BUILDING OCCUPANTS' KNOWLEDGE ON FIRE SAFETY EVACUATION PLAN AT SHOPPING MALL : EVACUATION PATHWAY

NABIHAH ABDUL MALIK

BACHELOR OF OCCUPATIONAL SAFETY AND HEALTH WITH HONORS

UNIVERSITI MALAYSIA PAHANG

UNIVERSITI MALAYSIA PAHANG

DECLARATION OF THESIS AND COPYRIGHT

Author's Full Name : _____

Date of Birth : _____

Title : _____

_____

_____

Academic Session : _____

I declare that this thesis is classified as:

☐	CONFIDENTIAL	(Contains confidential information under the Official Secret Act 1997)*
☐	RESTRICTED	(Contains restricted information as specified by the organization where research was done)*
☑	OPEN ACCESS	I agree that my thesis to be published as online open access (Full Text)

I acknowledge that Universiti Malaysia Pahang reserves the following rights:

1. The Thesis is the Property of Universiti Malaysia Pahang
2. The Library of Universiti Malaysia Pahang has the right to make copies of the thesis for the purpose of research only.
3. The Library has the right to make copies of the thesis for academic exchange.

Certified by:

_____	_____
(Student's Signature)	(Supervisor's Signature)
_____	_____
New IC/Passport Number	Name of Supervisor

BUILDING OCCUPANTS' KNOWLEDGE ON FIRE SAFETY EVACUATION PLAN AT SHOPPING MALL:EVACUATION PATHWAY

NABIHAH ABDUL MALIK

Thesis submitted in fulfillment of the requirements

for the award of the degree of

Occupational Safety and Health

Faculty of Engineering Technology

UNIVERSITI MALAYSIA PAHANG

JANUARY 2018

SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Occupational Safety and Health.

_____

(Supervisor's Signature)

Full Name : Associate Professor Dr. Mohd Fadzil Mohd Idris

Position :

Date : 7 December 2017

STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

_____

(Student's Signature)

Full Name : Nabihah Abdul Malik

ID Number : PA14040

Date : 7 December 2017

ACKNOWLEDGEMENTS

I am sincerely grateful to Allah S.W.T for giving me strength and patience to complete this research. Without the permission of Allah, this thesis will not be successfully completed.I am also truly grateful and would like to express my sincere thanks and gratitude to my supervisor, Associate Professor Dr.Mohd Fadzil Mohd Idris for his constant guidance and support in making this research possible. He had always believed in me and my abilities despite the many flaws I showed throughout the whole research process. He had relentlessly helped me improve not only my proposal report, but also myself as a whole with his passion and care. His encouragement has given me the strength and willpower to keep pushing to complete this research and I am truly thankful and honored to be given the golden opportunity to be guided by him.

Most sincere and utmost thanks go to both my beloved parents for showing so much love and support. Their constant prayers and belief kept the author staying strong especially at times when author felt like giving up. I would also like to express gratitude to fellow course mates and friends whom provided guidance and help throughout the two semesters of this research.

ABSTRACT

Fire safety consideration give influence when designing a building. Tragic disaster such as fire in large public and residential buildings (cafes, trades, and building) usually results in tragic consequences in people and environment. Studying the level of awareness and knowledge about fire safety evacuation plan particularly at the shopping mall can prevent possibility of injury, fatality or loss of property. Data collection was done using three methods that are questionnaires, walkthrough inspection and interview. Data was analyze using descriptive statistics because no association or relationship that need to be studied. The mean from the Likert Scale was used to determine the level of awareness among building occupants. The level of awareness is moderate. Management of the shopping mall was found to be lack in fire safety knowledge. In conclusion, the level of awareness on fire safety evacuation plan can be improved by training and education, digital screen display, installation proper signage and also compounding action by the management of the shopping mall.

ABSTRAK

Pertimbangan keselamatan kebakaran memberi pengaruh ketika merancang bangunan. Bencana tragis seperti kebakaran di bangunan awam dan kediaman yang besar (kafe, perdagangan, dan bangunan) biasanya mengakibatkan akibat tragis kepada orang dan alam sekitar. Mempelajari tahap kesedaran dan pengetahuan mengenai pelan pemindahan keselamatan kebakaran terutama sekali di pusat membeli-belah boleh menghalang kecederaan, kematian atau kehilangan harta benda di masa hadapan. Pengumpulan data dilakukan menggunakan tiga kaedah iaitu soal selidik, pemeriksaan dan wawancara. Data dianalisis menggunakan statistik deskriptif kerana tiada persatuan atau hubungan yang perlu dipelajari. Mean dari Skala Likert digunakan untuk menentukan tahap kesedaran dalam kalangan penghuni bangunan. Tahap kesedaran adalah sederhana. Pengurusan pusat membeli-belah didapati kurang berpengatahuan tentang keselamatan kebakaran. Kesimpulannya, tahap kesedaran tentang pelan pemindahan keselamatan api dapat ditingkatkan dengan latihan dan pendidikan, paparan skrin digital, pemasangan papan tanda yang betul dan juga tindakan penggabungan oleh pengurusan pusat membeli-belah.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

UBBL	Uniform Building By-Laws 1984
SPSS	Statistical Package for Social Science (SPSS) Version 24

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Fire safety consideration give influence when designing a building. However, the design of the building also appears to remain not be concerned with matters related to fire safety considerations. Fire safety is a set of practice contracted to reduce the loss caused by fire. This chapter mainly highlight on the general idea of this study along with the research objectives, problem statements, research questions, research hypothesis, significance of study, scope of study and conceptual framework.

1.2 BACKGROUND OF STUDY

Tragic disaster such as fire in large public and residential buildings (cafes, trades, and building) usually results in tragic consequences in people and environment. Current buildings are designed higher and more complex than before. Generally, disasters can be grouped into the following types (Pu & Zlatanova, 2005). Primary disasters such as: fire, power outage, terrorism, chemical releases, earthquake, flood, hurricanes, etc.

Shopping malls face much type of risks, from accidents and trips to the risk of fire. This study is focus on shopping malls instead of retail store because people these days prefer to spend their leisure time at shopping mall. They prefer to spend their weekend or free time at the mall because they can get everything they want there. Furthermore, there are many restaurants in the mall so people can eat and hangout after they shop their goods. In large, multi-occupancy building such as shopping mall, the need for fire safety control and the benefits of these controls should not be in any doubt. Every building needs to have reliable fire detection system to support the rescue operation.

Fire safety is an extensive, multi-disciplinary requirement in building design. According to researcher (Maluk, Woodrow, & Torero, 2017), the design of individual building elements is needed to comply with 'acceptability' criteria given in building codes.

The classification of buildings and fire protection systems is closely connected. Therefore, the main object of safety system is to detect, eliminate, and reduce the risk of those potential hazards. A research by (Qian-li & Ting-lin, 2011) which was conducted in China showed that bigger commercial complex needs higher fire safety. Style of the indoor walking street, the building style and the distribution of business operations inside the complex and the occupancy density also covered by fire protection system. Firefighting equipment, fire alarm, smoke control pattern, sprinkler valves as well as other important design parameters also included in the protection system.

Brazil has experienced several fires that caused human and material losses. A research by Rodrigues et al., (2017) reported that few preventive information has been provided to raise awareness among users. The way people respond to an event depends on how the situation is clarified. Other research which is conducted by Tancogne-Dejean & Laclémence (2016) showed that early awareness of danger is aggregable to a successful evacuation. While a researcher in USA (Kuligowski & Mileti, 2009) found that being farther from safety increases a person's risk perception.

There are two main categories in evacuation, which are pre-movement activity and the action of escape. Pre-movement time is one of the facts that specify the total evacuation time. It includes occupant response time, which may have behaviours and recognition time. Human responses in pre-movement times cause the prediction of time duration become very complicated. During evacuation analysis, the period could not be ignored. If the occupants delay too much time to move out of the building, it is impossible for them to escape from the building safely due to some critical space in evacuation pathway being blocked.

Average number of fires per year in countries in 2010-2014
Среднее число пожаров в год в странах мира в 2010-2014 годах
Mittlere Brandanzahl in den Staaten in den Jahren 2010-2014

N	Number of fires per year Число пожаров в год Gesamtanzahl der Brände pro Jahr	Number of countries Число стран Anzahl der Staaten	Countries Страны Staaten
1	600 000 - 1 500 000	1	USA
2	100 000 - 600 000	13	UK, France, Germany, Russia, Poland, China, India, Brazil, Italy, Mexico, Australia, Argentina, Pakistan
3	20 000 - 100 000	21	Japan, Indonesia, Turkey, Canada, South Africa, Malaysia, Netherlands, Ukraine, Spain, Iran and others
4	10 000 - 20 000	20	Thailand, Algeria, Uzbekistan, Romania, Kazakhstan, Cuba, Czech Republic, Belgium, Serbia, Denmark, Finland and others.
5	5 000 - 10 000	15	Iraq, Shri-Lanka, Syria, Tunis, Slovakia, Georgia, Singapore, Croatia, Philippine and others
6	< 5 000	150	Countries have, as a rule, less than 5 thous. fires per year
Total/Итого/Gesamt:		**220**	

Note: There are no data from such the large countries as Nigeria, Bangladesh, Egypt.
Every such country may have from 30 to 50 thous. fires per year.

Figure 1.1: The statistics of fire accident from International Association of Fire and Rescue Service

Source : www.ctif.org

Figure 1.1 shows the statistics of fire accident from International Association of Fire and Rescue Service shows that fire accidents happened around the world. On January 2017, a huge blaze engulfed big shopping centre in Russia. The fire burned down some parts of the building. According to reports, two cars in the mall's parking lot are believed to start the fire but the cause of the blaze has not been identified. Hundreds people evacuated from the building after an announcement was made. There is also fire accident occurred in shopping mall in South Korea. The accident killed four and 40 other people are injured. The fire spark came from a kids' play area in the mall. Two builders, a worker and a shopper were reported dead. Most of the 47 injured complained of smoke inhalation.

On August 2016, Westfield shopping centre in Stratford was evacuated after a fire alarm blow up in the food court area. Thousands of the shoppers leaving the mall as the alarm

rang out. Investigations are underway to find out the reason why the alarm goes off. There were various complaints from shoppers regarding the evacuation procedure with many calling it ‘dangerous’ as they said there are no signage at the mall and no proper evacuation pathway.

Many fire accidents also reported in Malaysia each year. In 2012, on the passageway level of the building at Kuala Lumpur Convention Centre (KLCC), a small fire broke out from restaurant. Hundreds of people were evacuated from KLCC after an announcement through loudspeaker system asking people to leave the building was made. Shoppers and office workers were among the first to be evacuated. Federal Territory Fire and Rescue Department assistant director Azizan Ismail confirmed the incident and said no injury or casualty was reported. There are also accidents at Midvalley Megamall and One Utama Shopping Centre. Fire accident at One Utama Shopping Centre happened on 2014. The fire came from Food Republic food court in the new wing of the shopping mall. The cause of the fire was apparently from the poor ventilation system. Fortunately, no one was injured by the fire as the fire was put out as soon as possible.

The latest fire accident happened at Midvalley was on 5th April 2017. There were two explosions caused by gas leakage at two restaurants. The explosions happened while maintenance staffs were doing checks at the kitchens of both restaurants, a routine inspection involving all restaurants at the shopping centre. Eight people were injured but no fatality was recorded.

PERANGKAAN KEBAKARAN MENGIKUT JENIS BANGUNAN
DI MALAYSIA BAGI TAHUN 2011

BIL	JENIS BANGUNAN / NEGERI	PLS	KED	PP	PRK	SEL	KL	NS	MEL	JOH	PHG	TRG	KEL	SBH	SWK	LAB	PUT	JUMLAH
1	KEDAI	2	41	58	37	150	66	31	70	54	43	23	14	23	40	1	1	654
2	KILANG	1	19	31	8	116	3	16	31	29	7	2	2	20	20	2	0	307
3	SETOR	5	15	13	24	50	21	8	8	33	2	3	8	12	15	0	0	217
4	WOKSYOP	0	8	6	5	15	6	2	3	9	2	4	3	6	2	0	0	71
5	HOTEL	0	2	0	0	2	12	3	2	1	3	2	1	4	2	1	0	35
6	PUSAT B/BELAH	0	4	0	0	1	10	0	1	0	1	1	0	0	0	0	0	18
7	PEJABAT	0	6	5	1	31	37	9	3	10	5	3	2	9	10	1	0	132
8	TEMPAT HIBURAN	0	2	0	1	1	3	1	0	3	4	1	0	2	2	0	0	20
9	RESTORAN	0	4	1	0	22	20	2	1	1	2	0	2	3	5	0	0	63
10	RUMAH KEDIAMAN	12	199	186	152	609	416	138	90	186	99	72	128	280	186	7	1	2,761
11	SETINGGAN	0	6	7	5	7	7	3	0	4	2	0	1	16	8	0	0	66
12	BILIK DAPUR	1	11	45	5	87	0	7	7	17	9	6	0	14	17	2	1	229
13	MAKMAL	0	0	0	0	5	4	0	0	1	1	1	0	1	0	0	0	13
14	SEKOLAH	2	4	9	4	19	17	8	6	6	6	1	4	7	3	1	0	97
15	ASRAMA	1	5	2	0	8	3	0	1	5	4	4	0	3	2	0	0	38
16	HOSPITAL/KLINIK	0	0	2	0	2	8	0	0	1	0	0	0	4	0	0	0	17
17	GUDANG	1	1	0	0	3	0	0	1	0	0	0	1	0	2	0	0	9
18	LAIN-LAIN	9	14	36	30	148	4	21	7	48	21	86	19	13	40	2	3	501
JUMLAH		34	341	401	272	1,276	637	249	231	408	211	209	185	417	354	17	6	5,248

Figure 1.2: The statistic from Fire and Rescue Department of Malaysia

Source : www.bomba.gov.my

1.3 PROBLEM STATEMENT

There must be fire hazard in each building. A fire hazard is any situation in which there is higher than normal risk of harm to people or property due to fire. Based on the statistics above, it is stated that the fire accident in shopping mall still present. Fire accident can cause fatality or injury to anyone.

