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Research on Safety Evaluation Model of Fire-Fighting Facilities of High-Rise Building in University

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Abstract: In the process of fire acceptance of high-rise buildings in Universities, this study finds that there are many hidden dangers in the safety management of fire-fighting facilities in high-rise buildings in Universities. This study investigates the safety management of fire-fighting facilities in high-rise buildings in Universities, and finds that there are some problems in the safety management of fire-fighting facilities in high-rise buildings in Universities, such as the weak management system, the lack of fire safety awareness of managers, and the lack of practice in using fire emergency plans. This study explores the factors that affect the safety management of fire-fighting facilities, and further explains the degree of influence of these factors on the safety management of fire-fighting facilities in high-rise buildings in Universities. In this study, when selecting the evaluation dimensions, not only considered the standardization of fire safety management of high-rise buildings in Universities, but also examined the fire safety management personnel of high-rise buildings in Universities and the fire safety literacy of teachers and students. Such that, four dimensions of fire management system, fire safety education, personnel fire quality and emergency response plan are selected as the fire safety evaluation indicators of high-rise buildings in Universities, and the fire safety evaluation model of high-rise buildings in Universities is constructed. Finally, from the perspective of fire risk control, this study puts forward reasonable suggestions and Countermeasures for the management of fire-fighting facilities of high-rise buildings in Universities.

Keywords: Safety Management, Hierarchical Analysis, Fire-Fighting Facilities, Fire Safety, Evaluation Model

1. Introduction

Recently, fires in high-rise buildings have occurred frequently at home and abroad, and the safety of fire protection facilities in high-rise buildings has once become a hot spot of social concern. In the fire inspection of high-rise buildings in University, it is found that there are hidden dangers in the safety of firefighting facilities. Although University have done a lot of work in the provision of fire protection facilities, they have done poorly in the management of fire protection facilities, mostly staying on the surface of fire protection facilities safety inspection, and many important aspects have not been given due attention.

This study analyzes the current situation of the safety management of fire-fighting facilities in high-rise buildings in University, analyzes its influencing factors, and further explains the degree of influence of these factors on the safety management of fire-fighting facilities in high-rise buildings in University. On this basis, the safety evaluation model of high-rise buildings in University is constructed, and rationalized suggestions and countermeasures are proposed for the management of high-rise buildings in University from the perspective of fire hazard control, in order to provide technical reference for the safety management of high-rise buildings in University.

2. The Safety Management of Fire Protection Facilities of High-Rise Buildings in University

The danger of fire in high-rise buildings is greater because the fire in high-rise buildings spreads faster and is more difficult to put out. on June 25, 2021, the Ministry of Emergency Management issued the Regulations on Fire Safety Management of High-rise Buildings (hereinafter

referred to as the Regulations) by Order No. 5 of the Ministry of Emergency Management, and the Regulations [1] have refined and clarified the key aspects of fire safety management.

High-rise teaching buildings and dormitories in University can easily cause mass casualties in case of fire because of the difficulty of evacuation of people. Generally speaking, it is difficult to manage the fire safety facilities of high-rise buildings in University, and the following problems mainly exist in the current management.

2.1. Fire Prevention Management System Is Not Too Sound

Due to the limitation of the current management system of University, most University set the fire safety management department in the security department, and generally the fire department is responsible for the overall fire prevention work of the school. As a section-level unit, the fire department will certainly feel "having more than enough strength" to manage the fire-fighting facilities of the whole University. To do a good job of fire safety in the whole school, we need to change the concept that fire safety in University is only the responsibility of the fire department or the security department, and the school needs to make more efforts to create a fire safety atmosphere and promote the awareness of responsibility of "fire safety is everyone's responsibility" by establishing a fire safety responsibility system for teachers and students.

2.2. Lack of Fire Safety Awareness Among Managers

Most of the managers of fire-fighting facilities in University have not received special firefighting knowledge training, and they are not familiar with the operation principle and operation method of fire-fighting facilities, and they are not clear about how to check the causes of the problems and how to solve them. They cannot maintain the fire protection facilities in a timely and effective manner according to the relevant provisions of the fire protection code, and rely too much on the maintenance service of the fire protection maintenance company. The fire management personnel are sitting in the engine room and looking at the situation of fire-fighting facilities through the network, and the installed fire-fighting facilities are "empty", so that in case of emergency fire, they cannot confirm the fire situation in the first time and start the linkage facilities to put out the fire, which delays the best time to put out the fire and eventually leads to a big disaster.

