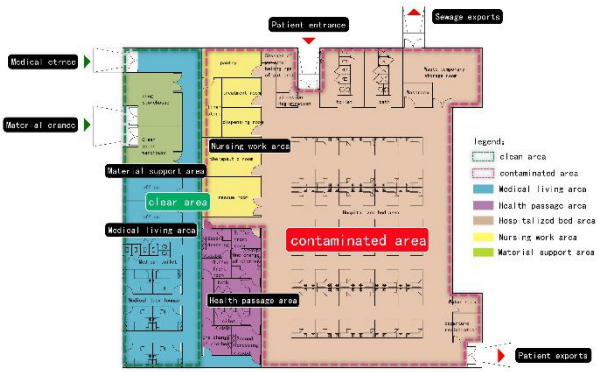

Fig. 1 schematic plan of basic functional space for emergency reconstruction of industrial buildings

2.3 In line with indoor use functions, planning outdoor site zoning

Combined with the division of indoor functional zones for emergency reconstruction of industrial buildings above, and with multiple indoor operation lines and sanitary needs to be met for emergency transformation, the outdoor site is divided into five areas, which are in turn the patient admission and transfer area, which is divided into patient admission, transfer and ambulance disinfection, and the auxiliary area in the contaminated area, which is used to build temporary sanitation facilities and temporary dirt storage space to support patients' life and operation. Emergency materials loading and unloading area for the handling of medical materials and clean materials; medical preparation area for placing large-scale mobile medical precision equipment; medical outdoor distribution area for medical staff count and temporary collection and distribution. For the connection of outdoor sites in various districts, it is also necessary to set up the cleaning isolation according to the cleaning properties of the sites in each district, and under this premise, plan the relevant streamline of the outdoor site, such as clean streamline, doctor-patient streamline, passenger-vehicle streamline and so on.

3. Conclusion

Based on the research direction of emergency transformation of industrial buildings under the background of major public health emergencies, this paper puts forward the "basic unit of epidemic prevention" for the application of industrial buildings in emergency transformation, and provides a reference for the follow-up emergency transformation design of industrial buildings. further standardize the design mode of industrial buildings at the emergency transformation level, and improve the emergency transformation efficiency of industrial buildings.

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Research on Rutting Model of Semi-Rigid Asphalt Pavement Based on Hamburg Rutting Test

Chengyu Zhai[1], Bo Yao[1], Luxiaodong Zhou[2]

1. Department of Civil Engineering, Nanjing University of Science and Technology, Nanjing 210094, China.

2. Jiangsu Zhonglu Engineering Technology Research Institute Co.,Ltd, Nanjing 210019, China.

Abstract *:* In order to establish a more effective rutting model of semi-rigid asphalt pavement, after sampling on-site,the Hamburg rutting test was conducted to analyze the relationship between ambient temperature, load magnitude,number of load actions and rutting depth; Taking Shami model as a reference,the environmental temperature,load size,load times and asphalt thickness are taken as model parameters;the rutting prediction models of upper,middle and lower surfaces of semi-rigid asphalt pavement structure are established by multiple linear regression analysis,and the models are modified by 6 sections of 4 expressways.The model is used to test 8 sections of 5 expressways,the results show that the average error rate of the calculated value of the model is 15.16%,which is obviously lower than the average error rate of 27.32% of the calculated value of the rut model in the current standard.Therefore,the model has high accuracy and can provide theoretical guidance for the design and maintenance of semi-rigid asphalt pavement.

Keywords *:* Semi-Rigid Asphalt Pavement; Hamburg Rutting Test; Rut; Rutting Prediction Model

Introduction

Rutting is one of the main diseases of asphalt pavement of high-grade highway in China, which not only affects the driving comfort and safety seriously,but also reduces the service life of highway[1].Semi-rigid asphalt pavement is widely used in China. With the increasing traffic volume of expressways, rutting of semi-rigid asphalt pavement has become a prominent problem, and the pavement damage caused by rutting is as high as 80%[2].The research on rutting of semi-rigid asphalt pavement and the establishment of reliable rutting prediction model can not only predict the rutting depth in highway design, but also contribute to pavement maintenance decision-making[3].