Most of the people do not know how to response to the hazard. People are not aware of the fire hazard and building evacuation process. There are two main portions in evacuation, which are pre-movement activity and the action of escape. They do not take seriously about the danger they are facing due to ignorance or maybe it is not happening to them yet. Even if something were happening, people would like to check to confirm of the scene whether it is a right fire alarm or it could be false alarm. Therefore, this may lag the evacuation time for the people in public area. Different people have particular experience, point of view and awareness about fire evacuation.

During emergency, there might be overcrowding and people crumbled to get out from the building within the safe evacuation time. The amount of time needed to leave the building is determined by the evacuation pathway (Lindell, 2008). Time of travel motion is another period of evacuation time. The conditions that need to be considered in evacuation time are normal condition, normal conditions except some selected spaces blocked and dynamic blocking of some spaces.

It is the building owner's responsibility to let every building occupant knows about the fire evacuation plan. Lack of fire safety awareness to allow people to have enough information about the evacuation and exit route for them to be safely walked out of the building during the emergency. Also, there are no emergency and evacuation plan in the building because the management has not enough budgets to spend on fire safety requirement. However, this is yet to be proved in this study.

In fire emergency, the blocking of spaces will change with time due to the smoke movement between different slots. Only a little space will remains for some period of time. This situation makes it difficult for people to escape from the building. The prediction of evacuation time also becomes more complex. The evacuation path must be large and wide so people can easily save themselves during an emergency .

Most building occupants are not properly informed through training, education or through fire drills due to some circumstances that insist in their growing up period. Some may be trained or be taught in classroom, for example, fire safety courses or involve directly with if they are working as fire fighter. The information can be taught to the public in term of fire safety in two ways. One is formal and the other one is informal. Formal education involved in any seminar. While informal education is by watching television, reading newspapers or listening to the radio. It is good if they have their own experience involved with fire accident. However, building occupants need to be informed and well trained wherever or whenever they are present in the building in term of protection and prevention system that are available in the building.

The design of any fire protection and prevention system is the most concern that takes into account the usage of the building. Fire protection in land-based buildings usually achieved thru passive fire protection (the installation of use of fire-resistant walls, floors, and

doors). Education is also a passive prevention system because people educated in terms of knowledge and theory but not in the practice. In a real exercise, it is really expensive. Direct education usually involved training and courses but indirect education is only by listening to information, rules and regulations. The management could not kill someone for the sake of training. That is why people could not see the real danger they are facing in the building. However, training and knowledge can build the awareness among building occupants to act smarter.

Active fire protection is fire sprinkler systems, fire alarm systems and fire extinguisher. Assuming modern shopping mall must have already fulfilled fire safety requirement. Nonetheless, this study will focused more to prevention system of fire safety that involve exit route, evacuation path and signage that is connected along the evacuation path. At least one primary exit and one secondary exit route plan should be invented. Uniform Building by Laws 1984 stated that these exits must be far away from each other to avoid that the fire may block both. Exit sign need to be placed in every suitable location where the direction will lead to the nearest emergency exit. Signage provides clarity of direction (Kusumowidagdo et al., 2016).

Figure 1.3: Kiosks and extension at shopping malls

1.4 RESEARCH OBJECTIVES

Among the research objectives that will be focusing on this study was very much related to research questions as researcher trying to related the research questions and research objectives.

1. To identify the level of knowledge of building occupants and management of building regarding fire evacuation plan particularly in shopping mall.

2. To determine the preventive measures among building occupants to accelerate the evacuation time out of the building.
3. To observe the adequacy of fire protection system installed within the evacuation pathway in shopping mall.

1.5 RESEARCH QUESTIONS

From previous cases and studies related to fire safety evacuation, there are crucial issues to be solved. The issues are to reduce the rate of injuries and fatality and to increase the awareness among building occupants. Among the research questions are:

1. What building occupants know about fire evacuation plan in the shopping mall?
2. What are the matters that obstruct and delay the building occupants' time to egress from the building?
3. What are the fire protection and prevention system that can be found in the shopping mall particularly along the evacuation path or escape route.

1.6 RESEARCH HYPOTHESIS

The hypotheses of this research are:

1. Management does not have knowledge and does not supervise shop owners about fire safety.
2. Level of awareness among building occupant is low.
3. Fire safety preventive and protection measure is not adequate at the shopping mall.

1.7 SIGNIFICANCE OF STUDY

This study is significant, as it will inform the building occupants about the importance of knowing the fire evacuation plan in the building. Evacuation plan need to be easy to

understand and in its simplest way of escape among building occupants including the business, tourist, shoppers as well as the management so the building occupants so they will know exactly what to do and able to follow the right evacuation plan during any emergency. The management should be well trained in order to be able to make right evacuation decision regarding fire safety for building because their decision about fulfilling the requirement or not will determine the number of fatality and injury among shoppers in case of fire emergency. This could also be one of the main requirements to have fire risk assessment in building by fire safety consultant. It will help the insurance industry to determine whether certain building can be covered with lower premium or higher premium due to their lack of management understanding regarding fire safety procedures.

1.8 LIMITATION OF STUDY

This study will be conducted at shopping malls in Kuantan because the period given to conduct this study is only within four months so researcher picked several shopping mall in Kuantan as a representative of all shopping malls in Malaysia. There are some barrier and limitation while conducting this study. The distance between Kuantan and Universiti Malaysia Pahang is not that far compared to any shopping malls in Kuala Lumpur. Sometimes, they are too many people in the shopping mall especially during weekend so it is somewhat crowded. Furthermore, some retailer might find it is disturbing them when they have to answers all the questions that are hand to them. Other limitation is the management of the shopping mall probably will give a late respond. This study will only focused on the shop owners or retailers, so the permission from the building's owner is necessary.

1.9 SCOPE OF STUDY

This study will focus mainly on shopping mall in Kuantan, as a representative of all malls in Malaysia. The reason why shopping mall in Kuantan are chosen because no one had ever done any study related to fire safety at Kuantan malls as any articles about it cannot be found. Rules and regulation that can be referred in this study is Uniform Building by Law 1984. This study also focuses on shop owners and management of the shopping mall and the location is only above ground level.

1.10 CONCEPTIONAL FRAMEWORK

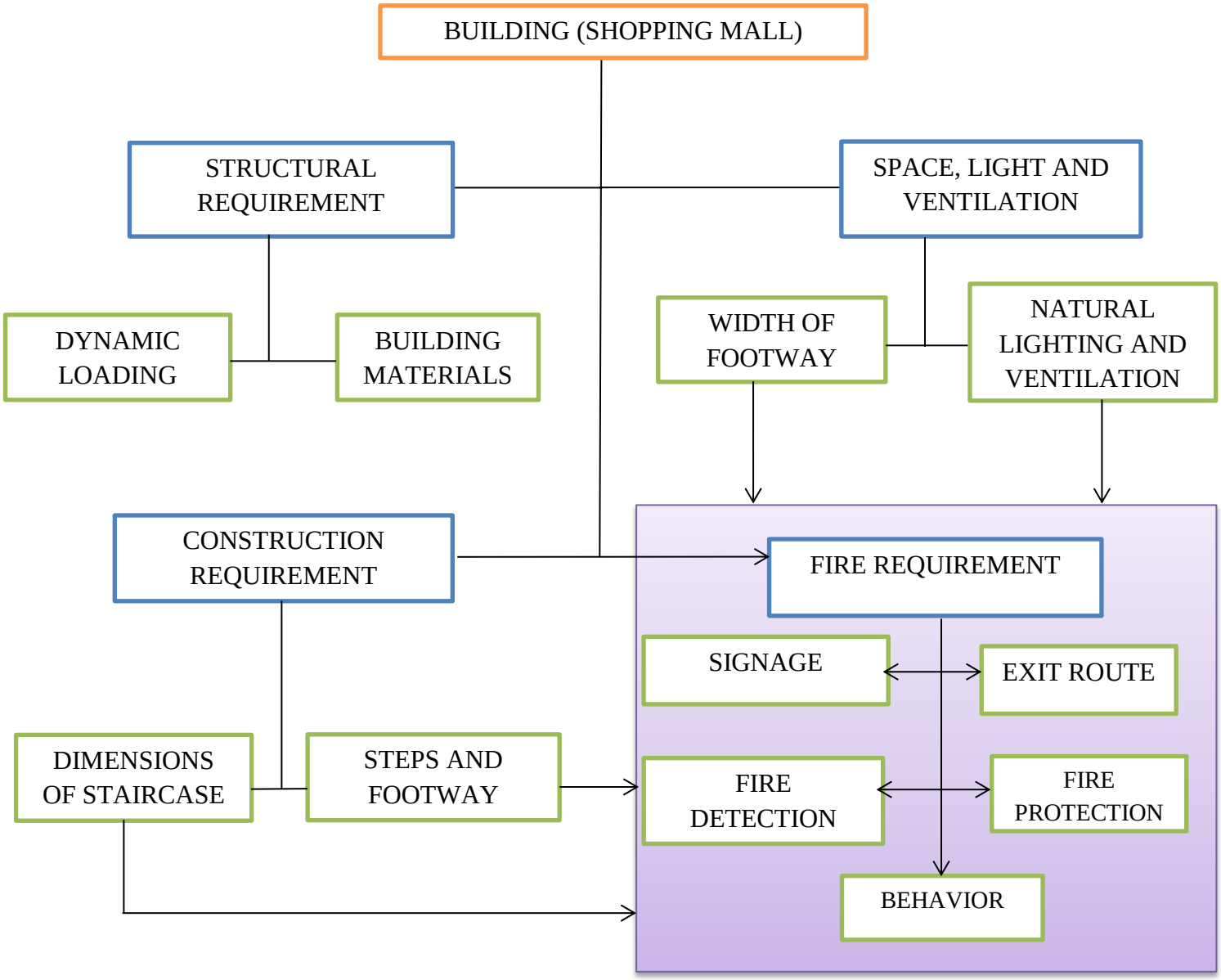


Figure 1.4: Conceptional framework

1.11 OPERATIONAL DEFINITION

1.11.1 Building occupant

A person, family, group, or organization that lives in, occupies, or work in the building.

1.11.2 Exit Route

Exit route is the route where people usually escape during emergency. Based on Uniform Building by Law 1984, exit route is a route by which persons in any storey of a building may reach a place of safety outside the building and may include a room, doorway corridor, stairway or other means of passage not being a revolving door, lift or escalator. Exit routes must be located as far away as rational from each other in case one is blocked by fire or smoke. Exit routes must be permanent parts of the workplace.

1.11.3 Evacuation Plan

An evacuation is for the use of public and occupants in case of a fire as well as for the fire fighters. A good fire escape plan should be clearly visible so that the fire escape route can be clearly understood by the readers. These plans should be placed at the area where public and occupant usually pass by and easily can be seen. Figure 1.4 is an example of an evacuation plan for the ground floor of a shopping mall.

1.11.4 Signage

Signage is the use of signs and symbols or a design to communicate a message to exact group of people. Figure 1.5 is signage that usually exists in shopping malls. A sign reading ‘KELUAR’ with an arrow indicating the direction shall be placed in every location where the direction of travel to reach nearly exit is not immediately apparent (UBBL, 1984). Storey exits and access to such exits shall not be obscured by other decoration, furnishings or other equipment. All exit signs shall be illuminated continuously during period of occupancy. Fire safety sign like in Figure 1.6 also should be provided and understood by building occupants.

1.11.5 Fire Protection and Prevention System

Fire prevention train people to take precautions to inhibit potentially disastrous fires, and be educated about surviving them. This method can reduce emergencies and the damage caused by them. Fire protection system is an approved device, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof. Figure 1.6 and Figure 1.7 show break alarm glass and fire alarm system. Both are important in fire safety.

1.11.6 Dynamic Loading

In order to ensure due economy in design, the appropriate dynamic increase for all members affected shall be ascertained as accurately as possible (UBBL, 1984).

