Application of Fire Emergency Lighting and Evacuation Instructions in Buildings

Wang Fang

China Northeast Architectural Design & Research Institute Co., Ltd, Shenyang, Liaoning, China

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Abstract: The basic design idea of installing a fire protection facility system in a building is to realize fire detection functions such as early detection of fire and evacuation of personnel, suppression of initial fire, and effective prevention of fire spread. The rapid development of economy, science and technology has led to the emergence of various buildings, especially large public buildings. Therefore, corresponding security issues are increasingly exposed. This paper first analyzes the problems existing in fire evacuation of large complex buildings, and points out the importance of fire emergency lighting and evacuation indication systems, which provides a guarantee for improving the safety of buildings. At the end of this paper, the design principle of evacuation indicator system is explained with an example of a hospital, which provides a theoretical basis for engineering designers.

1. Introduction

The emergence of complex architecture has brought great convenience to people's lives, but also brought new security risks. According to the latest statistics, in recent years, very serious catastrophic fire accidents have occurred in countries all over the world, causing incalculable losses to people's lives and property, leaving extremely profound lessons for people. Since the 1990s, in the case of major fire accidents in public gathering places, the number of mega-fires, the number of injured people and the number of dead people in large complex buildings such as shopping malls are increasing year by year.

The main characteristic of fire is that its combustion is uncontrolled in space and time, causing huge losses to people's lives and property as well as economic property. It may even deprive people of their most precious life and cause irreparable damage. When the fire broke out, the interior of the building is dimly lit. Due to the heat generated by the combustion and the influence of smoke, people are panicked and eager to escape. If there is no effective emergency lighting and clearly visible evacuation instructions, it will definitely lead to people to go around, looking for escape exits, so that missed the best escape time, causing unpredicTable consequences. However, when a fire started in the building, daily lighting electricity will be cut off automatically, general lighting equipment will not work properly, and the original evacuation lighting indicator system boot path curing, inflexible. Large complex buildings have large scale and complex structure, and different fire locations may lead to different optimal escape paths. To a large extent, the traditional evacuation lighting indicator system cannot meet the complex environment of complex buildings. Therefore, in order to ensure the safety of complex buildings, improve the evacuation efficiency of trapped people and reduce the loss of personal property and economic property, it is very important to design and use the emergency lighting evacuation indicator system correctly.

2. Problems existing in the evacuation of buildings

As a representative of modern architecture, large complex buildings, especially high-rise complex buildings, have the following common features:

1) There are many layers of buildings, and the vertical evacuation distance is long. It takes a long time to evacuate to the ground;

2) There are many people, and when an emergency is evacuated, it is very prone to congestion;

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3) People with complex building structures and unfamiliar with the structure of the building can hardly find an accurate escape exit;

4) There are more flammable materials in the building, and the smoke and fire spread upwards quickly, and it is easy to break into the stairwell, which increases the difficulty of evacuation. For example, large hospital buildings have complex zoning structures. For example, large hospital buildings have complex zoning structures. The functions need to organize internal traffic flow paths according to the principle of separation of doctors and patients, separation of sewage and pollution. However, the mobile population in the hospital is large and most of them are injured and sick, so they do not have the evacuation ability of healthy people, which greatly increases the difficulty of escaping from the fire scene.

3. Application of emergency lighting and evacuation in buildings

The emergency lighting evacuation indicator system is a lighting system for the evacuation of people in the building and the operation of fire control staff. The system is generally composed of emergency lamps, sub-area controller, emergency lighting distribution electrical box and other relevant equipment. The emergency lighting monitoring host can display the working status of each device in the system and adjust the working status of all the evacuated lamps in the system. The sub-area controller has a port for communicating with the outside world, and can communicate with the fire alarm controller to realize the sharing of the fire scene information. After the controller receives the signal of the fire alarm controller alarm, the relevant algorithm calculates the available evacuation path. Finally, adjust the direction of the field evacuation indicator lamp, and the emergency lamp enters the emergency state. The emergency lighting evacuation indicator lights up quickly after entering the emergency state, and the corresponding emergency sign lamps are also illuminated after entering the emergency state, providing emergency lighting and safety exit indication directions for the evacuation personnel to evacuate the dangerous fire areas. Because the evacuation indication system and the fire alarm system realize information sharing, it is possible to guide the trapped personnel to escape the dangerous area more timely and effectively.