In recent years,many domestic and foreign scholars have done a lot of research on rutting model prediction. In 1987,A. Wijeratne[4] obtained the constitutive relationship between recycled asphalt concrete and original asphalt concrete through repeated load triaxial tests,and established a rutting model based on traffic volume and load;In 2004, Fwa et al[5] put forward a rutting prediction model based on *C-φ* model, and further confirmed the validity of *C-φ* model to asphalt pavement rutting prediction and evaluation; In 2008, Li Honghua[6] compared the indoors rutting test with on-site sampling, the results of the on-site sampling Hamburg rutting test and the indoor forming sample Hamburg rutting test show that the rutting depth of the on-site core sample is generally greater than that of the indoor test, moreover,Hamburg rutting test can evaluate the high temperature anti-rutting performance of asphalt mixture and monitor the construction quality of asphalt pavement;In 2015, Wang Haiyan,et al[7] tested the permanent deformation of six mixtures at different temperatures and wheel load pressures by means of a Hamburg rutting machine,the rutting prediction model considering the mixture property,axle load times, temperature,shear stress and running speed is established; In 2017, Hu Peng,et al.[8] paved a 9m long test section indoors. Through a biaxial accelerated loading test,a rutting prediction model including temperature and load action times was established.However,the test section only has an AC-13 asphalt surface layer. The test results are not applicable to high-grade highways. In 2019, Yang Yonghong, et al.[9] adopted dynamic modulus as an index to reflect the viscoelastic properties of asphalt mixture and its resistance to permanent deformation, based on the three-layer rutting test, a rutting prediction model including asphalt thickness, loading times and dynamic modulus was established.Based on the mechanical experience design method of MEPDG (Mechanical Empirical Pavement Design Guide), Chinese researchers carried out a series of technical

researches such as "Research on asphalt pavement design indexes and parameters (2004-318-000-04)". On September 1, 2017, the code for design of highway asphalt pavement (JTG D50-2017)[10] was officially promulgated.The mechanical experience design method of semi-rigid base asphalt pavement suitable for China is formed.However, the rutting prediction models established by the above-mentioned researchers are all based on the test method of indoor formed specimens, which are not closely related to the actual road conditions.

In this paper, a set of rutting prediction models suitable for semi-rigid asphalt pavements will be established through the Hamburg rutting test based on site sampling, and the actual road section data will be used for correction and verification.

1. Hamburg rutting test

1.1 Design of Hamburg rutting test

Rutting test is one of the most important tests in performance test of asphalt mixture.The plan of this test is to carry out the Hamburg rutting test on the upper, middle and lower layers of the core samples of asphalt mixture.The equipment of Hamburg rutting tester[11][12] is shown in Fig. 1 ~ Fig. 2.In the test scheme, four main factors are considered, which are ambient temperature, load size, load times and thickness of specimen. At the same time, Air Bath is chosen as the test environment, finally, the degree of deformation (rutting depth) of the specimen is recorded as the test result.

Figure.1 Hamburg rutting tester

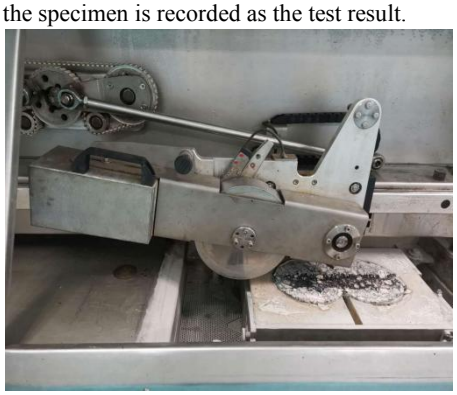

Fig.2 Testing machine roller

（1）Core specimen：In order to reflect the performance of the asphalt mixture under the working condition of the actual pavement more objectively, the cylinder asphalt mixture core samples obtained from the field of the semi-rigid asphalt pavement in Jiangsu Province were selected as the test materials, its initial properties are the same as the asphalt mixture in the Carriageway.The upper layer, middle layer and lower layer of core samples were taken as test pieces, among which the upper layer was 4 cm thick and the material was modified asphalt SMA-13, the middle layer was 6 cm thick and the material was modified asphalt AC-20, and the lower layer was 8 cm thick, the material is modified asphalt AC-25.The core specimen in test is shown in Fig. 3.