1.11.7 Width of Footway

The width of any verandah-way or uncovered footway shall not be less than 2.25 metres but piers or columns to a maximum depth of 600 millimetres from the boundary of the street may be permitted on such verandah-way or footway.

1.11.8 Natural Lighting and Ventilation

Every room designed, adapted or used for residential, business or other purposes expect hospital and schools shall be provided with natural lighting and natural ventilation (UBBL, 1984).

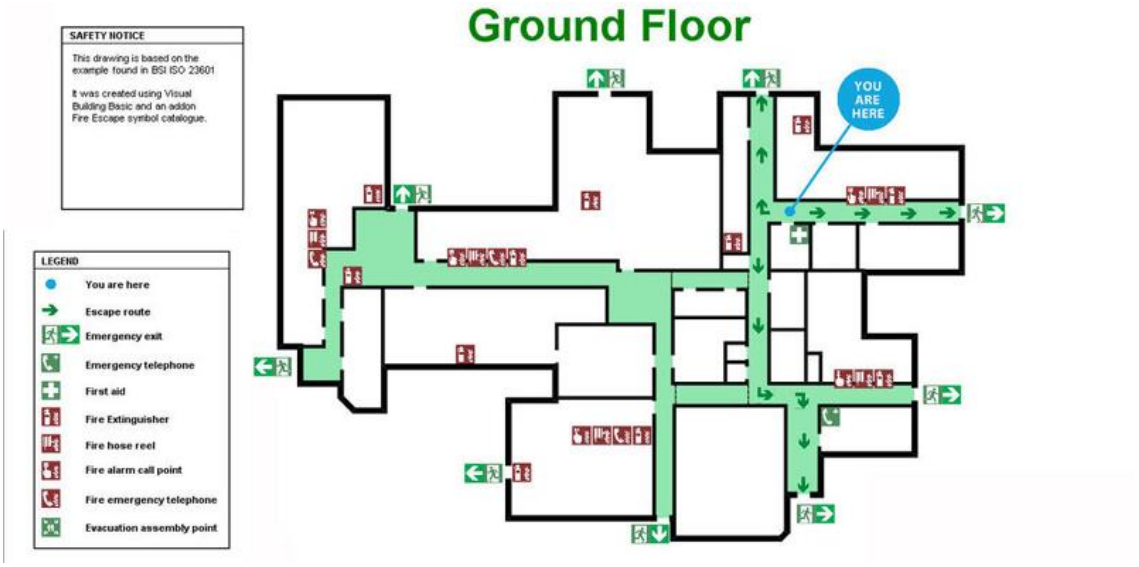


Figure 1.5: Evacuation plan

Figure 1.6: Signage about fire safety

Figure 1.7: Break alarm glass

Figure 1.8: Fire alarm system

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter will explain more about fire situation in shopping mall and issues related to fire accident in shopping mall. Other than that, this chapter emphasizes on the definition of evacuation plan, evacuation pathway, signage, human behaviour related to evacuation and the previous research findings related to evacuation pathway egress and human awareness. This chapter is important to achieve more information on the related issues about evacuation pathway, the awareness among people, incidents or emergency involving egress to narrow the scope of the study only on these particular issues. Compared to hospital or normal shops, sometimes the amount of people in the building is not as much as in shopping mall. The type of people of building occupant in shopping mall is classified from infant until elderly. Therefore, the study on evacuation will be more focus on how the egress passage is being used during any emergency at shopping mall.

2.2 FIRE INCIDENT IN SHOPPING MALL

As the economies grow, a number of high-rise buildings and large complex shopping centres have been built in Korea (Ahn, 2016). In China, these complexes integrate different businesses into on large building where customers can do shopping, eat or enjoy themselves (Qian-li & Ting-lin, 2011). Nowadays, many people go shopping in their free time and it even has become a culture. People choose shopping as their hobby compared to other activities. In this modern world, shopping is unavoidable to everyone. Other than that, a research in India done by Mittal & Jhamb (2016) said that Indian shopping malls fit into the definition provided by the International Council

of Shopping Centres (2004): “Shopping Mall is the most common design mode for regional and super-regional centres”. In other parts of Asia, such as in Hong Kong and Singapore, the increasing number of shopping centres is mostly influenced by tourism and high-class lifestyles (Kusumowidagdo et al., 2016).

There are numerous reasons people spending their leisure time at the shopping mall. It has become a public place for society even in major cities, shopping mall functions as circulation and transportation connector. Youngsters in this generation prefer to spend their free time at shopping mall instead of participating in sports. Spending time in shopping mall is more comfortable because it is air conditioned as because Malaysia’s weather these days is quite hot and sometimes the temperature can reach 34°C. Most of the family on weekends visit restaurant to dine and spend some time. People also think that spending time at shopping mall will make them look more attractive. This observation is evident in the urban life in other shopping centres in Asia, especially in Indonesia with its expanding middle class that spends most of its activities inside shopping centres (Kusumowidagdo et al., 2016). Figure 2.1 shows the activities that mostly people will do at shopping mall.

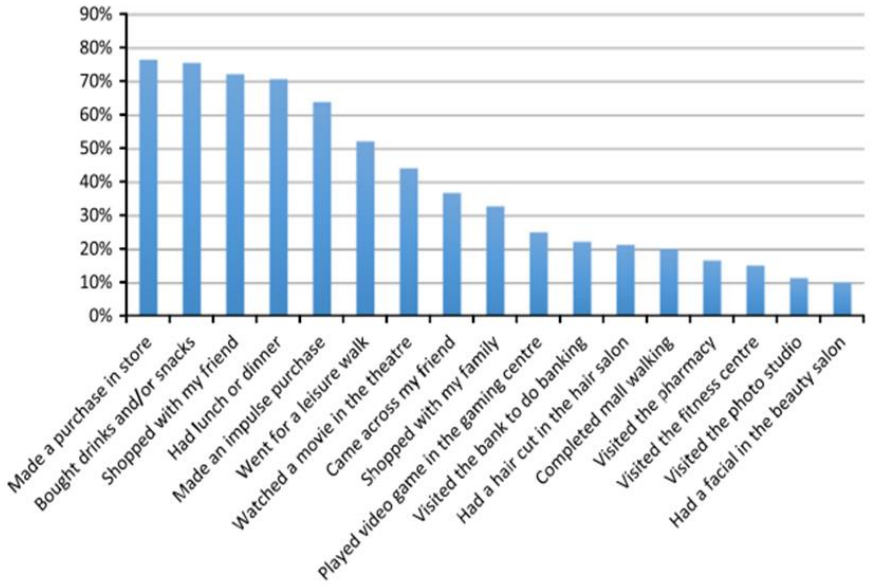


Figure 2.1: Shopping mall activities

Source: Rahman, Kwong-Kay Wong, & Yu, 2016

However, shopping mall contains many possible emergency issues such as a fire situation, terrorism-driven emergency or natural disaster. Ahn (2016) also stated that safety issues have gained significant attention under fire situation. According to Pu & Zlatanova (2005), disastrous accidents such as fire in large public (shopping mall) usually result in tragic consequences for people and environments due to the process of evacuating the shopping mall during emergencies. Among the consequences, people tripped or injured because of no proper evacuation technique. Tragic consequences are injured or fatality due to stand on or pushing during escaping from fire.

Large shopping mall is multi-functional with high fire load. Fire load in shopping mall could be categories in terms of merchandise such as cupboards, perfumes, electrical equipment, furniture, cooking activities and in cinema from the popcorn machine. If fire occurs in a large commercial complex, it can spread very quickly and grow into a large fire in a short time (Qian-li & Ting-lin, 2011). Example is from perfume, the explosion can spread quickly because it is flammable and from cooking activities in the restaurant's kitchen. Building owners are also likely to be interested in ensuring that the public trust or business image is untarnished in case of a fire, and in this case some building owners may be interested in taking additional efforts

or (costs allocation) to develop more rational approaches to fire safety design (Maluk et al., 2017). In order to improve fire safety requirement, the owner will ensure the fire safety installation and equipment, maintenance, training cost are given to all employees or business owners or tenant of vendor.

2.3 FIRE EMERGENCY EVACUATION PLAN

The emergency evacuation plan (EEP) is a preparedness package for guiding evacuation operations; take out people from the risk area, with the goal of reducing the loss of life and property to ensure the continuity of the business. The accidental severity, death tolls, and property losses are related with several influencing factors including individual exposure duration, governmental pre-warning time, population density, speed of response of disaster carrier, evacuation plan, and some other factors (Zhang et al., 2017). The goals of fire safety is to protect life safety, property protection, to ensure the continuity of mission which means the shopping mall will continue to operate even after fire incident, to make sure the environment is conducive , gain public trust and no more anxiety and the cost which is insurance.

According to Ahn (2016), fire safety evacuation becomes more important issue in large-scale buildings and it is important for all agents to evacuate immediately when the fire emergency occurs. He also said that it is important to evacuate the occupants from fire area because they could suffocated and die due to the inhalation of smoke. Smoke is dangerous because the hot plume travel along within high temperature. Therefore, a lot of fatality in fire accident is due to suffocation. This hot plume and smoke can move along the corridors or walkways, which involve a lot of movement during evacuation if it is not properly controlled. Therefore, the control smoke within the passage way is very important. It is very significant that fire evacuation plan to be well understood by building owner and building occupant because it is a document, which includes the actions to be taken by all building occupants in the event of fire.

Based on Uniform Building By-Laws 1984, a fire escape plan is for use by the public, occupants in case of a fire and a good fire escape plan should therefore be clearly visible, with legible lettering, and the fire escape route made clear to the readers. These plans should be placed at the most frequent building occupants pass through or

used. Based on Safe Work Australia Emergency Plans Fact Sheet, an emergency plan must provide emergency procedure including an effective response to an emergency, evacuation procedures such as an effective response to an emergency, evacuation procedures and effective communication between the person authorised to coordinate the emergency response and all people at the workplace. It also provides information, training and instruction to relevant workers in relation to implementing the emergency procedures. Crowd management can benefit from research on crowd characteristics related to behavior in order to develop guidance for fast and effective evacuation processes and evacuation process depends on the performance of the exits (Sagun et al. 2013). Figure 2.2 is the example of escape pathway at a shopping mall.

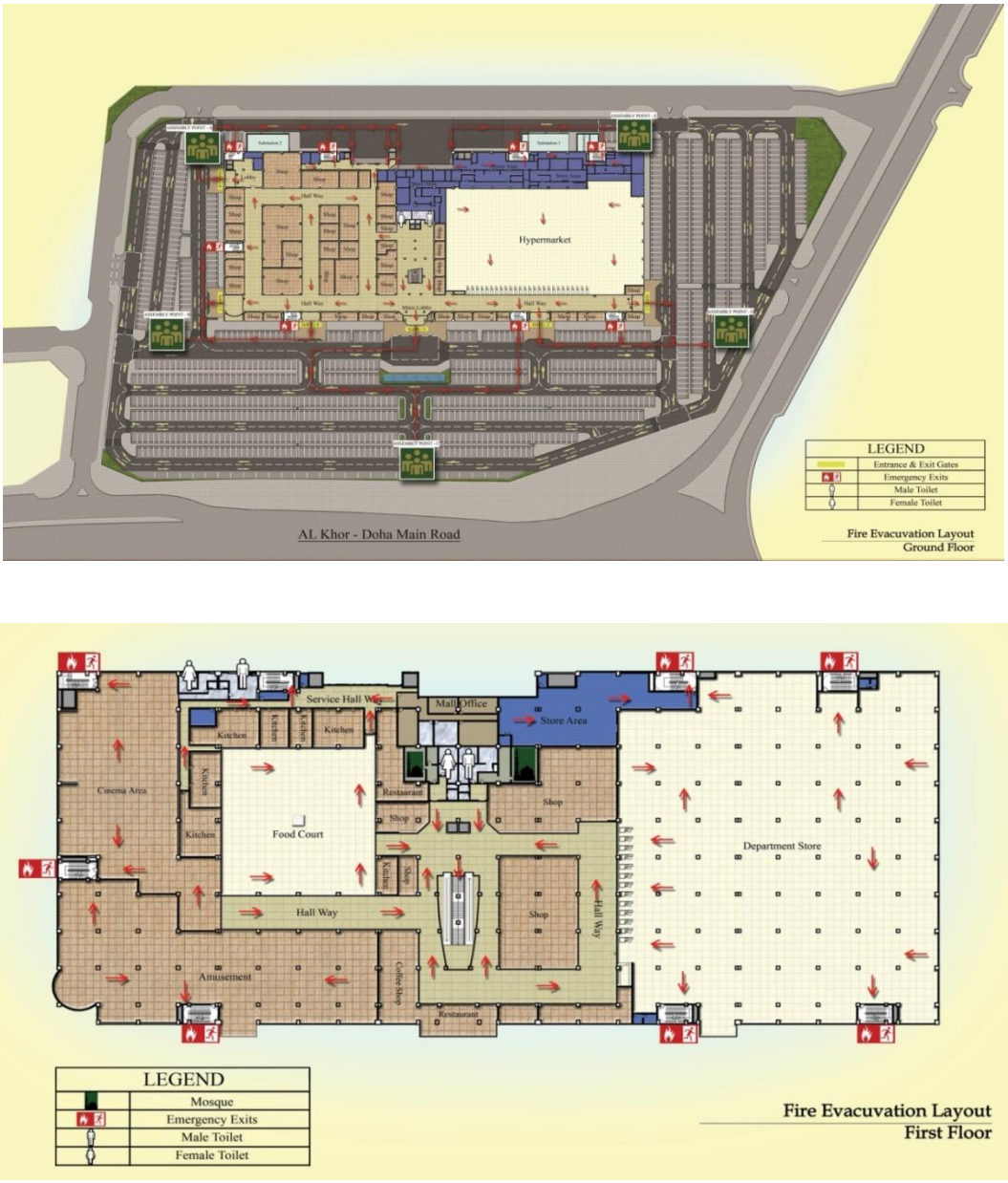


Figure 2.2: The pathways to escape

Source : alkhormall.com

2.4 EVACUATION PATHWAY

Evacuation exits should satisfy certain criteria so that people can pass through the exits safely and quickly (Pu et al., 2005). A research in Canada by (L. Zhang et al., 2016) found that three factors, namely the length of evacuation route, time of evacuation process and density of pedestrian flow, are identified to have significant impact on the efficiency of the evacuation process. In the choice of an evacuation route, many pedestrians choose the shortest or fastest evacuation route without considering the crowded condition. Qian-li et al., (2011) conducted a research in China and found that the typical problem for the fire protection design of large commercial complex is that its travel distance and evacuation width cannot meet the requirements of the code. Evacuation exits should satisfy certain criteria so that people can pass through the exit safety and quickly (Pu et al., 2005). Pu & Zlatanova (2005) also stated that different standards give different requirement for exits' width, numbers and capacities. Generally, there should be:

- 1 exit for up to 60 persons;
- 2 exits for 61-600 persons;
- 3 exits for over 600 persons.

