

Appraisal of Passive and Active Fire Protection Systems in Student's Accommodation

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Abstract - Fire protection systems are very important systems that must be included in buildings. They have a great significance in reducing or preventing the occurrences of fire. This paper presents an assessment of fire protection systems in student's accommodation. Student accommodation is a particular type of building that provides shelter for students at University. In addition, it is also supposed to be an attractive environment, conducive to learning, and importantly, safe for occupation. The fire safety of occupants in a building, must be in accordance with the requirements of the building's code. Therefore, the design of the building must comply with the Uniform Building By-Law (UBBL) 1984 of Malaysia, and provide all of the required safety features. This paper describes the findings from investigations of passive and active fire protection systems installed in buildings, based on fire safety requirements, UBBL (1984).

1 Introduction

Fire protection, in terms of construction, is the means to inhabit or mitigate the ignition, growth and spread of fire and its effects through the built environment. The insurance industry has struggled for centuries to reduce risk from fire, and only in the past 50 years, have life safety systems and building codes matured to the point that compliance with applicable codes and standards provides a significant reduction in exposure [1]. Fire protection systems are not new systems in buildings. It is important that these systems are installed in buildings [2]. The building to be occupied must be equipped with the best security to protect occupants against accidental events, such as fire. In other words, a prevention system is a protection tool for building occupants [3]. With regards to installation, fire protection systems are usually installed as part of the building's detailed design; and placed in an easy to see and use location, in the event of fire [4].

Even though adequate systems have been developed, misconceptions about occupants' behaviour during fire exist, due to a lack of data available on the level of fire safety knowledge of the building's occupants [5]. Lack of fire safety knowledge by building occupants parallels the misconceptions of fire safety engineers about people's reactions when faced with fire [6]. This study seeks to examine fire protection systems in student's accommodation, consisting of two types of buildings, namely student dormitories and family house accommodations. It also seeks to assess these fire protection systems using UBBL (1984). Meanwhile, identification of the level of occupant's knowledge, according to these fire protection systems, is a minor objective of this study.

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2 Methodology

The methodology of this research consists of three steps. The first step is information gathering, which is obtaining data from various sources, such as journals, articles, etc. The second step is the fieldwork itself, which consists of observation, interviews, and questionnaires. These form the three main methods of collecting data. Observations were carried out at student accommodations, such as Tekun (Figure 1a) and Aman Damai (Figure 1b), Family Houses for postgraduates (Figure 2a), and Family Houses for undergraduates (Figure 2b), to identify whether fire protection systems were installed and to assess these fire protection systems according to UBBL (1984). Several interview sessions with the technician at Jabatan Pembangunan USM and an officer from Jabatan Bomba were conducted.



Figure 1. (a) Desasiswa Tekun



(b) Desasiswa Aman Damai



Figure 2. (a) Postgraduate family house



(b) Undergraduate family house

3 Observations, Questionnaires, Results, and Analyses

3.1 Passive Fire Protection System in Student's Accommodation

3.1.1 Compartment

Even though compartmentation in buildings with large floor areas is important, the vertical spread of fire poses a more serious problem [7]. For this reason, compartmentation requirements around vertical openings are often especially strict. The design of Desasiswa Tekun includes

compartmentation. It has four compartments that can protect and resist against fire, and also avoid the spread of smoke throughout the whole building. Furthermore, compartmentation makes it easier for fireman to control and extinguish fires, because it does not allow the fire to spread easily to other compartments. Desasiswa Aman Damai has a block structure. Each block has two floors with a fire door to protect and resist against the spread of fire from one floor to another, if fire occurs.

3.1.2 Fire Doors

Fire escape doors need to be wide enough to allow people to pass through in the event of an evacuation [8]. Fire doors protect persons escaping from heat, and more importantly, from the smoke generated from a developing fire. The fire doors at Aman Damai are able to resist fire for one and a half hours. Fire doors were installed at both corners of the Aman Damai building, and at the centre of the building. The fire doors at Aman Damai functioned not only to resist fire, but were also used as an exit for occupants (Figure 3). Fire doors should always be kept closed; however, because of their other function, they were always open.



Figure 3. Fire resistance door at Desasiswa Aman Damai

3.2 Active Fire Protection Systems in Student's Accommodation

3.2.1 Sprinkler System

A sprinkler system is an active fire protection system. This equipment was only provided at Tekun, because these are new buildings that comply with UBBL (1984) requirements. This system was not installed in Aman Damai, because it was built in 1969; before UBBL (1984) was established. However, Jadwal Kesepuluh, UBBL [9] states that student's residential buildings not exceeding two to three levels, are required to have fire hose reels and automatic alarms. This type of system releases water automatically to extinguish the fire's source and minimize the fire from spreading.

3.2.2 Hose Reel

Fire hose reels are located to provide a reasonably accessible and controlled supply of water to combat a potential fire risk [10]. This system is important, because when fireman arrive, they can use the system to extinguish the fire. In student's accommodation, all buildings have this system. This system can be easily seen, because it is located on the exit route for Aman Damai (Figure 4) and at lobby lift area for the Tekun building. Most fire hose reels were inside boxes and could be swung. This is so it can be removed from the box to facilitate fire fighting at long distances. For the family houses (undergraduates), it was located at the centre of the building, so it could be used to extinguish both sides of the building using a 30 metre hose.