Fig. 3 Core specimen in test

（2）Ambient temperature：According to “Asphalt mixture rutting test (T 0719-2011)”in “Test code for asphalt and asphalt mixture in highway engineering”(JTG E20-2011) [13] , the rutting test temperature adopts 60℃.At the same time, the

maximum temperature of 70℃ in the temperature range provided by the Hamburg rutting test is chosen as the temperature variable.

（3）Load size：The standard load of Hamburg rutting test is 705N.According to the traffic load of the highway in Jiangsu Province, three loads of 700N for normal load, 800N and 900N for overload load are selected as the test load variables.

（4）Times of load action:The general loading method of Hamburg rutting test is to load the specimen until the number of round-trip movement of the steel wheel reaches 20000 times or until the specimen deforms to 20mm.Considering that the establishment of the model requires the data result of a certain number of groups, therefore, 10 groups of variables of 2000 times, 4000 times, 6000 times, 8000 times, 1000times, 12000 times, 14000 times, 16000 times, 18000 times and 20000 times were selected as the variables of load times.

1.2 Analysis of test results

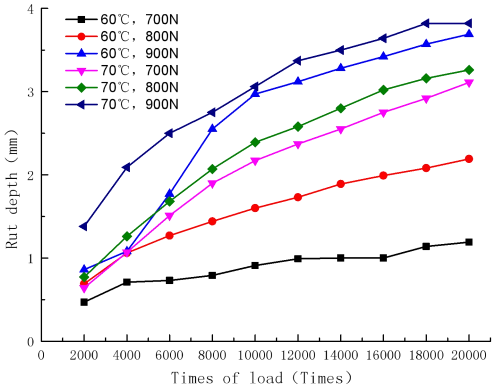

Fig. 4 Development trend of SMA-13 rut depth

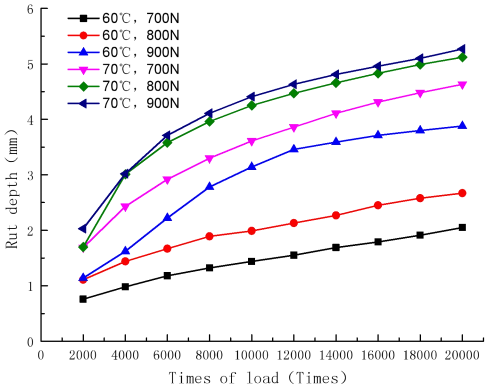

Fig. 5 Development trend of AC-20 rut depth

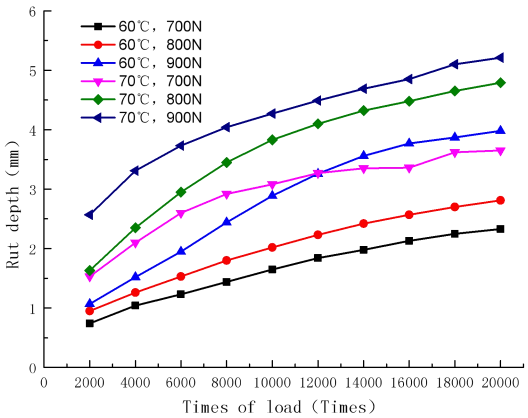

Fig. 6 Development trend of AC-25 rut depth

The results of rut tests for modified asphalt SMA-13, modified asphalt AC-20 and modified asphalt AC-25 are shown in Fig. 4 ~ Fig.6.

A total of 180 valid data were obtained from the Hamburg rutting test.From Fig. 4 to Fig. 6, it can be seen that the rutting depth increases with the increase of ambient temperature, load and load times, and the rutting depth of middle and lower layers is larger than that of upper layers.According to the test data, the initial rutting prediction model can be established by regression analysis.

2. Research on rutting prediction model

2.1 The basic form of rutting prediction model

The Shami model[14] is based on the APA test with specific temperature and load action times ,and the standard rut depth R_0 of asphalt mixture is chosen as regression factor to establish the prediction model of rut depth $R = f(R_0, T, N)$.The results show that the correlation between the results of Hamburg rutting test and actual rutting depth is more than 90% compared with APA test[15].Taking this model as reference, the APA rutting test was replaced by Hamburg rutting test of asphalt mixture, and the rutting prediction model was established by using standard rutting depth R_0 as a parameter reflecting the permanent deformation resistance of the material.The basic form of rutting prediction model for semi-rigid asphalt pavement including ambient temperature, load times, load size and asphalt thickness is obtained, as shown in Formula (1) .

$$\frac{R}{R_0} = k\ (\frac{T}{T_0})^t (\frac{P}{P_0})^p (\frac{N}{N_0})^n (\frac{d}{d_0})^q \quad (1)$$

In the formula:

t , p , n , q——Regression parameters;

k——Correction Factor;

R——Rutting depth of asphalt mixture（mm）;

T、P、N、d——Test conditions set in Hamburg rutting test ,they are temperature (℃), load size (N), load action times (times), and asphalt thickness (mm).