2.4.1 Width of footway

Evacuation ways can reduce the loss of life caused by the fire in the building in a way by controlling the spatial environment factor, which is a variation of exit width (Ahn, 2016). As regulated in building codes and standards, the distance that one travels from any point in the building to an exit is the travel distance. Ahn conducted a research entitled "An analysis of evacuation under fire situation in complex shopping centre using evacuation simulation modelling". This study was conducted in one of the South Korea shopping malls to observe the variation of evacuation time. He controlled a width of exit variation.

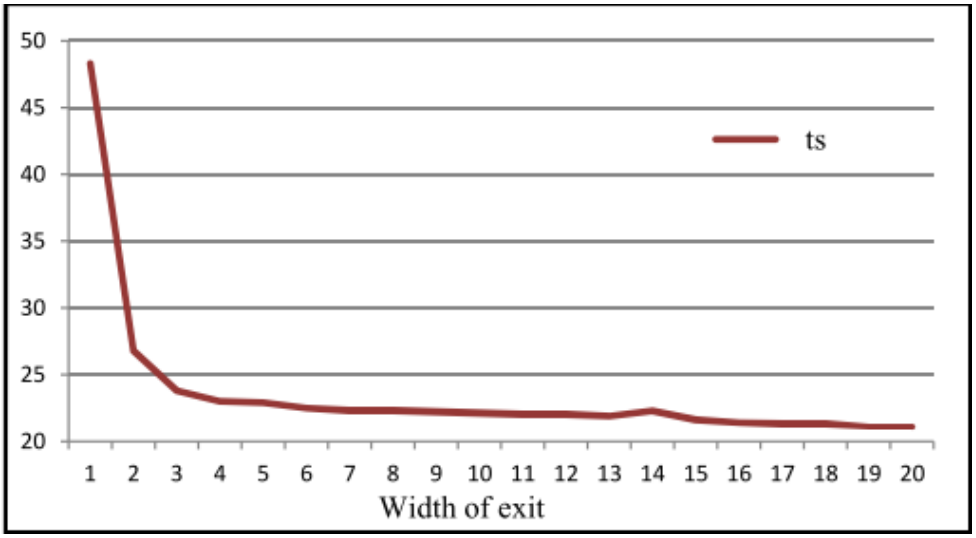


Figure 2.3: Result of exit width variation

Source: Ahn 2016

In the Figure 2.3, the result shows a sharply falling curve shapes. As the width of exit increase, the efficiency tends to look stable. Access shall be provided from a prominent point or points on the lot boundary, which is accessible to a public street or pedestrian way, directly to at least one entrance which is commonly used by the public or to a point directly adjacent to one entrance which is commonly used by the public (Rozelle, 2002). The footways shall be free from barriers such as kiosks, boxes, goods from the store, table, chairs, doors or doorways which will impede the passage of a wheelchair, or other form of barrier which will prevent access by persons with a disability. Rozelle (2002) stated that the clear width of the access route should not be less than 1200 mm. A research done by Pauls (1987) stated that the 1952 report also established the nominal 2.5-min clearing time for a space and it suggested the use of very high flows to perform the population capacity calculation {i.e., 40 persons per min per 530 mm or 21 ins of exit width}. Flow time is simply a function of the crowd flow capacity of the usable width of a particular circulation element and the population or number of people to be moved through it.

Different users need different footway widths (Massart, 2016). He also said that the feeling of comfort on a footway varies widely with the type of user.

2.4.2 Dimension of staircase

Except as provided for in by-laws 1994 every upper floor shall have means of egress via at least two separate staircases. Staircases shall be of such width that in the event of any one staircase not being available for escape purpose the remaining staircases shall accommodate the highest occupancy load of any one floor discharging into it calculated in accordance with provisions in the Seventh Schedule to these Bylaws. The required width of staircase shall be the clear width between walls but handrails may be permitted to encroach on this width to a maximum of 75 millimetres. Doors giving access to staircases shall be so positioned that their swing shall at no point encroach on the required width of the staircase or landing

Once the occupants have entered the exit staircase, they shall be protected (from exposure to fire risk and obstacles) throughout their descend down the staircase to the final exit at ground level. A sign should be located at each level landing in the staircase. The bottom of the sign should be located not less than 1.5m above the floor of the staircase landing. The sign should be placed adjacent to the door and shall be visible with the door open or closed.

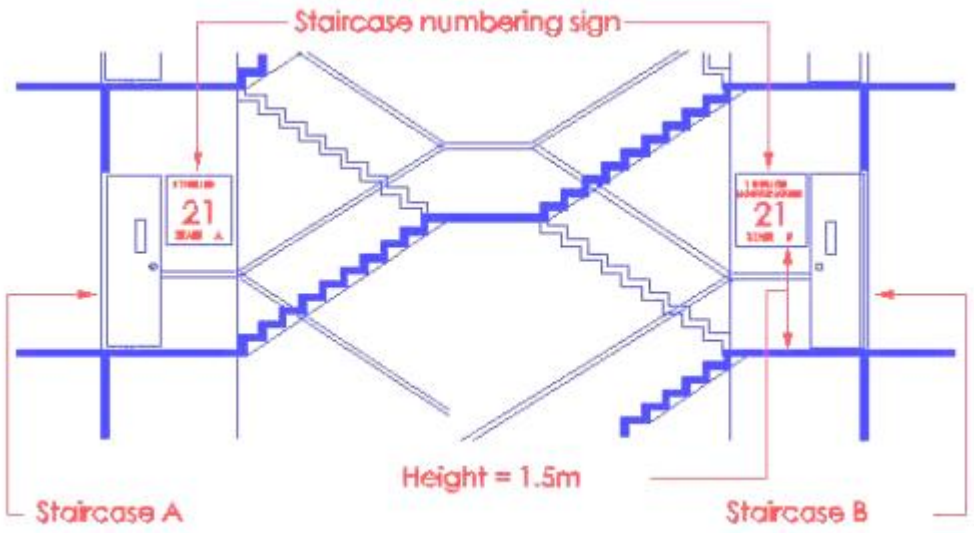


Figure 2.4: Scissor exit staircase

Source : The, 2013

The staircase need be only wide enough to serve each floor but not less than the minimum width allowed and in every case one of the protected staircases shall be assumed to be inaccessible and the remaining protected staircase shall be of sufficient width and number to accommodate the relevant occupancy. In figure 2.4, at least one of the staircases should be a minimum of two-unit width except that 900 millimetres may be allowed where total occupancy of all floors served by staircases is less than 50 and there should be no decrease in width along path of travel of a staircase.

2.4.3 Signage along the evacuation pathway

Based on UBBL 1984, storey exits and access to such exits shall be marked by readily visible signs and shall not be obscured by any decorations, furnishings or other equipment. Every exit sign shall have the word "KELUAR" in plainly legible letters not less than 150 millimetres high with the principal strokes of the letters not less than 18 millimetres wide. The lettering shall be in red against a black background. Appropriate signage shall be provided inside the staircase enclosure to direct occupants out of the building at ground level. The need for exit signs that attract attention when they need to be conspicuous, to redirect people to not just an exit route, but a viable and if possible an optimal exit route in an evolving emergency (Galea, Xie, Deere, Cooney, &

Filippidis, 2017). Emergency signage systems have widely been used in the built environment to assist people in evacuation by conveying directional information relating to escape routes and the location of emergency exits.

Even in the WTC 911 (2001) disaster, one of the reasons for the delays in evacuation was because many people could not find the emergency stairs, despite the exits being marked by emergency sign. Based on the research in Figure 2.5, the participants have made a conclusion about which sign that is clearer and sign that might make them confused. The failure of emergency signage systems to fulfil their intended purpose in these tragedies is mainly due to their potential to be overlooked by most people (Galea et al., 2017).

Sign	Agree/Strongly Agree	Disagree/Strongly Disagree	Total Number
	21%	68%	80
	22%	71%	77
Weighted average	22%	69%	157

Figure 2.5:Participants' level of agreement that combined cross and arrow confused them.

Source: Galea et al., 2017

Appropriate signage should be provided inside shopping mall so that the building occupants can follow the evacuation plan, as the instructions are clear enough. In Turkey, a research was conducted related to the awareness of the building occupants to the emergency signs. Most of the respondents were aware of the emergency signs in the building and indicated that the emergency signs were clear (Sagan et al., 2013). Figure 2.6 shows the clarity of building occupant seeing the exit sign during emergency.

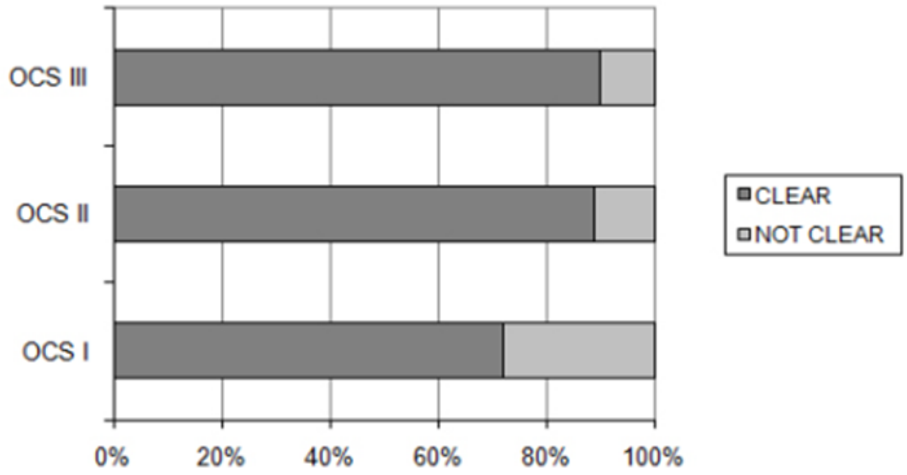


Figure 2.6: Clarity of the emergency signs.

Source: Sagun et al., 2013

2.4.4 Exit route

Sagun et al., (2013) also conducted a research entitled “Designing Buildings to Cope with Emergencies: Findings from Case Studies on Exit Preferences” in Turkey found that in case of an emergency, they have to choose their exit route and door to leave the area that is exposed to danger. People’s exit choice depends on the following factors : Familiarity with the exit door, distance to the exit, visibility of the exit door, signage, movement of other people, orientation of the fire marshals, obstacles on the exit route and queuing in front of the doors. The result from this research regarding the familiarity of occupant to the emergency exits revealed that that almost all of the building occupants were familiar with the emergency exits. Only a few respondents indicated that they were not aware of the existence of emergency exits in OCS 1 (16%) and OCS 2 (4%).

