

Construction of A Safety Risk Assessment Index System for High-rise Building Construction Based on The Fundamental Principles of Disaster Sociology

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Abstract

To reduce the risk of construction safety in high-rise buildings, we first analyze the types of safety accidents that exist in high-rise building construction. By introducing the basic principles of disaster sociology, we discuss and analyze from four aspects: disaster and society, disaster culture, disaster psychology, disaster behavior, This leads to the identification of risk factors for high-rise building construction safety from the perspective of disaster sociology, enriching the selection of indicators for risk assessment of high-rise building construction safety.

Keywords

Disaster sociology, high-rise buildings, indicator system.

1. Introduction

With the rapid development of urbanization in China, high-rise buildings have also made significant progress. The construction process requires high technical requirements, involves multiple types of work, and the environment is diverse and complex, hiding various safety risks. Traditional security risk factors often focus on technology and equipment, neglecting the social, cultural, and psychological factors that contribute to risk generation. Introducing the basic principles of disaster sociology into the field of high-rise building construction safety breaks through traditional perspectives and provides a new perspective for analyzing the risk factors of high-rise building construction safety.

2. Types of Safety Accidents in High-rise Building Construction

2.1. High altitude falling accident

In the construction of high-rise buildings, falling accidents from heights are the most frequent type of accidents, accounting for over 40% of accidents in the construction industry.[1] The main causes of injury accidents caused by construction workers falling from heights such as roofs, edge openings, scaffolding, and tower cranes include weak safety awareness, low work skills, inadequate safety protection facilities, inadequate safety management, and environmental factors, all of which may lead to high-altitude falling accidents.

2.2. Collapse accident

Safety accidents caused by instability and collapse of buildings, structures, scaffolding, stacking materials, etc.[2] The main causes of collapse accidents include two aspects: human factors and natural factors. During the construction process, illegal operations such as formwork support not being erected according to specifications and forced formwork removal due to insufficient concrete curing will weaken the bearing capacity of the building structure; In deep foundation

pit engineering, insufficient waterproofing measures or incorrect excavation sequence may cause soil sliding or even chain collapse. In addition, the indiscriminate stacking of building materials has gradually accumulated into a significant risk of local overloading. According to the analysis of natural factors, violent storms and earthquakes may cause collapse accidents.

2.3. Object strike accident

Object strike accidents are a common type of accident, characterized by strong suddenness and wide range of impact.[3] The main causes of object impact accidents include illegal throwing of objects, mechanical equipment failure, and inadequate safety protection measures leading to object falling. For example, incorrect wearing of safety helmets during construction, improper material stacking, lifting equipment failure, and lack of protective facilities causing objects to accidentally fall, resulting in serious accidents.

2.4. Mechanical injury accident

Mechanical injury accidents are usually caused by improper operation of mechanical equipment. The main reasons include illegal operations and inadequate equipment maintenance leading to mechanical failures; In addition, failure to maintain a safe distance between personnel and machinery, as well as insufficient safety awareness among operators, can also lead to injury accidents. Meanwhile, the lack of safety management can also increase the risk of mechanical injury, such as the absence of warning signs, unlocked tags, and safety publicity.

2.5. Crane injury accident

Crane injury accidents refer to personnel injuries and fatalities caused by mechanical failures, operational errors, or management negligence during the operation of lifting machinery, such as squeezing, falling, and object strikes. They mainly occur during lifting, installation, and other processes. Long term lifting operations such as lifting objects can cause cracks or fractures in the hook. If the hook is not replaced in a timely manner, it is easy to cause lifting injury accidents.[4]

2.6. Electric shock accident

Electric shock accident refers to a safety accident in which the human body directly or indirectly comes into contact with a charged body, causing physiological damage or even death due to the flow of current through the human body. The main reasons include construction personnel touching wires or cables, building equipment leakage, and improper high-voltage protection leading to electric shock.

3. Overview of Basic Principles of Disaster Sociology

Disaster sociology is a branch of sociology that mainly studies the phenomenon of disasters and their interrelationships with various aspects such as social structure, culture, economy, and politics. In depth exploration of the causes, evolution process, social impact, and social response mechanisms of disasters, providing scientific basis for disaster prevention, post disaster recovery, and reconstruction. The research content of disaster sociology not only covers the natural factors that cause disasters, but also focuses on analyzing the important role of social factors in the formation, evolution, and response to disasters.

Starting from the basic principles of disaster sociology, this study explores the safety risks of high-rise building construction from the perspective of disaster sociology. Based on the research of previous scholars, social and cultural safety risk factors are added to enrich and improve the safety risk index system of high-rise building construction.[5] From the perspectives of disaster and society, disaster culture, disaster psychology, disaster behavior, disaster and information dissemination, and disaster prevention, mitigation, and emergency

management, this paper discusses and analyzes the safety risk factors of high-rise building construction from the perspective of disaster sociology.