Among them, T_0、P_0、N_0 and d_0 are the standard test conditions, which are 60 °C for T_0,20000 times for N_0,60 mm for d_0 and 700 N for P_0. R_0 is the rutting test depth under standard conditions.

2.2 Establishment of initial rutting prediction model

The results of Meng Shutao[16], Lu Zhenglan[17] and He Aijun[18] show that the rutting depth increases linearly with the thickness of the rutting specimen within a certain range.Therefore, the exponent q of the（d/d_0）term in the rutting prediction model can be taken as 1.

The regression parameters of asphalt mixture with upper, middle and lower layers are obtained by multiple linear regression analysis.The value of R_0 obtained from the Hamburg rutting test is shown in Table 1.

Table 1 Rutting test depth R_0 under standard conditions (unit: mm)

layer	Upper layer	Middle layer	Lower layer
R_0	1.19	2.05	2.33

It can be concluded that the result of the initial rutting prediction model is shown in Formula (2) .

Upper layer：
$$\frac{R_1}{R_0} = \left(\frac{T}{T_0}\right)^{3.595} \left(\frac{P}{P_0}\right)^{3.517} \left(\frac{N}{N_0}\right)^{0.457} \left(\frac{d}{d_0}\right)$$

Middle layer：
$$\frac{R_2}{R_0} = \left(\frac{T}{T_0}\right)^{4.471} \left(\frac{P}{P_0}\right)^{1.907} \left(\frac{N}{N_0}\right)^{0.409} \left(\frac{d}{d_0}\right) \quad (2)$$

Lower layer：
$$\frac{R_3}{R_0} = \left(\frac{T}{T_0}\right)^{3.523} \left(\frac{P}{P_0}\right)^{1.703} \left(\frac{N}{N_0}\right)^{0.464} \left(\frac{d}{d_0}\right)$$

2.3 Modification and verification of the initial rutting prediction model

In formula (1), k is the correction coefficient, which is used to modify the initial rut prediction model, and to establish the relationship between the initial rut prediction model and the actual highway rutting condition.In order to determine the

correction coefficient k in the rutting prediction model, so that the finally obtained rutting prediction model can be used in actual design and inspection work, choose to use actual road section data to modify and verify the initial rutting prediction model.

2.3.1 Model modification based on actual pavement structure data

Considering the applicability of the final model, the Huaixu High Speed and Xinyang High speed, which have the same structure as the samples of the Hamburg rutting test, are selected.It also chooses the Huning expressway with SMA-13, SUP-20 and SUP-25 pavement structure and the Yanjiang Expressway with AK-13, AC-20 and AC-25 pavement structure to determine the correction coefficient.The pavement structure and traffic conditions of each section of the expressway are shown in Table 2.

Table 2 Road structure and Traffic conditions

Road section	Upper layer	Middle layer	Lower layer	Cumulative number of axle load(ten thousand times)	Equivalent temperature (℃)
HuNing1	4cmSBS modified asphalt SMA-13	8cmSBS modified asphalt SUP-20	8cm70# Ordinary asphalt SUP-25	2389.3	25.3
HuaiXu	4cmSBS modified asphalt SMA-13	6cmSBS modified asphalt AC-20	8cm70# Ordinary asphalt AC-25	1010.4	24.98
XinYang1	4cmSBS modified asphalt SMA-13	6cm70# Ordinary asphalt AC-20	7cm70# Ordinary asphalt AC-25	539.4	24.82
XinYang2	4cmSBS modified asphalt SMA-13	6cm70# Ordinary asphalt AC-20	7cm70# Ordinary asphalt AC-25	512.72	24.82
XinYang3	4cmSBS modified asphalt SMA-13	6cm70# Ordinary asphalt AC-20	7cm70# Ordinary asphalt AC-25	592.44	24.82
YanJiang	4cmSBS modified asphalt AK-13	6cmSBS modified asphalt AC-20	8cmSBS modified asphalt AC-25	1483.28	24.98

Through the construction of elastic layered system and mechanical calculation, to determine the upper, middle and lower layers of each section of the pressure, the results are shown in table 3.