The emergency lamps include emergency lighting lamps and emergency sign lamps. The emergency lamps change their working state after receiving instructions from emergency lighting controller. Emergency lighting lamps are in a non-working state under normal conditions. When a fire or other emergency happens, they will be switched to the emergency state and be lit up quickly to provide emergency lighting for evacuation channels. Emergency sign lamps usually only provide indication information. Generally, they are in a closed state in places with bright light, and the basement or places with dark light are generally lit. When there is a sudden accident such as a fire, they are immediately transferred to an emergency state. The sign lamp becomes flashing, indicating that a dangerous situation has occurred in the building.

China's standard for fire emergency lighting evacuation system “Technical Standard for Fire Emergency Lighting and Evacuation Indication System” GB51309-2018 has been officially implemented since March 1, 2019, and has played a unified role in the emergency lighting and evacuation instructions of buildings. The approval of the standard will further promote the deployment of fire emergency lighting and evacuation indication systems.

Emergency lighting lamps are all kinds of lamps that provide lighting and signs for the safe evacuation of personnel and the normal operation of firefighters. The classification is shown in Figure 1.

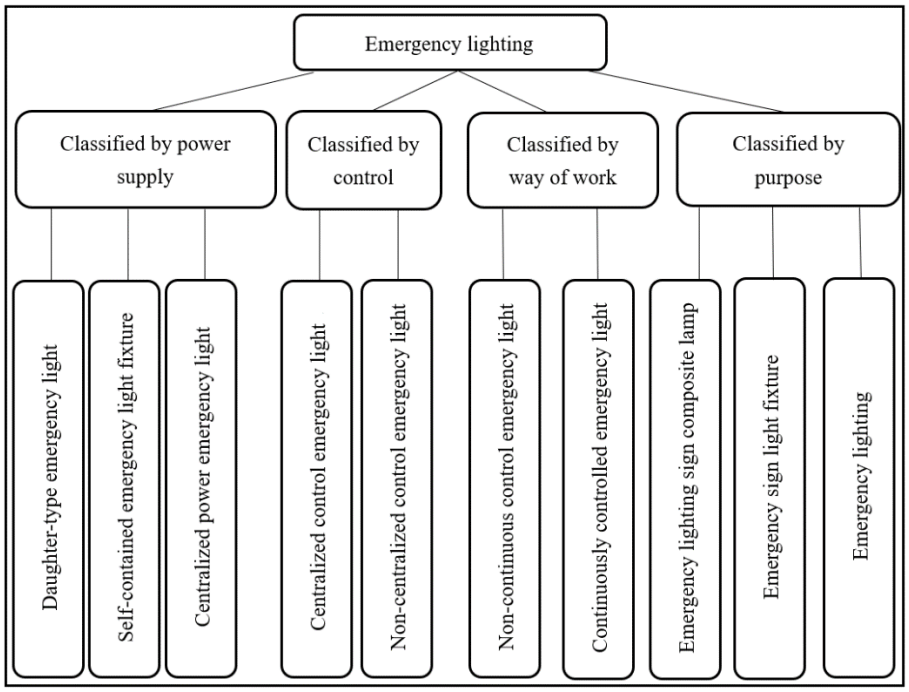

Figure 1 Classification of emergency evacuation lamps

This kind of emergency lamps are usually put out and do not work. When a fire or other accident occurs, the system will light up quickly after being transferred to the emergency state, providing essential illumination for the escape of the trapped personnel on the scene, helping the trapped people to quickly escape from the scene of the fire.

4. Intelligent lighting evacuation indication system design

Due to the increasingly complex structure of modern buildings, in order to help people find the exit at the first time when there is an emergency, this paper designs the intelligent emergency lighting evacuation indication system of large comprehensive buildings.

Fire emergency lighting and evacuation indication system in the case of fire, all fire emergency lighting and signage lamps are transferred to emergency work, providing necessary assistance for evacuation and firefighting operations. Therefore, rapid response, safety and stability are the basic requirements of the system. . Among them, the emergency conversion time: should not exceed 5s; the emergency conversion time of the system used in high-risk areas should not exceed 0.25s.