2.3. Lack of Fire Emergency Plan Rehearsal

Some researchers have made case analysis of fire accidents in University, and the study concluded that most of the causes of fire accidents are due to the lack of attention to fire safety education for teachers, students and teaching and support managers, and the poor fire safety awareness of teachers, students and teaching and support managers, who should regularly promote and educate teachers, students and employees in schools about fire safety. Besides, an effective measure to guarantee the fire safety in University is to hold fire emergency drills. However, in fact, some University fire drills are more "performance" in nature, often in form. University should really put the "fire drill" into practice.

3. Evaluation Dimensions of Fire Safety of Fire-Fighting Facilities of High-Rise Building in University

The selection of dimensions is the key step to build the evaluation model of fire safety management of high-rise buildings in University, and the evaluation dimensions must reflect the commonality and be oriented. For a good evaluation index system, the selected dimensions must be operable. In this study, when selecting the dimensions, we not only consider the standardization of fire safety management of high-rise buildings in University, but also examine the fire safety management personnel of high-rise buildings in University as well as the fire safety literacy of teachers and students.

3.1. Collection of Evaluation Dimensions

In this study, we searched and analyzed various fire safety evaluation indexes, and retrieved 393 core journals in the past ten years with the title of "fire" and "safety" on the Internet, and analyzed the academic attention in the past ten years, see Figure 1. The number of articles has been fluctuating up and down, and the number of articles in July 2021 has been the same as that in 2019, and according to this trend, it should continue to rise. In this study, the 19 core journals of the last decade with the titles of "fire protection", "safety" and "evaluation" were reviewed, and the top 10 keywords were analyzed. The pie chart of keywords is shown in Figure 2.

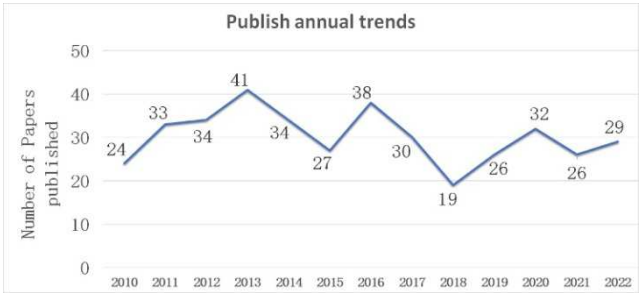

Figure 1. *Academic attention of "Fire protection" and "Safety" in recent 10 years.*

At present, the overall level of safety management of fire safety infrastructure in domestic University is relatively low [2], and innovative safety management thinking is the key to maintaining fire safety in University [3]. Through combing and analyzing the relevant literature, fire management and fire rescue are always the hot topics of fire safety research [4]. In the past 10 years, China's fire safety management research has focused on fire safety management, fire safety risk assessment, fire rescue, fire safety optimization, and decision

making [5]. With the development of artificial intelligence technology, the research on fire safety management has shown a trend of focusing on intelligence, and the research methods have been gradually diversified. This study is based on "firefighting facilities" and "safety management", and focuses on building a safety evaluation model for fire-fighting facilities in high-rise buildings in University.