The original rutting prediction model (2) is used to calculate the rutting depth of the above 6 groups of road sections respectively and make regression analysis with the measured value. The correction coefficient K is obtained as shown in table 4.

Table 3 Pressure on each surface layer (unit: N)

Road section	Upper layer	Middle layer	Lower layer
HuNing1	700	650	360
HuaiXu	700	645	426
XinYang1	700	653	450
XinYang2	700	653	450
XinYang3	700	653	450
YanJiang	700	653	460

Table 4 Inspection results of each road section correction

Road section	Calculated value of model (mm)	Measured value (mm)	Calculated value of the modified model (mm)
HuNing1	4.35	9.4	8.90
HuaiXu	3.45	7.2	7.05
XinYang1	3.03	6.35	6.20
XinYang2	2.96	6.2	6.06
XinYang3	3.16	6.65	6.47
YanJiang	2.86	4.4	5.85
correction coefficient *k*			2.047

The correlation coefficients between calculated and measured values are 0.996 for Multiple R and 0.991 for R Square, which indicates that the regression fitting degree is very high.The P value of Significance F (F significance statistic) is 1.805E-05, which is much smaller than the commonly used statistical significance level of 0.05. The F test is passed, and the overall regression equation is significantly effective.Therefore, the modified model has a high accuracy in predicting the actual road rutting.In the actual prediction calculation, the upper, middle and lower layers of asphalt pavement are calculated respectively by using the model, and then the rutting depth of asphalt pavement is obtained.Then the final rutting prediction model obtained after modification is shown in Formula (3).

$$\text{Upper layer：}\quad \frac{R_1}{R_0}=2.047\left(\frac{T}{T_0}\right)^{3.595}\left(\frac{P}{P_0}\right)^{3.517}\left(\frac{N}{N_0}\right)^{0.457}\left(\frac{d}{d_0}\right)$$

$$\text{Middle layer：}\quad \frac{R_2}{R_0}=2.047\left(\frac{T}{T_0}\right)^{4.471}\left(\frac{P}{P_0}\right)^{1.907}\left(\frac{N}{N_0}\right)^{0.409}\left(\frac{d}{d_0}\right) \qquad (3)$$

$$\text{Lower layer：}\quad \frac{R_3}{R_0}=2.047\left(\frac{T}{T_0}\right)^{3.523}\left(\frac{P}{P_0}\right)^{1.703}\left(\frac{N}{N_0}\right)^{0.464}\left(\frac{d}{d_0}\right)$$

Total rutting depth： $R = \sum R_i$ （i=1，2，3）

2.3.2 Verification of model based on actual pavement structure data

Eight unmaintained sections of five expressways in Jiangsu province, including Huning, Xinyang, Ningjingyan, Suhuaiyan and lianxu, were selected as the test sections.The rutting prediction model formula (3) is used to calculate the above verified road sections, and the calculation results are compared with the rutting model calculation results in the current norm. The results are shown in Table 5.

Table 5 Comparison of calculated value of prediction model with that of standard model

Road section	Calculated value in current specification（mm）	Calculated value of rut prediction model（mm）	Measured value（mm）	Error rate of current specification（%）	Error rate of rutting prediction model（%）
HuNing2	7.04	6.51	6.45	9.14	0.93
HuNing3	10.43	9.53	9.3	12.15	2.47
XinYang4	7.3	9.32	9.84	25.81	5.28
XinYang5	6.9	9.35	9.88	30.16	5.36
XinYang6	7.4	10.31	10.33	28.36	0.19
NingJingYan	5.843	5.297	3.1	88.48	70.87
SuHuaiYan	4.72	5.73	4.6	2.61	24.57
LianXu	9.26	8.48	7.6	21.84	11.58
Average error rate（%）				27.32	15.16

It can be concluded from table 5 that the error rate of the rutting prediction model is lower than the specification error rate in 7 out of 8 sections.The average error rate of the rutting model in the current specification is 27.32%, while the average error rate of the rutting prediction model is only 15.16%.To sum up,the proposed rutting prediction model, Formula (3),has acceptable validity and accuracy.