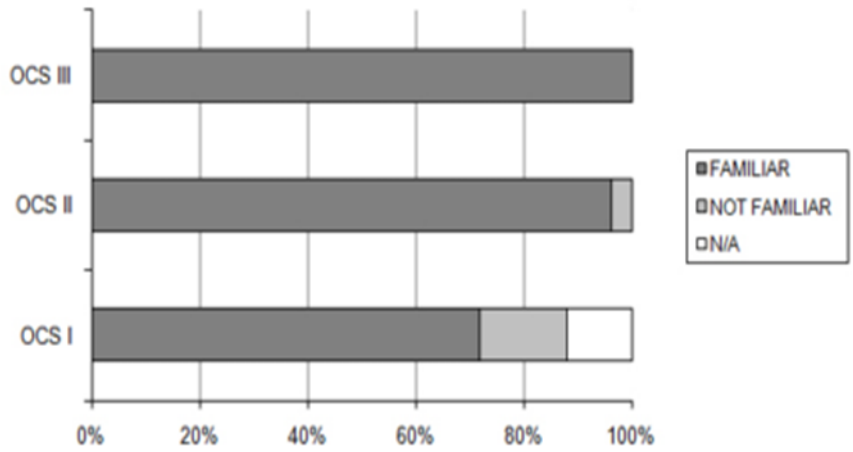


Figure 2.7: Familiarity with the emergency exits

Source: Sagun et al., 2013

Based on Figure 2.7, it proved that all the occupants use the familiar door they always use to enter even though some of them were actually closer to other alternative exits. In such circumstances, people often attempt to evacuate via familiar routes or the way they entered the building, bypassing or ignoring alternative means of escape, such as emergency exit routes and emergency exits.

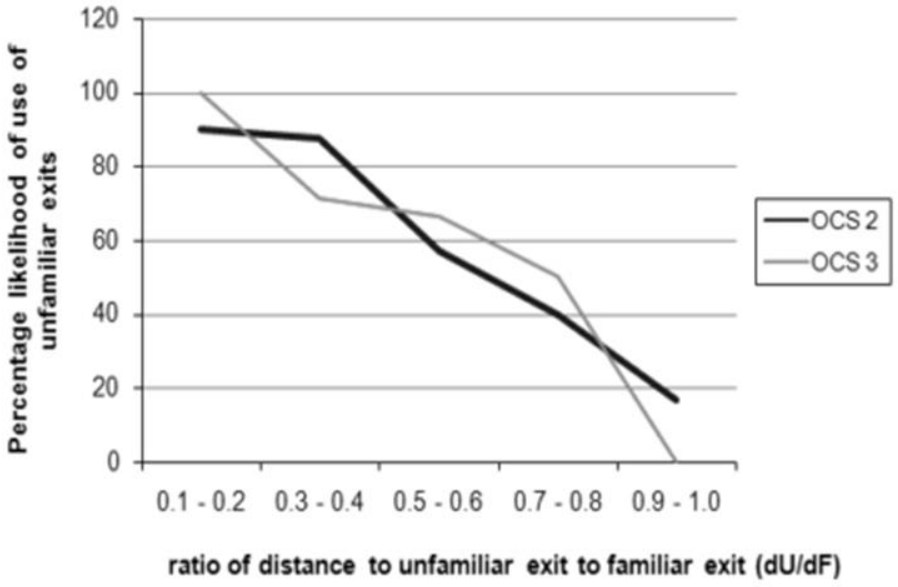


Figure 2.8: Percentage likelihood of using unfamiliar exit.

Source: Sagun et al., 2013

When individuals meet paths with multi-directions, they have to make decisions of which path to take. Their decisions depends on many factors, which include persons' habits, familiarity, social affiliation, access visibility, personal experience, light or sizes of different paths, pollution of various routes, and so on. Figure 2.8 shows the percentage likelihood of using unfamiliar exit.

2.4.5 Natural lighting and ventilation

The owner of the structure shall provide and maintain light, ventilation and space conditions in compliance with these requirements. Interior lighting quality influences people's visual comfort and satisfaction with a space (Jin, Li, Kang, & Kong, 2017). The turnover effects of shopping centre environments such as value perception, satisfaction, loyalty, and behaviours like the length of stay. Jin et al., (2017) also stated that quality of light environment is an important consideration in shopping centres. Improving the artificial lighting and introducing daylight has positive effects on turnover. There was a statistically significant relationship between impressions and lighting levels. Thermal and airflow simulation is used to improve the original natural

ventilation system design in order to address winter thermal comfort problems that were due to excessive cold airflow in the mall corridors.

2.5 BLOCKAGE AT EVACUATION PATHWAY

The path of egress travel along a means of egress shall not be interrupted by any building element. The ability of building occupants to move to a safe area is influenced by a number of factors related to the characteristics of both the building and the building occupants. These can be summarized as: People flow rate, door dimensions, visibility of the exits, door condition (open or closed), building geometry, obstacles on the way to exits (furniture, columns, etc.), circulation routes and signage (Sagun et al., 2013). Questionnaire was given to the building occupants at a selected building in Turkey related to the exit preferences and the results interpreted in a chart form.

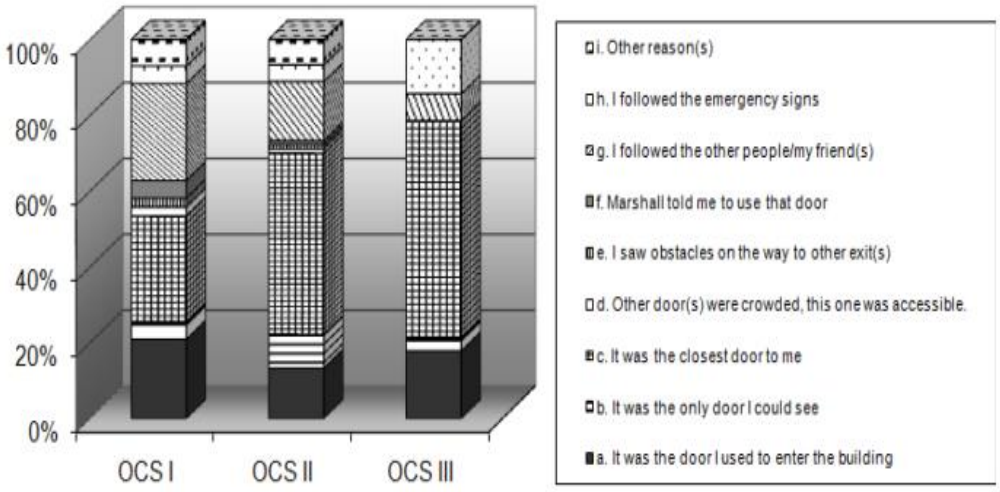


Figure 2.9: Reasons for exit preferences

Source: Sagun et al., 2013

"Following emergency signs" and "visibility" factors were the next most important factors. In Figure 2.9, the percentages for the other factors in the list are very low. "Crowding in front of the doors", "obstacles" and "orientation by the marshals" were not even chosen as a reason for exit preference by any respondent in OCS III. Exit preference can change the evacuation time based on familiarity factor. According to

Ahn (2016) during an unimpeded situation, the agent will move straight forward to the next goal. However, affected by interactions with surrounding obstacles, especially when avoiding collision, the agents are not likely to move strictly along the shortest path. Route calculation cannot only consider travel distance and the dynamic factor of this is level of disability. Disable people not only slow down the movement, people with specific movement aids, such as wheelchair cannot use stairs unaided (Pu & Zlatanova, 2005). Figure 2.10 shows that blockage at evacuation pathway at shopping mall do exist.

Figure 2.10: Examples of blockage at the pathway

Source: Google image

2.6 HUMAN BEHAVIOR DURING FIRE EMERGENCY

Human behaviors during building evacuation such as congestions, herding, panic, ignorance of guidance or variations in route and exit preferences based on the level of familiarity with the building are challenges to design a fixed guidance system for safe building design and they are effective issues to improve safety in buildings (Sagun et al., 2013). Sagun et al., also said that each person perceives the space, behaves, interacts and makes decisions for way finding, navigation or evacuation within

his/her own perspective. (Pu & Zlatanova, 2005) stated that the environment and human factors above will be both considered for the evacuation route calculation. There are many factors to be considered in indoor evacuation such as building structures and agents' psychological and physical behaviors (Ahn, 2016).

Due to these reasons, Korean government conducted an evacuation drill with 4,000 people in this mall in 2014 (Ahn, 2016). The result for this drill is shown in Figure 2.11. As the result of evacuation drill, those who evacuate within 10 minutes or only 350 people while it took 20 minutes for 800 people and 30 minutes for the rest. However, all the people who participated in the drill were the staff of this mall and all of them were familiar with the structure of this mall. They set several cases and groups for analysis of exit awareness.

Categories	Level of exit awareness	Known exits
Group 1	aware of all exits locations	8
Group 2	aware of a half of exits locations	4
Group 3	aware of two of exits locations	2
Group 4	aware of just one exit location	1

Figure 2.11:Classified group by level of awareness

Source: Ahn, 2016

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter will be discussing about the research procedures that will be carried throughout the study. This chapter consists of research design, study sample, scope of study, research techniques and data analysis.

3.2 RESEARCH DESIGN

Quantitative research is the numerical representation and manipulation of observations for the purpose of describing and explaining the phenomena that those observations reflect (Sukamolson, 2007). In addition, according to Cohen (1980), quantitative research is defined as social research that employs empirical methods and statements. The data are not usually numerical. The study ends with confirmation or disconfirmation of the hypothesis in Chapter 1.

An appropriate choice of study design is cohort, cross sectional, and case-control studies are collectively referred to as observational studies (Mann, 2003). In order to study the awareness and behavior of people in the commercial building on evacuation plan, this paper adopts questionnaire survey method to investigate building owners and shop owners or retailers within the shopping malls in Kuantan, the capital city of Pahang.

Cross-sectional study is taking a representative sample that is possible to generalise the results obtained to the population as a whole. Cross-sectional is quick and relatively easy to perform and give a fair idea of the health status of the community. This study is followed with interviews to collect further and clearer data on variables of a sample of cases. Cohort study is an “observational” design comparing individuals with a known risk factor or exposure with others without the risk factor or exposure.

Mann (2003) also said that the investigator measures a variety of variables that might be relevant to the development of the condition. Data are collected prospectively. It is conducted among chosen groups specifically to look at them exposure chosen not only for their exposure status, but also for their ability to facilitate the collection of relevant information.

Questionnaire is a commonly used tool in epidemiological studies. The term questionnaire to refer to the data collection form that is used to ask questions of research participants (Olsen et al., 2004). It can be used as the sole instrument for data collection, just like in cross-sectional design. The degree to which a questionnaire produces data that are relevant and valid to a study's goals and objectives will depend on and how well the questionnaire is carry out, how well the questionnaire is designed and how well questions are composed. A valid questionnaire measures what it claims to measure.

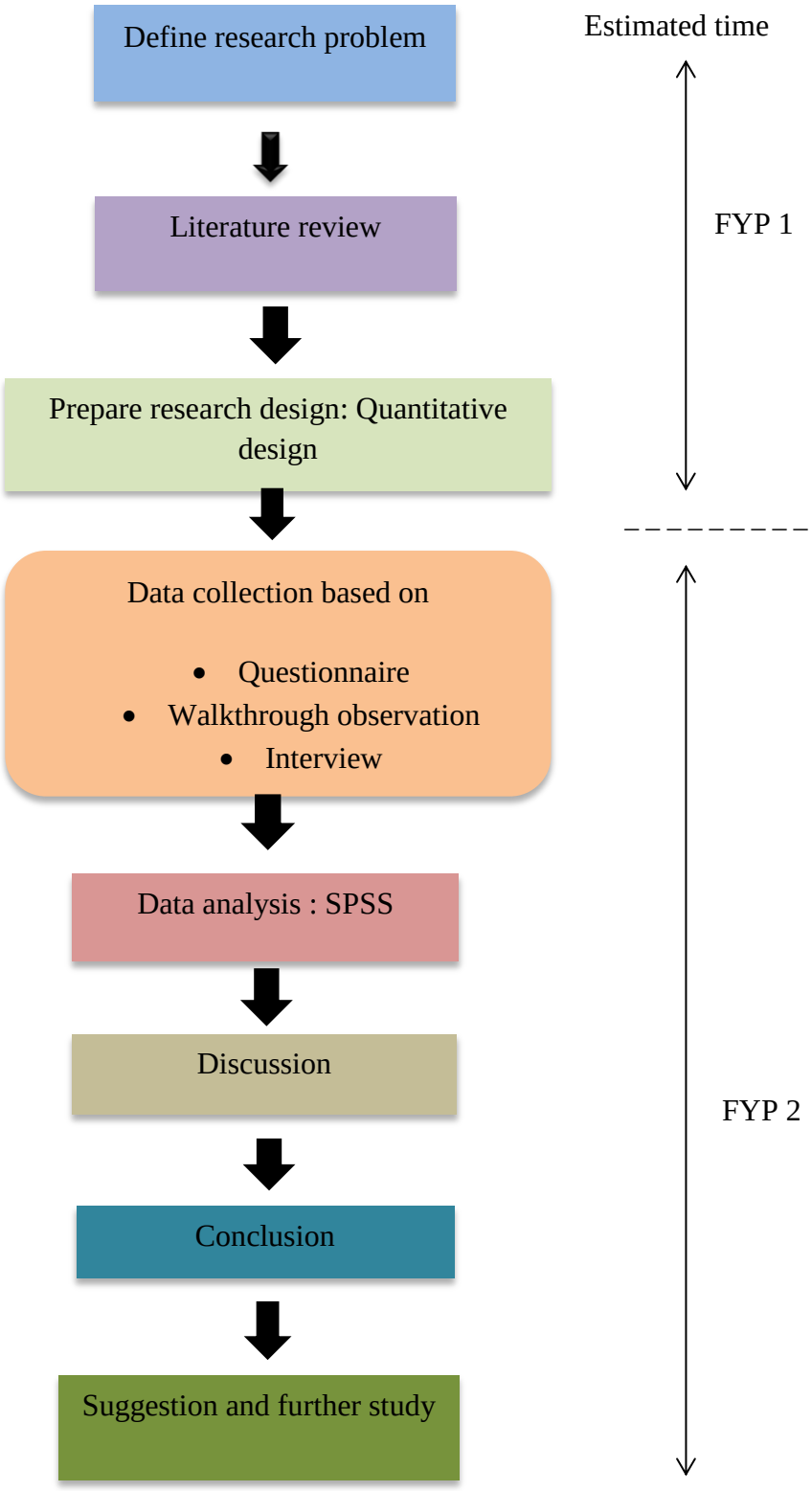


Figure 3.1:Research process and procedures flowchart

3.3 STUDY SAMPLE

The purpose of a questionnaire is to gain important knowledge about a population (Olsen et al., 2004). Sampling is the process of selecting unit from a population. In this research, the advisable type of sampling that can be used is simple random samples (SRS). Fridah (2002) stated that a simple random sample is obtained by choosing elementary units in such a way that each unit in the population has an equal chance of being selected while for Olsen et al., (2004), a SRS is a sample taken in such a way that each combination of sample size individuals in the population has an equal likelihood of being selected. It is a basic type of sampling and the advantage from simple random sample is the possibility of bias in information given may not happen.