4. Construction of Safety Risk Index System for High Rise Building Construction

4.1. Principles of Construction

4.1.1. scientific principle

The selection of evaluation indicators should be based on sufficient scientific basis, in accordance with construction technical specifications and relevant accident statistical analysis, combined with the characteristics of high-rise building construction, to scientifically construct a safety risk assessment indicator system. The concept of indicators needs to be clear and able to accurately reflect the main factors of safety risks in high-rise building construction, ensuring the reliability of evaluation results.

4.1.2. systematic principle

The construction of high-rise buildings is a complex system engineering that involves numerous links and factors. The evaluation indicators should comprehensively cover all aspects of construction, including the risk factors of "personnel, machinery, materials, methods, and environment", and the indicators should be interrelated and complementary to each other, forming an organic whole. From the planning and design in the early stage of construction, to the use of materials and process operations during the construction process, to the final acceptance inspection in the later stage, corresponding indicators should be considered to avoid evaluation loopholes.

4.1.3. Feasibility principle

The selection of safety risk assessment indicators should be easy to obtain and quantify, so that data can be collected and analyzed smoothly in journal literature. For indicators that are difficult to obtain data, reasonable alternative indicators should be used to reflect relevant risks.

4.1.4. principle of independence

The evaluation indicators should be kept as independent as possible to avoid excessive information overlap or redundancy between them. Each indicator should be able to independently reflect a certain characteristic of construction safety risks, thereby improving the accuracy and effectiveness of the assessment.

4.2. Safety risk indicators under the basic principles of disaster society

4.2.1. Disasters and Society

There is a bidirectional dynamic relationship between disasters and society. When disasters occur, the first thing that happens is the destruction of the social material life system, which disrupts social order and reduces social functions; In terms of the impact of social development on disasters, the increasing level of social development objectively exacerbates the consequences of disasters. However, social development and advances in science and technology can also enhance human disaster prevention and mitigation capabilities, and rebuild the balance between nature, humans, and society.

The content of social functions mainly includes four aspects: economy, organization and management, cultural education, and information collection and dissemination. Disasters can cause varying degrees of damage, depending on the type, severity, and duration of the disaster. Increasing investment in social functions and improving the construction of disaster prevention infrastructure play an important role in disaster prevention. According to World Bank data, increasing 1% of GDP for disaster prevention can reduce disaster losses by 4% -5%. Therefore, if the level of economic development is high and the enterprise funds are sufficient,

it will increase investment in disaster prevention and reduction, adopt advanced technology, strengthen safety management, improve worker benefits, and thus improve the level of construction safety. From this analysis, the evaluation index of "social and economic conditions" is derived.

The government formulates and implements relevant policies and measures in disaster prevention, mitigation, and emergency rescue to enhance society's disaster prevention and post disaster recovery capabilities. The government should strengthen the construction of laws and regulations, improve disaster prevention and reduction regulations, clarify relevant policy objectives and regulatory requirements. In the process of policy implementation, the government should strengthen supervision over various levels of institutions and enterprises to ensure the effective implementation of relevant policies; The government improves the public's emergency awareness and self rescue and mutual aid capabilities through publicity, education, training and drills, so that the public can have a clear understanding and respond quickly when disasters occur; The government should also promote the participation of enterprises, institutions, and social organizations, and encourage them to carry out relevant rescue and support work. Through social participation, the government can better mobilize social resources and improve the efficiency and scope of rescue work. From this analysis, the evaluation index of "government regulatory strength" is derived.

4.2.2. Disaster culture

Disaster culture is the sum of collective cognition, behavioral patterns, and values formed by human groups in long-term disaster response, covering disaster prevention knowledge, emergency habits, and shelter facilities. It is not only the accumulation of historical experience, but also the embodiment of social wisdom in adapting to disasters, playing an important role in risk warning, behavioral norms, and community cohesion. Disaster culture emphasizes people's cognitive ability towards disasters, as well as their defense techniques and capabilities, including their views on disasters, their awareness of potential risks, and their awareness of disaster prevention and mitigation. The core of disaster culture is the concepts and behaviors that people possess and adopt under specific disaster conditions and environments, namely their way of life and behavior.[6] Disaster culture must be based on some material foundation and implemented in a certain form. Without the existence of basic living infrastructure, material resources, emergency equipment, and supplies, disaster culture will become illusory. China is a socialist country, and socialist morality emphasizes the importance of collectivism. The pan collectivist culture of "support from all sides in times of difficulty" often plays an important role in consolidating social forces.[7]

In order to reduce the occurrence of construction accidents, construction enterprises can promote cultural disaster prevention from three aspects: awareness, material and institutional. In terms of awareness, management personnel in high-rise building construction may neglect safety requirements in construction arrangements due to insufficient safety awareness, blindly pursue progress, and reduce safety investment. This weak safety awareness runs through the entire construction process, leading to the accumulation of safety hazards and greatly increasing the possibility of safety accidents, posing a serious threat to the safety of construction personnel and the quality of the project.