Figure 4. Hose reel installed at Desasiswa Aman Damai

3.2.3 Breakglass

The alarm is operated manually by the occupant using a breakglass system when fire is detected. Both buildings had this system. However, Jabatan Pembangunan used this breakglass procedure to inform other building occupants. This alarm system must be installed based on UBBL clauses 225 (1), 237 (2), and 244 [9]. Aman Damai installed breakglasses in three places; the middle of the building and at both ends of the building. Meanwhile, Tekun installed breakglasses at every compartment of the building. Each floor placed four breakglasses, but for compartments near to the lift, the system was only installed at the lift lobby. The related clauses in UBBL are 225 (1), 244 [9].

3.2.4 Heat Detectors

This device operates automatically and can detect fire. It also serves to activate the fire system when it detects a certain amount of smoke [11]. This system was positioned in the switch room of the at Aman Damai, and was needed to identify heat within that room. Tekun also provided this system in the switch room on the ground floor. These detectors detect the heat released by fire sources. Fire alarm systems are activated when heat is detected, alerting occupants of the need to evacuate.

3.2.5 Smoke Detectors

A smoke detector is a device that detects smoke, and is typically used as an indicator of fire. It also serves to activate fire systems, when a certain amount of smoke is detected. At Aman Damai, this system is located in switchboard rooms, due to an increased risk of a fire. Meanwhile, at Tekun, it is located at the lift motor room and the elevator shaft. It serves as an alarm for maintenance personnel, in case fire occurs during maintenance work. Placement of this equipment conforms with UBBL (1984), Clauses 225, 237, and 244 [9].

3.2.6 Fire Panel

Both of the student's accommodations have this system. Aman Damai has this system located at the centre of the building and Tekun (Figure 5) placed this system at the entrance. This makes it easy for firemen or guards to identify the location of fire. The panel operates zonally, thus making it easy for fireman to identify the location of a fire. The particular zone indicator light will light-up on both the main fire alarm panel and the repeater display panel. This alarm system must be installed based on UBBL (1984), Clause 225 (1) [9].



Figure 5. Fire alarm panel at Desasiswa Tekun

3.2.7 Portable Fire Extinguisher

Portable fire extinguishers apply an extinguishing agent that will cool burning fuel, displace or remove oxygen, or stop chemical reactions, so that a fire cannot continue to burn. Aman Damai have installed this system in every block. Carbon dioxide and dry powder fire extinguishers were installed on the ground floor, but on the first and second floors, only powder fire extinguishers were installed. They were located near escape routes, thus making it easier for occupants to fight fires. Tekun also installed this system on the walls of every compartment. CO₂ fire extinguishers were also installed at Tekun, but only in the PBA Room (Figure 6), because this room had a switchboard, with an associated risk of fire. Dry powder fire extinguishers were installed in this building and both family houses. Even though in UBBL, Jadwal Kesepuluh does not require portable fire extinguishers to be installed in dorms, for safety, this system was installed [9].



Figure 6. Portable Fire Extinguisher (CO₂) at Tekun in the PBA sprinkler tank room

3.2.8 Fire Lift

Lifts help provide access to floors above or below the main entrance level. For buildings where the topmost occupied floor is over 18.5 metres above the fire appliance's access level, lifts shall be provided. Installation should be designed and installed for the vertical transportation of fireman [6]. In student accommodation, only three buildings had lifts installed, this included Tekun (Figure 7). This lift was installed because the height of Tekun is more than 18.5 metres; and based on UBBL Clause 243 (1) it should installed [9]. Meanwhile, at Aman Damai and both family houses, staircases were provided for occupants for general movement and as an escape route for fire events.



Figure 7. Fire lift at Desasiswa Tekun

3.2.9 Exit Signage

When there is a fire emergency in building, all occupants must be notified of the most efficient way to exit. Exit signage is an effective guidance tool to help occupants escape if fire occurs in a building. “Exit” signs at Tekun were located at exits and staircases. Occupants unfamiliar with the layout of the building will find it easy to find exit routes, due to the sign’s proximity to the stairs. Thus making it easy for them to run if fire occurs. Aman Damai located these signs at exits in every block, on the left and right sides, and also in the centre of the building. Exits and escape routes follow the same route at Aman Damai; therefore, it is not difficult for occupants to find this signage when fire occurs. This signage was not provided at both family houses.

3.2.10 Emergency Lighting

Emergency lighting systems are designed to allow safe evacuation of a building. This lighting is used when the building’s main power supply fails. Aman Damai installed a number of emergency lighting in their building. If fire occurs, it will illuminate and guide occupants to the exit. Tekun also installed this lighting at the lobby lift and along the walkway of the building. Lighting was installed in every cube of compartments, due to the structure of the building, because occupants need emergency lights to take them out of the building if fire occurs. Post graduate family houses installed this emergency lighting system on the ground floor (Figure 8) and at staircases, thus providing a lighting system to illuminate these areas. However, undergraduate family houses only provided a lighting system to illuminate that area.



Figure 8. Emergency lighting fixed at postgraduate family houses

4. Conclusions

Based on the research carried out, the buildings in this case study were equipped with necessary fire protection equipment that complied with the requirements of UBBL (1984). However, the fire protection systems installed were different between new and old buildings. The building's design seems to influence the type of system provided. A comparison of student accommodation at Aman Damai and Tekun showed many significant differences in the active fire protection systems used; especially equipment. Various equipment was required at Tekun, due to the design of the building. Tekun is a new building that was built after building code UBBL (1984) was introduced. Meanwhile, Aman Damai is an old building that was equipped with a proper active fire protection system; only after it was upgraded to comply with UBBL.

Even though the basic requirement for fire fighting equipment and building performance in Aman Damai was adequate, detector installations in rooms should be provided as an initial step for preventing loss of life and property. For the family houses, the active fire protection system in the undergraduate family house was better than that of the post graduate family house. According to UBBL, the necessary fire protection system equipment was not installed in both buildings, because they are categorized as dwelling houses.

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