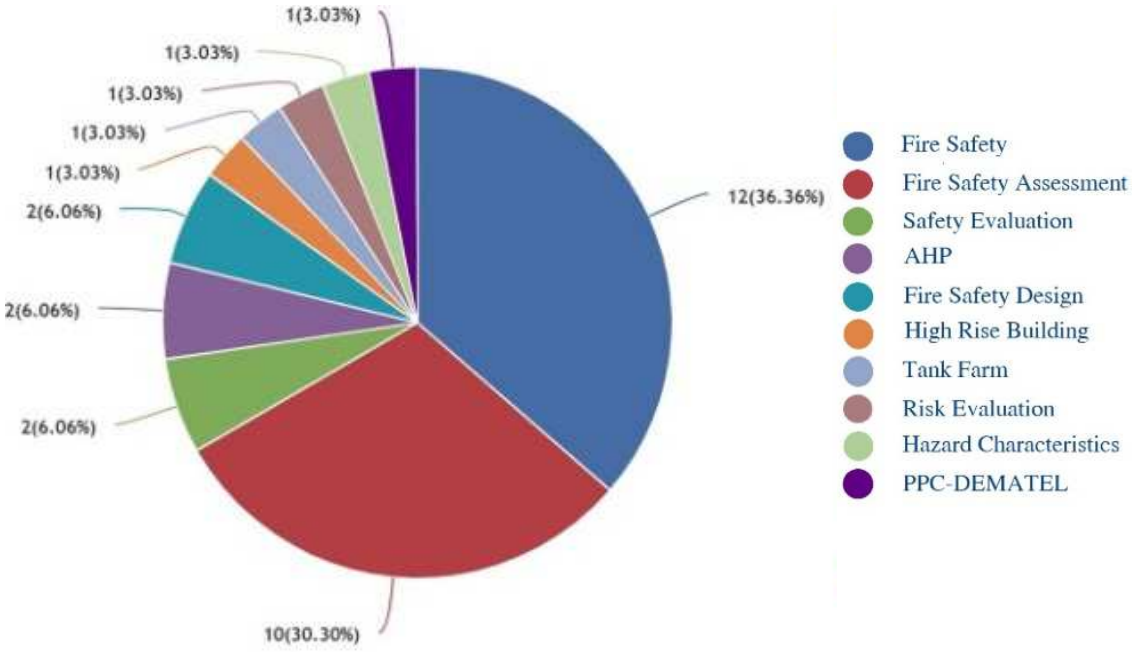

Figure 2. *Keyword distribution.*

S. Jiang et al. [6] considered that dormitory building structure, occupancy density and fire time are the three key factors to evaluate fire safety evacuation ability. Dong Yan [7] puts forward some standardization suggestions on the maintenance and management of fire-fighting facilities in Colleges and University Wang Mengyao [8] proposed that high-rise buildings should have fire safety resilience, and suggested that resilience, redundancy, intelligence and swiftness as four characteristic dimensions of fire resilience of high-rise buildings, and constructed a fire safety resilience assessment index system. Zhang Airan et al. [9] established an evaluation model based on the uncertainty of fire occurrence, development and damage caused, based on hierarchical analysis and unconfirmed measure theory. Qi Sun, Yelda Turkan [10] considered the physical characteristics of buildings, human factor behavior and fire conditions as the key factors affecting evacuation performance, and verified the framework through experiments. effectiveness.

Zhou Shengshi et al. [11] used the DEMATEL model to conduct a comprehensive evaluation of building fire safety, with design, system, product, management, and people as the first-order indicators of building fire safety risk evaluation. Miao Zhang et al. [12] considered the five influencing factors of comprehensive fire protection evaluation: human, fire equipment and facilities, fire safety management, environmental factors and planning; Wen Ruan et al. [13] took fire risk and fire protection facilities as the first and second level indicators of fire safety evaluation; Qilei Wang [14] proposed the active fire protection, passive fire protection and fire safety management by composed of super high-rise building fire safety evaluation index system; Zheng Yaqing [15] constructed a fire facility safety evaluation index system composed of regulations, management system, professional personnel, and technology application; Yan Min [16] took equipment factor, safety management factor, article factor, personnel factor, environment factor, and information factor as metro fire safety evaluation indexes. It can be seen that most of the previous fire safety evaluations include the two factors of people and objects.

3.2. Selection of Evaluation Dimensions and Construction of Evaluation Model

The current methods of fire safety evaluation can be divided into two categories: qualitative and quantitative. There are many high-rise buildings in University, and some college student dormitories, libraries and computer rooms are arranged in high-rise buildings. Once there is a fire, it is difficult to put out the fire, and the configuration of firefighting equipment in high-rise buildings in University needs to be improved according to the latest version of firefighting codes [17].

3.2.1. Selection of Evaluation Dimensions

Firstly, the evaluation objectives are clarified. The ultimate purpose of evaluation on the safety of fire-fighting facilities of high-rise buildings in University is to improve the safety of fire-fighting facilities of high-rise buildings in University in a targeted way.

Second, scientifically design the questionnaire. According

to the indicators collected in the early stage, we scientifically design questionnaires, select experts with certain influence in the field of fire safety management in University, managers of fire safety management departments in University and fire maintenance technicians as the objects of investigation, sort out and analyze their opinions and suggestions, further optimize the preliminary selected indicators, and ask the expert group to independently evaluate and rate the selected indicators [18].