The estimated population size for shop retailer is 220. During weekdays, the amount of shoppers usually not as much as during weekend because people like to spend their holiday at shopping mall. Population size is the total number of people that you could send the survey out to (Manno, 2013). Referred to (Morgan & Krejcie, 1970) table in Figure 3.3, the number of sample size is around 140 and the questionnaires will be distributed anytime to the retailer.

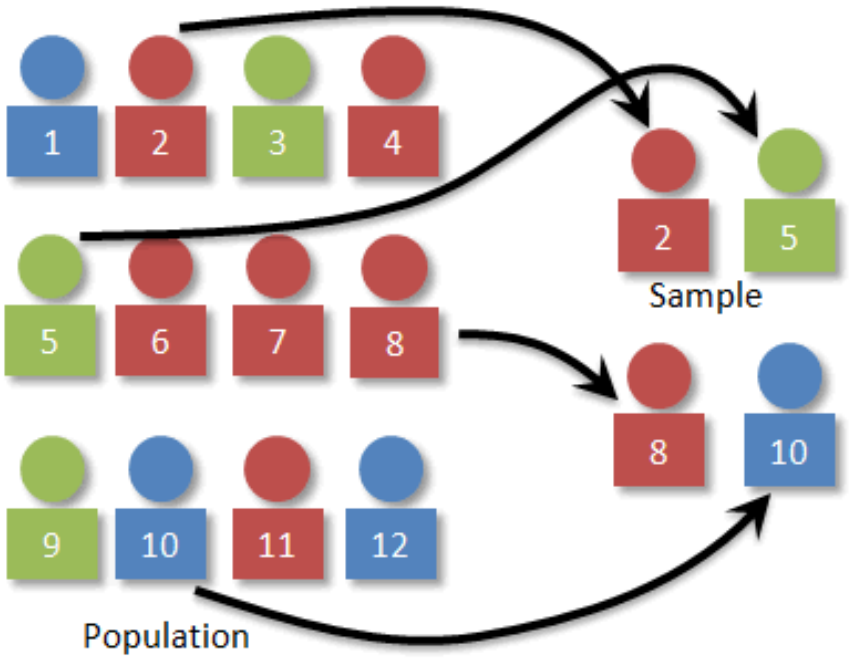


Figure 3.2: Simple random sampling

Table for Determining Sample Size from a Given Population									
N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	342
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	80000	384
Note; N Is Population Size; S Is Sample Size									

Figure 3.3: Table for Determining Sample Size

Source:Morgan & Krejcie, 1970

3.4 RESEARCH LOCATION

For the purpose of collecting information from respondent, the questionnaires will be distributed in Shopping Mall X in Kuantan, Pahang as the chosen building to carry out the study. Refer to Chapter 1, the location of the research is chosen due to the limitation of cost and time of conducting this study. In addition, it has been a popular hangout ‘spot’ for shoppers and window-shoppers in Kuantan. It is located in the city centre of Kuantan, Pahang. This shopping mall attracts popular and famous branded retail sellers and international concept stores with their extensive range of merchandise to do business here just like the other popular shopping malls.

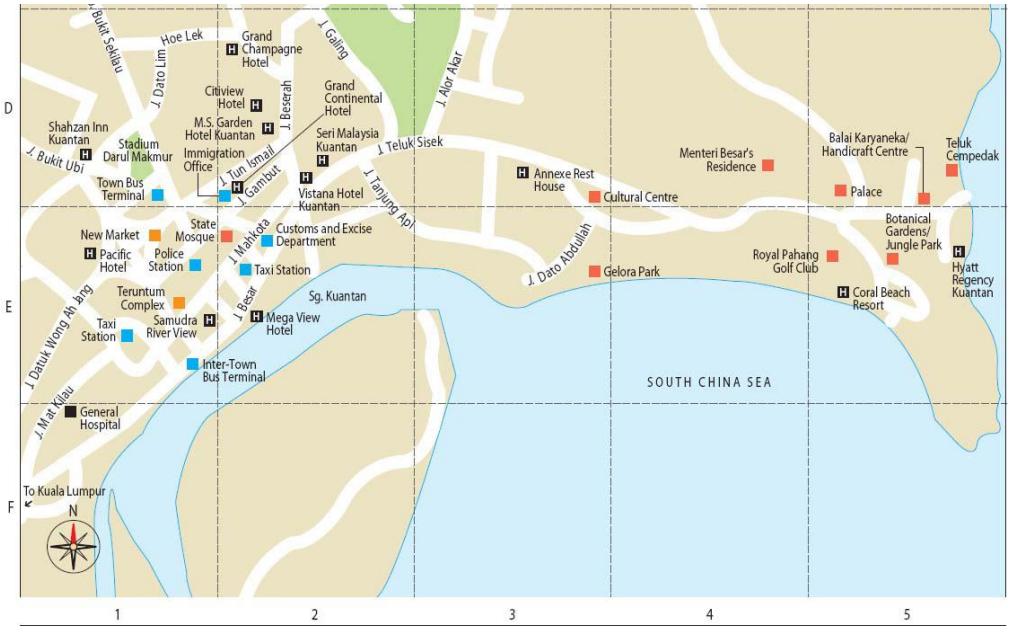


Figure 3.4:Kuantan City map

Source: Adapted from Google Map

3.5 SUBJECT/RESPONDENT

Respondents will be given instructions on how to answer questions. Shop owners or retailers were selected as the respondent because they spend most of their time in the building. They spend almost 12 hours a day as the working hour is usually from 10am till 10pm, so their awareness about evacuation plan is my concern. Their awareness and knowledge about fire evacuation is important because fire incident can happen anytime and the ignition of fire can be from anywhere. Shop owner could be the source of fire incident due to their negligence. The predicted times taken for the respondents to answer all the questions is between 2-5 minutes.

3.6 DATA COLLECTION

The choice of method is influenced by the type of variable, the data collection strategy, and the collection point. The relationship between the source, the variables and practical method can help in choosing the acceptable method. Data collection methods are documents and records, questionnaires, interviews, direct observing. Questionnaire is a method where form will be given and filled by the respondents before they return it

back to us. Direct observation is making direct measurements is the most accurate method for many variables.

3.6.1 Walkthrough observation

The purpose of conducting walkthrough observation is to do direct observation about fire safety plan at the shopping mall. Other than that, to assure whether there is a proper signage and evacuation plan map placed in the building. Even there is signage and evacuation plan map at the mall, does that building occupants aware and can see them clearly? The signage available in the mall need to be in a right size and color as required in Uniform Building by Law 1984 regulation. In addition, the purpose of walkthrough observation is to observe how smooth the evacuation pathway, the stairs, exit route, the doors and the distance travel. The installation of fire protection system such as fire extinguisher, fire alarm and fire hose were inspected. The focal point of this observation was to know whether there was any blockage at the evacuation pathways. Besides, during walkthrough observation, researcher recognized the potential hazard at the shopping mall than can cause fire.

3.6.2 Interview

Interviews are particularly useful for getting the story behind a respondent's experiences. Informal interviewing can be helpful in building report with respondents and in gaining their trust as well as their understanding of a topic, situation and setting. Informal interviews, like unstructured interviews, are an essential part of gaining an understanding of a setting and its members' ways of seeing. Interview was done with the building owner or the management regarding the awareness about fire safety specifically on evacuation plan and about fire protection and prevention systems installed in the shopping mall.

3.6.3 Questionnaire

Sukamolson (2007) stated that among many types of quantitative research, survey research is very popular and it has many types. Types of survey are in-person interviews, telephone interviews, omnibus survey, and self-administered questionnaires. There are two types of survey, which are cross-sectional and longitudinal survey. They

stated that in cross-sectional survey, a researcher collects information from a sample drawn from a population. Data collection was done at different points of time in longitudinal surveys to observe the changes.

The design of the questionnaire refers to the directions or instructions, the appearance and format of the questionnaire and, of course, the actual questions (Olsen et al., 2004). The questionnaire was designed in a user-friendly multiple-choice format for the shop owners and shoppers. These questions should be both understandable and relevant to the purpose of the research. Easy and clear questions will not take a lot of the respondent's time. The respondent might refuse to give cooperation and may refuse to answer any particular question if the question is bewildering.

Pilot test was done before proceed to the actual method. That process will ideally involve administering the questionnaire to a small group of persons from the intended target group and then following up to get feedback on the questions and on the questionnaire itself (Olsen et al., 2004). The total number of respondent chosen is actually 140 people but for the pilot test, researcher decided to distribute to only 10 shop retailers at Square One Shopping Mall Batu Pahat. This is to make sure the questions are understandable and acceptable to the selected audience. After assimilating the feedback from the pilot test, the finalised questionnaires were to the random selected respondent via Google Form and they need to complete all the questions given.

3.7 DATA ANALYSIS

Data analysis is the process of transforming the useful information from the sample, inspecting the variation in the data that obtained, as well as construct the conclusion or decision making from the raw data. In this study, Statistical Package for Social Sciences (SPSS) version 24 was used for the purpose of data analysis.

3.7.1 Statistical Package for Social Sciences (SPSS) Version 24

SPSS Statistics is a software package used for logical batched and non-batched statistical analysis. SPSS is a widely used program for statistical analysis in social science. Its features for statistics data analysis are descriptive statistics such as cross tabulation and frequencies. Also for bivariate statistics, there are mean, t-test and

ANOVA. This software was downloaded in computer system. A copy of the original file before start working should be made. There is an option to start all over again, in case accidently change or erase some variable and observations.

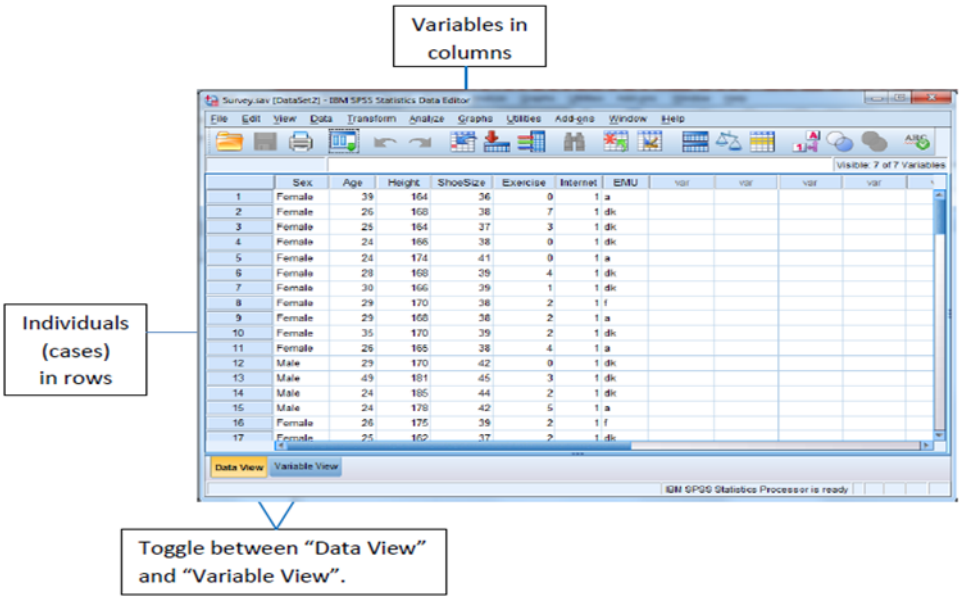


Figure 3.5:Data View (Data Editor window)