3. Conclusion

The environment temperature, the acting pressure and the loading times all have a great influence on the rutting depth.With the increase of the environment temperature, pressure and load times, the rutting depth of the specimen strictly increases.

Taking Shami model as a reference, the prediction models of the top, middle and bottom layers of the pavement structure are established through the multiple regression analysis of the Hamburg rutting test data.

According to the revision and verification of the actual road section data, the accuracy of the rutting prediction model in this paper is higher than that in the current specification.

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The Influence of Regional Cultural Characteristics on the Architectural Form of Urban Museums——Taking Anhui Museum as an Example

You He
College of Arts, Anhui University of Finance and Economics, Bengbu 233030, China.

Abstract: With the progress and development of social economy and the gradual improvement of living standards, people pay more and more attention to the pursuit of spiritual civilization. As an important place for historical and cultural research, inheritance and Exhibition protection, while its scale is expanding, the architectural characteristics are gradually integrated into the regional cultural characteristics. It is a symbol of the development of urban civilization and intuitively shows the regional cultural characteristics and historical details. This article takes the Anhui Museum as the starting point, deeply study and analyze the influence of regional cultural characteristics on the design of urban museum architectural form.

Keywords: Regional Cultural Characteristics; Museum; Architectural Form; Influence

Introduction

With the development of the construction of global cultural integration, while promoting cultural exchange, it is also affected by foreign culture. In the field of architecture, most architectural forms and styles blindly follow western architecture and pursue novel shapes, resulting in the uniformity of China's modern architecture and the lack of China's regional cultural characteristics, which affects the inheritance and development of historical culture and regional culture to a certain extent. In addition, as a symbol of urban area and a portrayal of the culture of the times, the museum has special spiritual connotation, which is of great practical significance for improving the people's sense of identity, expanding the people's knowledge and raising the people's spiritual realm. In this regard, we can strengthen the scientific design of the architectural form of urban museums, seek the balance between traditional culture and modern innovation, effectively integrate regional cultural elements, closely combine history, art and culture, reflect the traditional beauty and innovate and carry forward regional culture at the same time.

1. Relevant overview

1.1 Overview of Anhui Museum

Anhui Museum is an important cultural symbol of Anhui Province. At present, it is the operation mode of one hospital and two museums, which contains rich historical and cultural characteristics in architecture. The old museum mainly displays the characteristics of Anhui modern history, and the new museum comprehensively displays the highlights of Anhui history and culture. The exhibition building is a soviet style building, and its basic display includes Anhui historical and cultural display, four characteristic displays, etc. In addition, Anhui Museum integrates history, nature and social education and its architectural shape is thick and vicissitudes, reflecting the Hui architectural style of "four water return to the hall and five connections".As the cultural symbol and historical carrier of cities in the province, Anhui museum not only carries the renewal and development of contemporary culture, but also can effectively protect and inherit and carry forward the traditional regional culture.

1.2 Overview of regional culture

Regional culture mainly refers to the national treasures created by our ancestors and continuously inherited and carried forward through historical development. It is a traditional culture with distinctive regional and national characteristics. Regional culture not only reflects the local natural environment, but also involves different levels in the local area, such as values, cultural cultivation, artistic level, lifestyle, religious beliefs and social customs. Different regions have obviously different cultural differences, so we can see that culture has distinct regional characteristics. In this paper, regional culture mainly refers to the excellent local culture that can effectively affect architectural creation in the process of historical development. In the process of museum architectural engineering design, the combination of regional cultural characteristics and architectural form design can improve the fit between museum architecture and the surrounding environment; The proper integration of regional cultural elements into morphological design can promote the inheritance and development of traditional culture, and effectively improve the identification of the museum, which not only conforms to the surrounding environment, but also has its own unique architectural style.

2. Analysis on the current situation of architectural form design of urban museum

With the continuous improvement of people's pursuit of spirit, museums around the world are also gradually increasing. Their architectural form and design style show the characteristics of specialization and diversification, which has a great impact on the overall design and continuous development of museums, but at the same time, other problems also appear. First, there is less integration of regional culture. Some museum buildings lack an in-depth understanding of regional culture during the actual construction, and their regional cultural elements are less applied in the form design, which can not fully reflect the characteristics of regional culture. Second, pursue novel design. In modern society, with the development of global cultural exchange, more and more people pursue novelty and uniqueness, and even worship foreign culture, which leads some museum architects to blindly pursue novelty and integrate foreign cultural elements in the actual design process, and then gradually lose the design and inheritance of China's traditional culture and regional culture. Therefore, in the process of urban museum architectural form design, while pursuing modernization and innovation, we should also scientifically design and reasonably use China's traditional culture and regional cultural characteristics, so as to promote cultural inheritance and development.

