Available online at www.sciencedirect.com

ScienceDirect

Procedia Engineering 211 (2018) 747–754

Procedia Engineering

www.elsevier.com/locate/procedia

2017 8th International Conference on Fire Science and Fire Protection Engineering
(on the Development of Performance-based Fire Code)

Fire Safety Analysis of Building Partition Wall Engineering

Qian WANG[a], Cong ZHANG[b,*]

[a]*Fire Engineering Department of Chinese People's Armed Police Force Academy, Langfang, 065000, China*
[b]*Graduate Department of Chinese People's Armed Police Force Academy, Langfang, 065000, China*

Abstract

Building partition wall, as one of the building partition constructions, and as one of the major renovation projects of the decoration and renovation engineering in commercial and official buildings, it often has an effect on the project's fire safety. In this article, the type, structure and materials of partition walls are summarized in classification, factors affecting the fire performance of building partition walls are analyzed, and problems of partition walls in engineering and fire protection designing are illustrated and analyzed. International and national standards are analyzed. Through discussions on fire safety audit and setting of partition walls, the adverse effects of partition wall renovation projects on building structures, damage to fire prevention compartment, impact on evacuation route of people, smoke control design and on other fixed fire protection facilities, are discussed in this article. It can be seen from these projects, if building partition walls were designed improperly, it would do great harm to building fire safety. Therefore, it should be taken seriously in fire safety designing. Some suggestions on the problems in the application of partition wall engineering are proposed, which can provide references for fire prevention designing.

© 2018 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the organizing committee of ICFSFPE 2017.

Keywords: building partition wall, decoration, renovation, fire performance, fire safety design

1. Introduction

With the development of commercialization of the city, many large and medium-sized shopping malls, office buildings, KTV rooms, hotels and many other buildings have been emerging rapidly. Taking into account the sound proof effect, installation of convenience, price and other factors, many businessmen use partition walls for space separation, and partition design is widely used in interior decoration of modern construction. Therefore, whether the selection of partition wall materials and the installation is reasonable, directly affect the load-bearing capacity of the building, the evacuation safety of people in fire, fire prevention compartment, fire detection and warning area.

In recent years, a large number of experiments on building elements are carried out by scholars[1-5]. A large number of structural experiments on partitions of different shapes, materials and structures are carried out, data of combustion performance and fire limitation of the wall are obtained. Factors affecting the fire resistance of the partition wall are analyzed, and the safety of new type partition wall is analyzed and evaluated.

In China, the fire resistance is defined and judged mainly by determining the combustion performance and fire resistance of the partition wall and its influencing factors. For example, datas of various structures, materials and fire resistance limits of various types of partition walls[6] are listed in Appendix 1 of Code for fire protection design of buildings.

The research subjects of building partition wall in foreign countries are mainly focused on the analysis of the factors affecting the fire resistance of building partition and the establishment of basic database, evaluation on the combustion and safety of new materials. For example, in the seventh chapter of International Building Standards of the United States(2012 edition), calculation methods of fire resistance on highly requested firewall, ordinary firewall and fireproof partition are regulated. Their materials, thickness, thickness of plastering layer under normal atmospharic temperature and in fire are also

* Corresponding author. Tel.: +86-15081689157.
E-mail address: 1540552557@qq.com

1877-7058 © 2018 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the organizing committee of ICFSFPE 2017
10.1016/j.proeng.2017.12.071

requested.

Japanese Architectural Standards (JIS 6[S], 2009 Edition), in which specific requirements of the structural material of the partitions have been made by Japan, especially, specific requirements for the partition walls of residential structures. French construction technology standards (NFP72-203-1/A1-2003), in which the interior wall packing materials are instructed to improve its quality and weight. At present, the use of refractory materials are not in line with the requirements of the partition wall in construction and decoration of engineering. The present research is not thorough and meticulous in the aspects of the fire risk caused by behavior of the building and partition wall removal at random. The predecessors only studied the combustion performance and fire resistance of the partition wall isolately, and could not combine with the specific application of actual engineering. In this paper, problems mentioned above are furtherly studied.

2. Classification, construction and fire resistance analysis of building partition wall

According to its structure, building partition wall can be divided into three types: masonry partition, skeleton partition and plate partition. According to fire resistance, building partition can be divided into two types: non-fire partition wall and fire partition wall. And the fire partition wall can divided into two types: fireproof partition wall and non-load bearing firewall. The fire-resistant limit of non-load bearing firewall can be up to 3 hours or more, and fireproof partition should be conformed to specifications for different fire resistance requirements[7-9], and can play a refractory function, and should be set in accordance with the specifications strictly.

2.1. The masonry partition wall

The masonry partition wall is partitions without load bearing built with various blocks. Masonry partitions mainly consist of clay brick partition walls, block partition walls, hollow brick partition walls, etc.. When the thickness of partition wall is the same, the fire resistance depends on the type of blocks. Fire resistance of different kind of partition walls is different. Another factor that affect the fire resistance of partition walls is the masonry method. And the fire resistance ratio of the empty partition walls is inferior to stuffed partition. The masonry partition wall has high fire resistance and good heat insulation, but its unit density is larger than other kinds of partition walls.

2.2. The skeleton partition wall

The skeleton partition wall is a light partition composed of stud and panel. The stud partition structure is flexible and can be erected to any height and thickness, and its interior can be filled with fireproof and heat insulating materials[10-13]. According to the type of stud, stud partition can be divided into steel stud partition wall, wooden stud partition wall and gypsum stud partition wall.

The flammability of the stud material affects the fire resistance[14-16]. Fire resistance performance of the steel stud partition wall is the best, the gypsum stud partition wall is the next, and wooden stud partition is the worst. The type and thickness of wall panel materials also affect the fire resistance of partition walls. As for non-combustible material panels, the greater the thickness, the better the fire resistance. The fire endurance of 15mm double layer refractory plasterboard is 2.00h, 12mm refractory plasterboard is 1.00h; if it is steel stud partition, the fire endurance is 1.50h and 0.90h respectively. Consequently, under the same conditions, the wooden stud has better fire endurance than the steel stud, so it is necessary to carry out fire-resistant protection for the steel stud when necessary. The structure of the skeleton partition, such as the thickness of the packing, fireproof protection and the wall decoration will also affect fire resistance of the skeleton partition wall. The skeleton partition wall material can meet the requirements of light weight, sound insulation, heat insulation, fire resistance, water-proof, and is easy to assemble and dismantle.

2.3. The slat partition wall

The slat partition wall is assembled with partition plate whose height equals to the room. Slat partition wall can be divided into combustible plate partition and non-combustible plate partition[17-18]. Combustible plate partitions include plywood partitions, plasterboard partitions, particleboard partitions, and Tabor partitions. Non-combustible plate partition walls mainly include calcium silicate board partition wall and metal plate partition wall. Their thickness is mostly 60-120mm, and the quality is light and convenient in construction. For slat partition walls, main factors affecting the fire resistance is the panel type[19-20], with which fire endurance vary. As the skeleton partition wall, thickness of the plate and wall decoration will affect the fire resistance of the slat partition wall. The slat partition walls are of light quality, high strength, energy saving, earthquake resistance. It increases the use area, reduce the project cost and has some other advantages.

Download English Version:

https://daneshyari.com/en/article/7226429

Download Persian Version:

https://daneshyari.com/article/7226429

Daneshyari.com