Source: www.ssc.wisc.edu

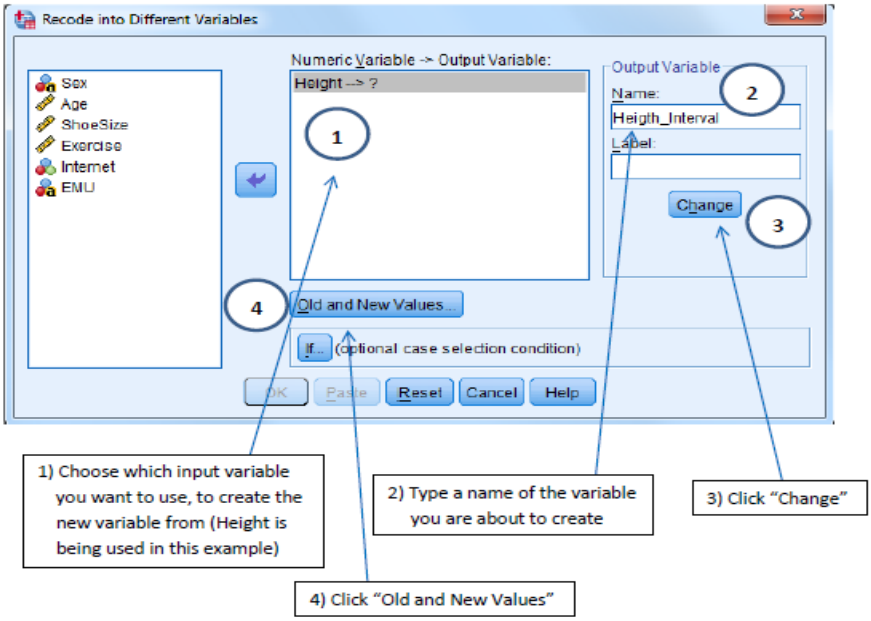


Figure 3.6: Creating new variables

Source: www.ssc.wisc.edu

3.7.2 Descriptive Statistics

Descriptive statistics are brief simple details that summarize a given data set, which can be either a representation of the entire population or a sample of it. Descriptive statistics are broken down into measures of central tendency and spread. Measures of central tendency include the mean, median and mode.

CHAPTER 4

DATA ANALYSIS

4.1 INTRODUCTION

This chapter focuses on the data collection and data analysis about building occupants' awareness on fire safety evacuation plan specifically on the evacuation pathway. Data collected will be analysed using SPSS Version 24.

4.2 PILOT STUDY

A pilot study can be defined as a small-scale study that helps to examine the practicality and feasibility of the methods to be used in a subsequent larger and more comprehensive investigation (Viechtbauer, Smits, Kotz, Bud, & Spigt, 2015). The pilot study was done on 16th August 2017 at Square One Shopping Mall Batu Pahat. 10 random shop workers were picked at the mall to fill in the questionnaire via Google Form. Good cooperation was given so the data collection process was done within a day. The data received was transferred to Microsoft Excel before it was analysed using SPSS Version 24. The goal of a pilot study was the detection of unforeseen problems (Viechtbauer et al., 2015).

Cronbach Alpha was used to give a measure of the internal consistency of a scale. Before a test can be employed for a research, validity of the internal consistency should be ensured. As the estimate of reliability increases, the fraction of a test score that is attributable to error will decrease (Tavakol & Dennick, 2011).

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.806	.797	29

Figure 4.1:Output Cronbach Alpha

Figure 4.1 shows the result of the Cronbach alpha. The Cronbach alpha is 0.806, which is acceptable and valid. As the estimate of reliability increases, the fraction of a test score that is attributable to error will decrease (Tavakol & Dennick, 2011). If the items in a test are correlated to each other, the value of alpha is increased. Alpha is an important concept in the evaluation of assessments and questionnaires.

4.3 DATA COLLECTION

Data collection process started with the preparation of questionnaire forms. The questionnaires distributed to the respondents via Google Form. The questionnaire were divided into 4 sections, Section A focuses on the background of the respondents, Section B on awareness and preparedness of fire safety evacuation, Section C on action during emergency and Section D on the evacuation pathway.

A) Section A

This section is the introduction of respondent. It gives the information on the background of the respondent on their age, sex and education level.

B) Section B

This section focuses on the knowledge about fire safety among the respondents. For this section, the types of questions asked are about fire evacuation plan at the shopping malls, signage, fire extinguisher and fire training.

C) Section C

This section focuses on the action during emergency. This section type of questions asked is on the respondents' actions such as the decision of choosing exit route, the adequacy of the pathway and the process of evacuation from the building.

D) Section D

This section focuses on the evacuation pathway. This section is about the travel distance, size of stairs for total evacuation, escape route size and lighting system.

4.4 DATA ANALYSIS

Analysing the data obtained from the selected respondent. The total number of sample is 140. There are among shop owners and retailers at Shopping Mall X. Data obtained from the questionnaires that have been given to the respondents. During data collection, good cooperation were given by the respondent so the process of collecting the data was smooth and finished within the estimated time.

4.5 DEMOGRAPHIC INFORMATION

One hundred and forty retailers at Shopping Mall X were randomly chosen for this study. The retailers were of different age, gender, and education level. This information was obtained from the questionnaire as supplementary information to aid in this study.

Table 4.1: Demographic data of 140 retailers at Shopping Mall X

	Frequency (n)	Percentage (%)
Age (Years)		
Below 18	6	4.3
Between 18 – 30	128	91.4
Above 30	6	4.3
Gender		
Male	56	40.0
Female	84	60.0
Education Level		
SPM	82	58.6
STPM	5	3.6
Matriculation/Foundation	11	7.9
Diploma	25	17.9
Bachelor's Degree	17	12.1

4.5.1 Age

The age of the retailers divided into 3 ranges that are below 18 years old, 18-30 years old, and above 30 years old. Based on Table 4.1, the highest frequency based on age range is 18-30 years old, which comprises of 128 retailers or 91.4% of the sample, followed by age range of below 18 years old and above 30 years old with the same amount which is 6 and percentage 4.3% of the sample.

4.5.2 Gender

Based on Table 4.1, it shows that the frequency of female retailers is significantly higher than male retailers. This is because the population of the shop owner or retailers are mostly females, thus contributing to the high frequency of the female retailers in this study. Genders do influence the level of awareness. Men participants demonstrated higher level of self-awareness, self-management, social awareness and relationship management in compare with women (Khalili, 2004). However, gender will not be explained further in this study.

4.5.3 Education level

Education level of the shop owners were divided into 6 categories, which are SPM, Matriculation, Diploma, STPM and Bachelor's Degree. According to Figure 4.1, the highest frequency of retailers according to education level was in SPM level, comprising of 82 retailers or 58.6% of the sample, of which is significantly higher in frequency compared to other education levels. The second highest frequency was in Diploma level, comprising of 25 retailers or 17.9% of the sample, followed by Bachelor's Degree level, which was of 17 retailers or 12.1% of the population, and then by Matriculation level, comprising of 11 retailers or 7.9% of the sample. The lowest frequency of retailers according to education level was STPM level that is only 1 retailer or 3.6% of the sample.

4.5.4 Daily visited areas in building among retailers

Daily visited areas in building among retailers means that the retailers visited one or more location in the shopping mall. Within 8-12 hours of working, most of the retailers use more than one location in the shopping malls. Based on Table 4.2, 108 of the respondents or 77.1% used more than one location in the shopping malls. They are said to move to other places such as toilet, prayer room or even restaurant in the shopping malls during lunch break hour. The other 32 respondents do not use more than one location in the shopping mall.

Table 4.2:Frequency and percentage of 140 retailers in Shopping Mall X according to usage of location in the building.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	108	77.1	77.1	77.1
	No	32	22.9	22.9	100.0
	Total	140	100.0	100.0	

4.6 KNOWLEDGE ON FIRE SAFETY

The objective of this part of the questionnaire is to seek opinion from the respondent on their knowledge about fire safety. The questions asked mostly related to fire safety measure, fire emergency, fire protection and prevention.

Table 4.3:Frequency of respondents' level of knowledge

Knowledge	Frequency					Total
	Scale					
	1	2	3	4	5	
Realise about fire emergency evacuation plan	24	33	26	45	12	140
Understand fire emergency evacuation plan	38	35	21	31	15	140
Written emergency procedures help	4	7	16	83	30	140
Emergency procedures written in large prints will be clearer	1	4	8	41	86	140
Know safety level at this mall	22	40	23	44	11	140
Know the signage function	2	8	12	67	51	140
Know how to use a fire extinguisher	4	13	16	60	47	140
Know where to gather during emergency	44	39	19	29	9	140

Scale representation:

1: Strongly Disagree

2: Disagree

3: Neutral

4: Agree

5: Strongly Agree

Table 4.3 shows the questions that been asked to the respondents regarding their knowledge on fire safety. The knowledge about fire safety includes realise about fire emergency evacuation plan, understand fire emergency evacuation plan, written

emergency procedures, know safety level and signage function at this mall, how to use a fire extinguisher and where to gather during emergency.

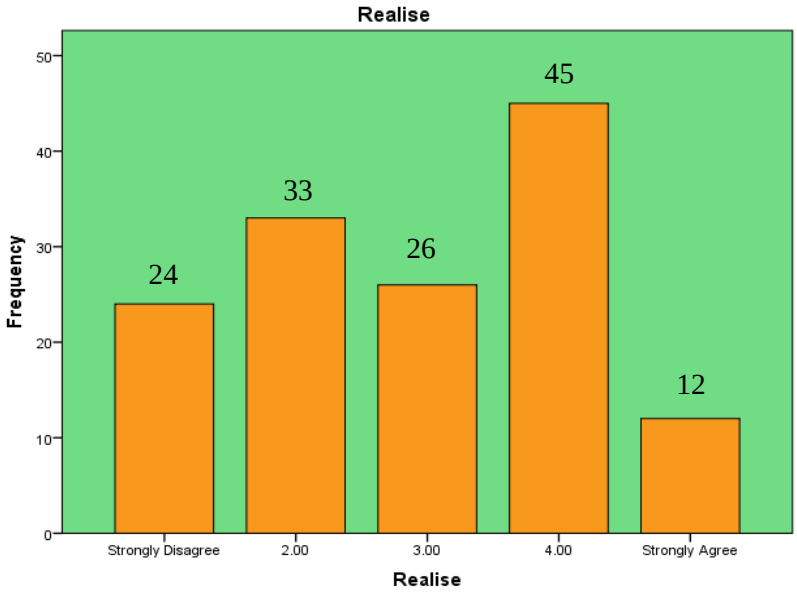


Figure 4.2: Frequency of retailers realise about fire emergency evacuation procedure operating in the mall

Figure 4.2 shows frequency and percentage of respondents that realise about fire emergency evacuation plan operating in the mall. It shows that 57 of the respondent (40.7%) do not realise about fire emergency plan and another 57 respondents (40.7%) realise about the existence of fire emergency plan.

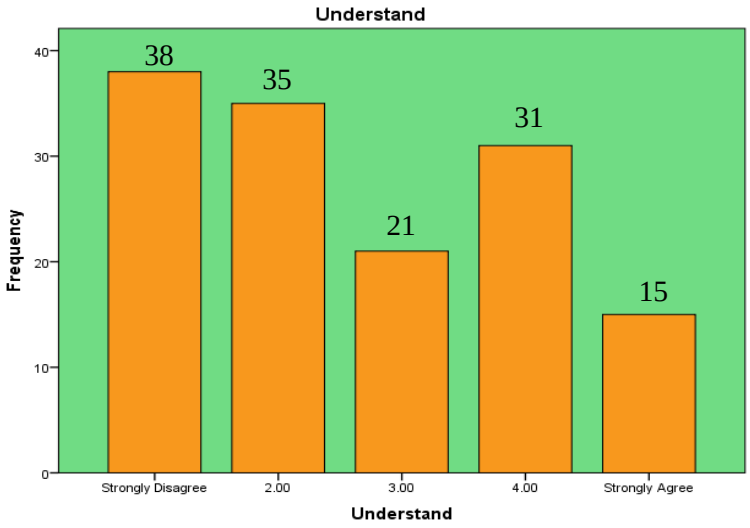


Figure 4.3: Frequency of retailers understand fire emergency evacuation plan

Figure 4.3 shows the frequency of retailers that understand the fire emergency evacuation plan and there are 73 respondents do not understand about the plan. The percentage is about 50% and this group of people might trap in case of emergency. This is a serious matter to consider in the discussion. The retailers are either need to be given a training or exposure about fire emergency plan by the employer. Out of 57 respondents who realised about the plan, only 46 understand the evacuation plan. The possible reason they do not realise and understand the fire emergency plan are that the plan's size are not big enough to be noticeable and not placed at the corridor way. Figure 4.4 is the fire emergency evacuation plan at Shopping Mall X. From walkthrough observation, it was found that the fire emergency plans are not big enough to be seen by every building occupant and not easy to read.