3. The influence of regional cultural characteristics on the architectural form of urban museums

In Anhui Museum, the characteristics of regional culture have a great influence on its architectural form, which is mainly reflected in the following aspects.

3.1 Architectural style

From the perspective of architectural form, the design concept of Anhui Museum is in line with the impression of most people on Huizhou architecture, such as white walls, black tiles and emerald mountains, which deeply shows the local regional cultural connotation. As an important regional museum connecting the north and the south of Anhui Province, it has multiple cultures. Anhui Museum chose the most prominent Anhui charm in architectural form, and effectively integrated the Jiangnan scenery form and traditional Confucianism and Taoism philosophy and its final architectural form showed the characteristic style of "four water return hall" and "five connection". In addition, the architectural color of Anhui Museum is mainly white and gray, which aims to show the regional cultural characteristics of Huizhou Folk Houses. Taking the geographical characteristics of Anhui as the main structure of the building, the building surface is decorated with bronze patterns. Ponds, roadways and zhaiqiao are built outside the museum, and bamboo and wood are planted. From the overall shape of the building, it shows the sense of massiness and boldness of the north, it also reflects the graceful beauty and garden beauty of the south. Throughout the Anhui Museum, the main building and various auxiliary landscapes coordinate

with each other, deeply integrate the regional cultural characteristics, and intuitively show the architectural form of Huizhou ancient villages.

3.2 Permanent exhibition

In Anhui Museum architecture, the permanent exhibition vividly shows the regional cultural characteristics and museum characteristics. For example, the four treasures of Huizhou study, as an important carrier of the regional cultural characteristics of ancient Huizhou, occupies an important position in the museum. Its architectural structure can be divided into Xuan paper hall, Hui ink hall, Xuan pen hall and inkstone hall, which closely connects the material civilization of Huizhou with the regional culture and shows the cultural spirit and character. The architectural color of its exhibition hall is mainly black-and-white design, which echoes with pink walls and black tiles. Its architectural layout, such as Huizhou four entry ancient architecture, shows the four treasures of study in turn, and effectively integrates the regional cultural connotation and traditional cultural spirit into the museum architecture. Huizhou ancient architecture is the characteristic landscape of Huizhou regional culture. In the architecture of Anhui Museum, in order to fully show its panorama, its exhibition hall directly moved the ancient folk houses here, which fully demonstrated the characteristic forms of Huizhou ancient folk houses, such as brick murals, carving art, feng shui knowledge, etc. at the same time, it also included three wells, horse head wall, powder wall and black tile. Integrate regional cultural characteristics into museum buildings, improve people's spiritual enjoyment and visual pursuit, and let people really understand the characteristic culture and the original appearance of the times in Huizhou. The infiltration and application of regional characteristic culture in Anhui Museum not only improves the inheritance of regional culture, but also fully shows the characteristic beauty and classical beauty of the museum.

3.3 Artistic conception embodiment

The design of architectural form of Anhui Museum is closely related to the environmental characteristics and humanistic characteristics of Anhui region. Moreover, the influence of regional cultural characteristics on the architectural form of Anhui Museum is also reflected in the artistic conception. The architectural form of Anhui Museum shows a diversified artistic conception. First, it shows the dense artistic conception of ink painting in the south of the Yangtze River. Taking the museum as the center, it constructs the water flow in the lotus pond and transplants emerald bamboo weeping willows, which reflects the Huizhou architectural style of "no water, no residence", and shows the dense artistic conception of the water town with the characteristics of water, mountains and screens. Second, it reflects the culture of emphasizing Confucianism and culture. Anhui museum is located in the hometown of Neo Confucianism and its architecture and display fully reflect the esteem and publicity of Huizhou culture, such as couplets, plaques, architectural display, and the architectural scenes of farming and reading heirs. Third, it shows the ethical order. In Anhui Museum, its memorial archways, ancestral halls and other architectural forms fully show the importance of Huizhou people to family blood. Some of the houses are decorated with wood carvings and brick carvings, carved with pictures of Bairen hall and twenty-four filial pieties, which deeply publicize the principle of filial piety; King Wen's visit to Xian and Jiang Taigong's fishing convey the meaning of respecting the king and the concept of entering the market. These architectural forms and carving decoration fully show the etiquette order and family ethics, enhance people's feelings and spread the characteristic style at the same time.