In terms of material aspects, the living environment of employees has a significant impact on the construction of high-rise buildings. A good living environment can ensure the physical and mental health of workers, such as sufficient sleep and hygiene conditions, which can reduce fatigue and disease transmission, and lower the risk of accidents. At the same time, standardized management of living areas can cultivate workers' sense of responsibility, promote the development of safe operating habits, and indirectly improve the on-site safety level. On the contrary, poor living conditions can easily lead to worker dissatisfaction and

laziness, increasing the probability of illegal operations. Therefore, enterprises should attach importance to the construction of living environment, implement living standards, improve supporting facilities, and build a basic guarantee for safe construction through hardware upgrades and behavioral incentives.

In terms of system, a sound emergency culture can strengthen the risk awareness of all employees, enabling workers to actively identify hidden dangers and participate in safety prevention and control. Through emergency training and drills, workers can proficiently master evacuation skills and equipment operation, significantly improving their ability to self-rescue and mutual aid in accidents. At the same time, emergency culture promotes enterprises to improve emergency plans and material reserves, ensuring rapid response and proper disposal of accidents, and reducing losses. Build a strong cultural barrier for the safety of high-rise building construction.

From this analysis, evaluation indicators such as "living environment for employees" and "construction of emergency culture system" are derived.

4.2.3. Disaster psychology

Disaster psychology is a comprehensive psychological phenomenon that arises in the specific context of a disaster, reflecting people's inner feelings and experiences regarding living conditions and actual living conditions after the disaster occurs. The connotation of disaster psychology includes two aspects: psychological processes and psychological characteristics. Psychological processes include cognitive, emotional, and intentional processes. Cognition refers to the feelings, memories, thoughts, etc. experienced during an accident; Emotion is a biased emotional response, such as sadness, resentment, sorrow, etc; Intention is the tendency behavior of relevant personnel under the conditions of an accident. Psychological characteristics refer to the characteristics of the relevant personnel at the time of the accident. In the construction process of high-rise buildings, once a safety accident occurs, relevant personnel may develop accident mentality. Under this psychological state, their negative emotions such as fear, anxiety, and unease may affect their subsequent work. From this analysis, the evaluation index of "psychological quality of relevant personnel" is derived.

The individual psychology during a disaster is not solely determined by the disaster situation, and individual traits are also a more critical determining factor. There are five factors that affect the psychology during a disaster, as shown in the following figure. People with an outgoing and optimistic personality may remain calm and actively seek solutions when facing disasters; Introverted and pessimistic individuals are prone to panic and helplessness. Experienced individuals with relevant knowledge can make more rational judgments about disaster situations, take effective response measures, and feel more secure psychologically; On the contrary, people who lack experience and knowledge often feel lost and under immense psychological pressure when facing disasters. From this analysis, the evaluation index of "personality of relevant personnel" is derived.

4.2.4. Disaster behavior

Moral psychology during disasters, like disaster psychology, includes elements such as moral cognition, moral emotions, and moral intentions. Moral intentions during disasters are the psychological driving force that triggers moral behavior during disasters. The types of moral behavior during disasters include sacrificing oneself for others, benefiting oneself at the expense of others, benefiting oneself without harming others, benefiting oneself without harming others, and harming others without benefiting oneself. If an engineering accident occurs during the construction process, if the relevant personnel can abide by ethics and laws and regulations, consider the overall situation, it is beneficial for handling safety accidents and has an important impact on subsequent construction. If relevant personnel exhibit selfishness, impulsiveness, selfish behavior, or even deviant behavior, it will have a negative impact on the

construction of the project. Based on this analysis, the evaluation indicators for "professional ethics and cultivation of relevant personnel" are summarized.

Based on the above analysis, the safety risk assessment indicators for high-rise building construction under the basic principles of disaster sociology are shown in the table below.

Table 1. Construction safety risk factors from the perspective of disaster sociology

Target layer	index
Risk assessment of construction safety in high-rise buildings	Psychological resilience of relevant personnel
	Personality of relevant personnel
	Professional ethics and cultivation of relevant personnel
	Socio economic situation
	Living environment for employees
	The government's regulatory efforts
	Construction of emergency culture system

5. Conclusion

Through systematic analysis of disaster sociology-related content, the study ultimately identifies safety risk assessment indicators for high-rise building construction from the perspective of disaster sociology. This enriches the safety risk assessment indicator system for high-rise building construction and provides a new perspective for construction safety risk assessment.

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