According to the environmental conditions of the real-time change of the fire scene, adjust the working status of the evacuation indicator, and take the approach of the fire source danger zone as the premise, and evacuate the evacuation through the shortest path on the premise of ensuring evacuation safety. The sensor detection technology is used to detect the real-time status of important nodes on the evacuation channel. The monitoring content mainly includes toxic gas concentration, fire spread trend, and site ambient temperature. The collected information is sent to the central processing unit, and the central processing unit performs comprehensive processing on multiple pieces of information, calculates the risk value of the node, converts the risk value into a virtual weight value, and then performs the path with the new virtual weight value. The optimization calculation changes the situation that the traditional evacuation indication system does not consider the change of the path condition and goes to the end from one to the end. It makes people's evacuation more flexible, improves the safety of evacuation, and shortens the evacuation time. The schematic diagram of evacuation scheme design is shown in Figure 2.

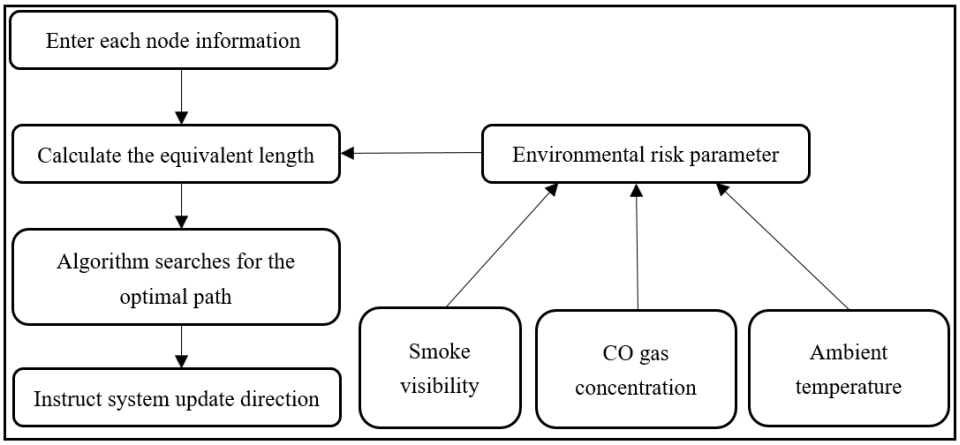

Figure 2 Schematic diagram of evacuation plan design

5. Case Study

A hospital project is a type of high-rise medical building with fire emergency lighting and evacuation indication system. The system has one host, and the system device and related equipment are composed of communication interface, regional collection module, equipment controller, power supply line, backup battery, intelligent emergency lighting distribution box and intelligent emergency indicator light. According to the layout of the building plane and the sign lights, three emergency lighting distribution boxes are arranged on each floor of the building basement. Except for the two sets of emergency lighting distribution boxes on the first floor, one emergency lighting distribution box is arranged on each floor. Each distribution box has several different types of evacuation indicator lights.

5.1 Evacuation indicator setting principle

1) A low-position two-way adjusTable marker light is arranged in the corridor, which has the function of changing direction and flashing, and is normally closed and does not work.

2) Large and medium-sized exit voice signs are installed at the safety exits and stairways of the fire zone. They have the functions of extinguishing lights, strobes, and voices. When a fire occurs, they can instruct people to quickly escape.

3) A smoke detector with an independent address in each floor evacuation area is selected as an information point for the fire alarm system linkage.

4) When a fire occurs, a ground (or wall) light flow indicator light may be placed in a place where a large number of people may gather in a short period of time and outside the main road.

5) According to the latest fire emergency lighting evacuation system specification, evacuation indicator lights of corresponding size are set in different places.

5.2 Setting Theory

When a fire occurs at or near the upper stairway, the smoke sensor of the fire linkage system detects the fire signal, indicating that the stair exit cannot pass here. After the host of the intelligent evacuation indication system receives the fire signal from the fire linkage system, immediately close the voice exit sign lamp and power supply of the stairs here, and adjust the direction of the two-way evacuation indicator light to point to the lower safety exit, and uses voice, strobe, optical flow, etc. to guide the escape personnel to choose a safe evacuation route. The system fully embodies the safe, rapid and accurate escape concept.

6. Conclusion

The high-rise, large-scale, multi-functional and complicated modern buildings have raised a new topic for fire emergency evacuation instructions. Due to the complexity of large-scale complex buildings, only fire detection and automatic fire alarm systems have been unable to meet the needs

of current buildings. In order to ensure that people's lives and property will not suffer losses in the event of an emergency, it is necessary to use fire emergency lighting and evacuation instructions correctly. After in-depth research, this paper proposes that the fire intelligent lighting evacuation system is a system that can actively and accurately indicate a safe escape route for evacuation groups, and stay away from danger and ensure people's lives.

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