3.4 Building materials

In the museum construction project, the building materials used are diverse, and different building materials can give people different feelings. For example, as a building material with a long history, the unique texture, color and texture of wood can overflow the feeling of comfort, elegance, tenderness and nature; The heaviness of stone will give people a calm, heavy, solemn and primitive feeling; The characteristics of glass will bring modern, clean and transparent feelings to the people. The organic combination of new building materials and traditional building materials shows a sense of modernity, enhances historicity, and can effectively arouse the emotional resonance between contemporary people and regional

characteristics. Taking Anhui Museum as an example, from the overall architectural analysis, the museum adopts the architectural style design of Hui style, and its outer wall is made of bronze texture building materials, showing a thick and long cultural history; The inner surface is lined with wood, reflecting humanization and warmth; The atrium curtain wall is made of clean and transparent glass, showing a modern sense; At the joint of the site and space, the entrance frame scenery of bamboo sea, pool, corridor and Huizhou archway is built, which reflects the profound historical accumulation and cultural characteristics. In this paper, the exhibition hall is explained in detail. The construction form of the museum exhibition hall is a solid volume with continuous turning characteristics, which constructs a square body with transparent four sides and defines its basic shape. The building materials used in its body have obvious characteristics. The texture covers the outer surface and abstractly displays the animal face patterns of the treasure of the town hall, giving the people a sense of thick, simple and primitive ancient bronze; In the transparent part of the square body, it can be found that the wooden panel wall covers the inner surface, which shows the Huizhou architectural style and gives the people a cordial and elegant impression. The different designs of outer materials and inner materials reflect the sharp contrast between cool and beautiful and gentle, thick and elegant, coarse and delicate, suggesting the diversified characteristics of regional culture and the building materials used in the physical exhibition hall create a quiet, historical and dark viewing environment.

3.5 Patio design

As a traditional architectural form in China, patio shows the architectural concept of "unity of heaven and man", and occupies an important position in Huizhou architecture. The architectural design of Anhui Museum mainly adopts the Huizhou architectural style, and the patio is one of the cores, which can ensure the ventilation conditions of Huizhou Folk Houses, ensure their daylighting conditions, and also have the basic function of regulating indoor temperature. In Anhui Museum architecture, the patio is essential. It is located in the core space in the middle of the museum, and its architectural form is similar to that of Huizhou villages. In the process of architectural form design, the designers strictly follow the style characteristics of four water return to the hall and five connections. The materials are mainly wood and glass, and the shape reflects the massiness and vicissitudes. At the same time, it can also play the role of thermal insulation and rain prevention. The design of the patio can not only improve the artistic conception and order of the internal space, but also effectively enrich the internal space level. The architectural design of the patio breaks the closure of the museum building, skillfully combines the external nature with the internal space, improves the visual stimulation, and shapes the historical atmosphere and cultural impression at the same time. In the process of architectural form design, the patio skillfully integrates Huizhou architectural style, historical and cultural characteristics, natural environment and humanistic feelings, so that the visitors can directly face the historical characteristics from the senses and improve their recognition and pride of the regional cultural characteristics from the emotion. Patio architecture is the designer's innovation and upgrading on the basis of traditional architectural methods, that is, integrating the characteristics of regional culture and combining contemporary architectural technology, so as to promote the inheritance and development of traditional regional culture and realize the innovative design of architecture.

4. Conclusion

In a word, regional cultural characteristics are the cultural wealth and historical inheritance of Chinese cities, and have important cultural value. Taking Anhui Museum as an example, it effectively integrates the regional cultural characteristics with the museum, endows it with the architectural form of Huizhou style, perfectly shows the historical characteristics and cultural inheritance of Huizhou ancient architecture, meets the spiritual needs of the people, and better continues the historical culture and inherits the regional characteristics.

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About the Author: He You (1986.04-), Female, Han, Bengbu, Anhui Province, Master's degree, Lecturer of College of Arts, Anhui University of Finance and Economics, main research direction is artistic design.