Finally, evaluation indicators were determined. After the questionnaires were recovered, the data were cleaned, invalid questionnaires were removed, and according to the experts' ranking of the importance of indicators and their opinions and suggestions, the principles of independence and ease of operation of evaluation index screening were adhered to, and on the basis of systematic analysis and field investigation and research, the functionality of high-rise buildings in University and the special characteristics of fire management in University were considered comprehensively, combined with the fire codes of high-rise buildings in China, the relevant literature on fire safety management of fire protection facilities On the basis of systematic analysis and field research, the evaluation indexes are further analyzed and finalized by taking into account the functionality of high-rise buildings in University and the special features of fire prevention management in University, combined with the fire prevention code of high-rise buildings in China, relevant literature and research results of other scholars.

3.2.2. Construction of Evaluation Model

This study analyzes the current situation of fire safety in high-rise buildings in University, takes the safety of fire safety in high-rise buildings in University as the research object, systematically analyzes the factors affecting the safety of fire safety in high-rise buildings in University, and finally selects the four dimensions of Management System of Fire Control, Fire Safety Education, Fire -Fighting Quality of Personnel and Drill Emergency Plan as the evaluation indexes of fire safety in high-rise buildings in University, and constructs the evaluation model of fire safety in high-rise buildings in University. The evaluation model of fire safety of high-rise buildings in University is shown in Figure 3.

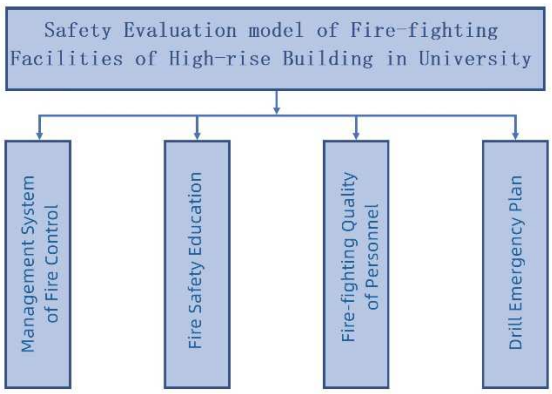

Figure 3. *Safety Evaluation model of Fire-fighting Facilities of High-rise Building in University.*

The management system of fire control of the University provides the possibility guarantee for the safety of the fire facilities of the high-rise buildings of the University, and it can be said that the management system of fire control is the necessary premise and important element for the safety guarantee of the fire facilities of the high-rise buildings of the University; fire safety education is the catalyst to promote the possibility of the fire safety managers, teachers and students to turn to the reality of the fire quality, and it has a Fire safety education is the catalyst to promote the possibility of fire safety quality to reality for fire safety managers, teachers and students, and has a relatively large role in promoting the fire safety quality of fire safety managers, teachers and students, and is a necessary condition for fire safety managers to improve the quality of fire safety; drill emergency plan is an effective means to improve fire safety managers, teachers and students to pay attention to fire safety; the quality of fire safety managers, teachers and students has a direct impact on the safety of fire safety facilities in University. Therefore, management system of fire control, fire safety education, fire-fighting quality of personnel and drill emergency plan are important factors affecting the safety of fire safety facilities in University.

4. Conclusion

The implementation of evaluation on the safety of fire-fighting facilities of high-rise buildings in University, and timely understanding of the problems of fire-fighting facilities safety management, can be targeted to eliminate potential hidden dangers in the nascent state, so as to effectively avoid fire accidents. First of all, in the process of fire safety management of high-rise buildings in University, it is necessary to adhere to the working policy of "prevention first, prevention and elimination combined", establish the fire safety management system of "clear firefighting responsibilities, detailed firefighting management, ensure fire safety", clarify the responsibilities and powers of firefighting management departments in University, and start from the school's fire safety management. The responsibility and power of fire safety management departments of University are clearly defined, and the fire safety responsibility system and job responsibility system are implemented from schools to colleges and other teaching units, so as to achieve "self-examination of safety, self-removal of hidden dangers and self-responsibility". Secondly, the fire safety of high-rise buildings in University is not a matter of the fire management department, but a common responsibility of teachers, students, teaching assistants and management personnel of the whole University. All teachers, students, teaching assistants and managers of the University should set up fire prevention awareness and improve fire prevention quality. While providing regular training on fire facilities management to firefighting managers to improve their firefighting quality. It is also necessary to create a campus safety culture atmosphere and carry out various forms of fire safety education to enhance the fire awareness of teachers,

students, teaching assistants and managers, so as to create a good safety environment for the cultivation of talents in University. In addition, University should formulate feasible fire safety management system and fire emergency plan, and establish emergency response and disposal mechanism. According to the fire fighting and emergency evacuation plan, the University should organize at least one emergency plan drill every year and continuously improve the emergency plan according to the drill situation.

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