Figure 4.4:Fire emergency evacuation plan at Shopping Mall X

The total number of retailers whom were agreed that the emergency plan is helpful is 113 (80.7%) from 140 retailers which are quite a lot. While only 11 respondents (7.9%) did not agree with it. They also think if the size of the fire emergency plan was printed in a bigger size, it would be clearer to be view and useful. Table 4.3 shows that there are 127 retailers (90.7%) agree and only 13 retailers (3.6%) disagree that the larger print of emergency plan could be more helpful and useful. Fire emergency plan should be helpful for building occupants as it shows the safe escape route during emergency so if building occupants are familiar and aware of the evacuation plan, they will not have difficulties during egress from building even under panic condition. Panic is condition where people think their very best they make decision during emergency but their best decision might not be the same with other people.

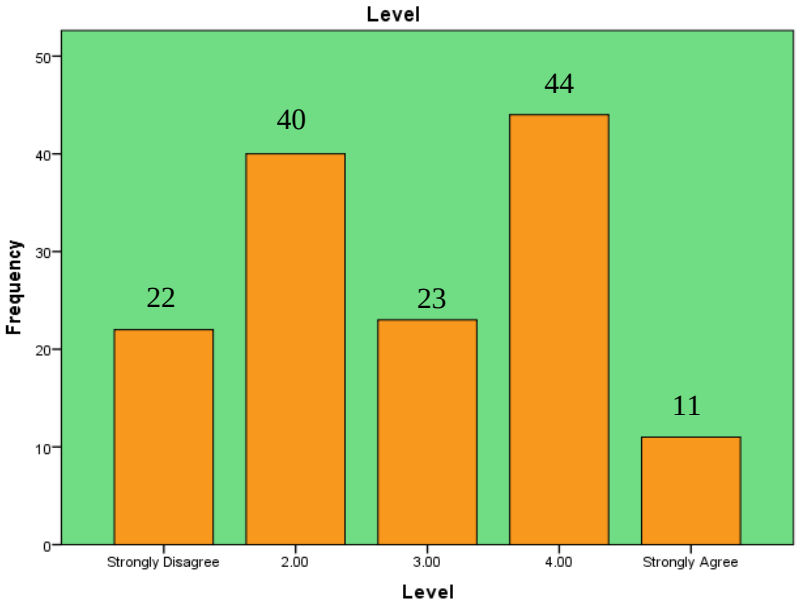


Figure 4.5:Frequency of retailers know their safety level at shopping mall

Figure 4.5 shows the frequency of retailers know about their safety at this shopping mall. 55 retailers or 39.3% of the sample know about their level of safety. The frequency of retailers that did not know their safety level at shopping mall is 62 that represent 44.3% of the sample and it is higher than 39.3%.

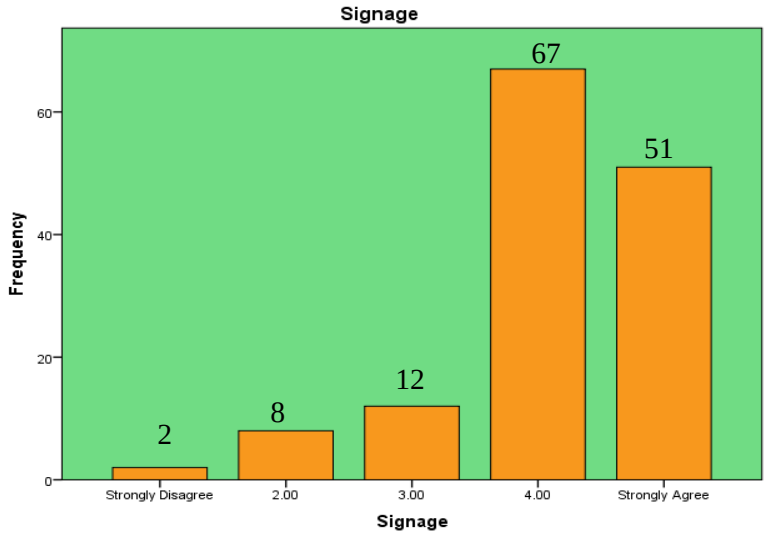


Figure 4.6:Frequency of retailers know the function of signage

Figure 4.6 shows the amount of retailers that knows the function and meaning of a signage. There are 118 number of retailers (84.3%) knows the function of signage while 10 retailers (7.1%) did not know the function and meaning of a signage. Signage is useful and can be use as guide along the escape route for the building occupant during emergency. However, during walkthrough observation, it was found that the signage at the mall is not adequate. The signage only placed at the exit door and not along the evacuation pathway. Figure 4.7 is the signage at Shopping Mall X. If the direction of travel to the exit or exit discharge is not immediately apparent, signs must be posted along the exit access indicating the direction of travel to the nearest exit discharge. Exit sign (KELUAR) or arrows showing the way out during emergency should be placed along the pathway.

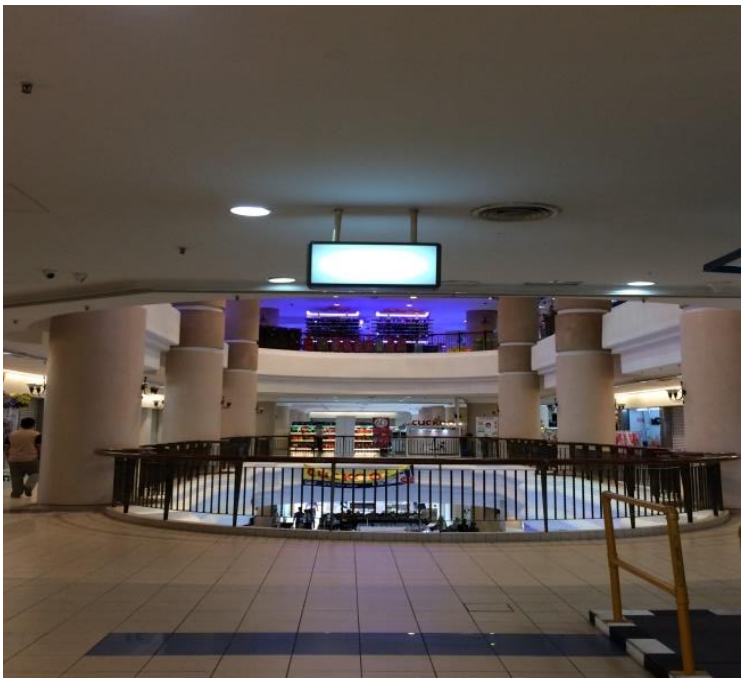


Figure 4.7: Signage at Shopping Mall X

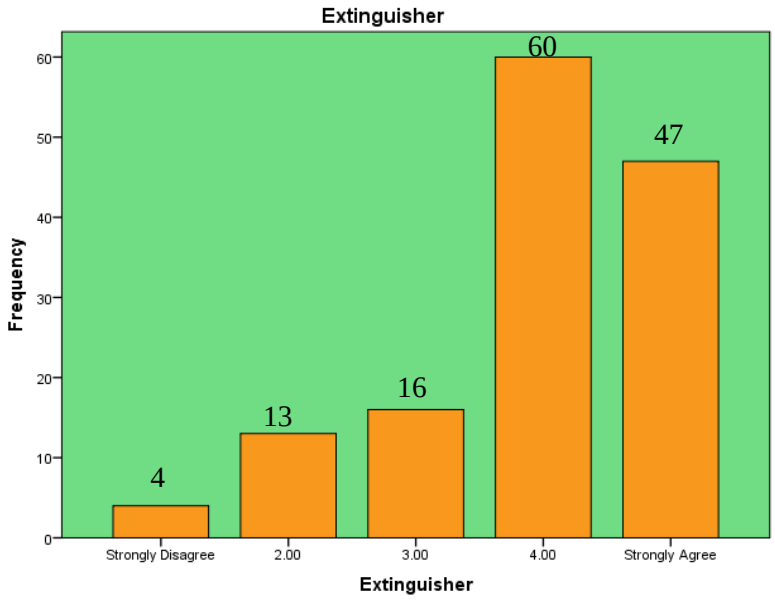


Figure 4.8: Frequency of retailers know how to use fire extinguisher

Figure 4.8 shows the frequency of respondent that know how to use fire extinguisher is 107 (76.5%) and the number of respondent that do not know how to use fire extinguisher is only 17 with the frequency of (12.2%). The installation of fire extinguisher in this shopping mall is not adequate because they are hard to find and placed far away from the stores and not properly maintained. Other than that, safeguards such as fire sprinkler, smoke detector, flame detector, fire doors and emergency lighting installed in this shopping mall. Safeguards designed to protect employees during an emergency must be in proper working order at all times.

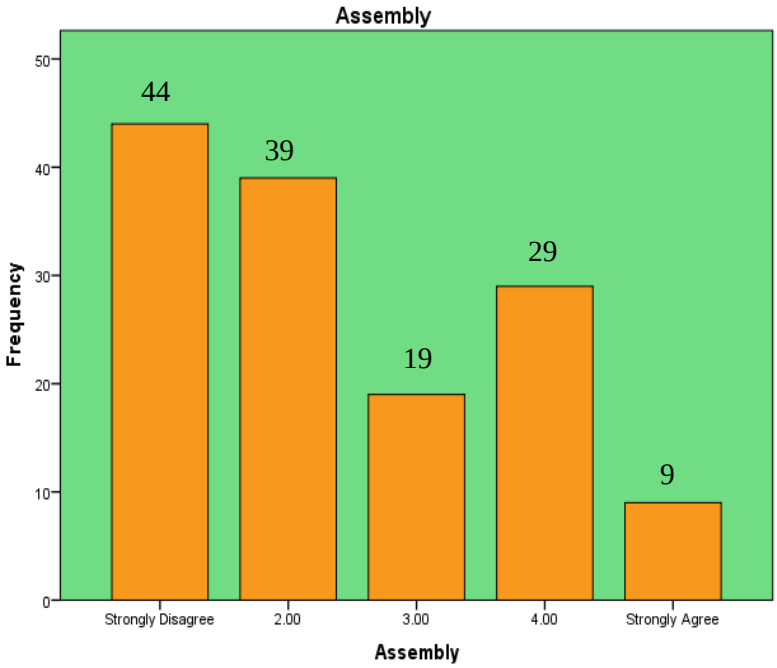


Figure 4.9: Frequency of retailers know where to gather during emergency

Refer Figure 4.9, the amount of respondents that know where to gather during emergency are only 38 (27.1%) and the amount of retailers that do not know where to gather is more than a half which is 83 that represent 59.3%. Without proper sharing of information, the retailers might not be able to be found during headcount at the assembly point. These 38 retailers probably will delay the headcount to be reported during any major accident. The retailers need an exposure and training from their employer so that they know what to do and where to go during any emergency. Further recommendation will be discussed at Chapter 5.

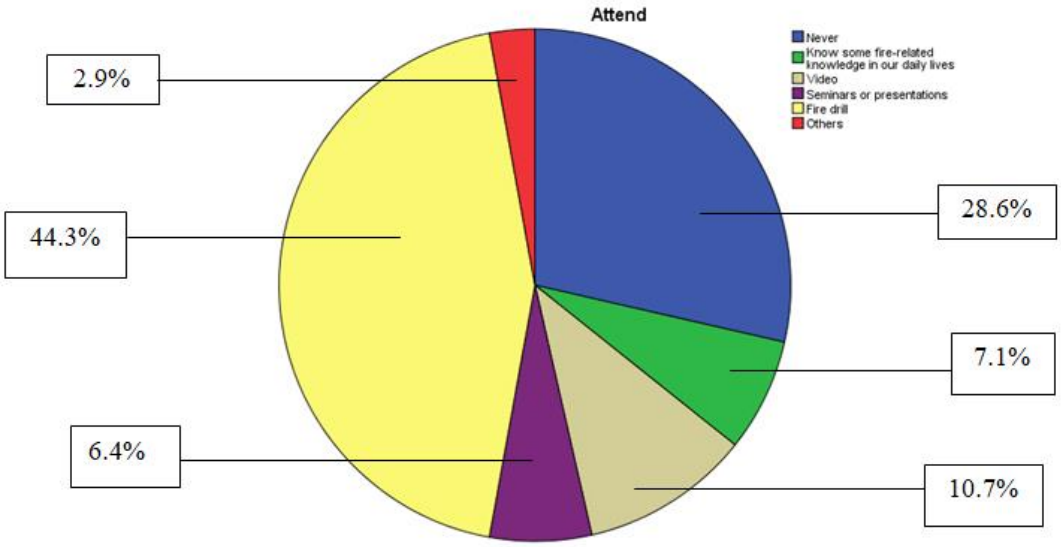


Figure 4.10: Pie chart about frequency of retailers attend fire training

Figure 4.10 shows the number of retailers attends fire training. A proper conducted training will help to avoid the circumstances of fire occurring and to extinguish the fire while still under develop stage or to ensure that the fire usage of any activities is under control. 40 of the retailers (28.6%) never attend fire training. The rest had attended fire training and have little knowledge about fire training. 10 of the retailers (7.1%) know some fire-related knowledge in their daily life, 15 respondents (10.7%) learned about fire training from watching videos, 9 retailers (6.4%) knew from seminar or presentation. Most of the retailers had attended fire drill, with the frequency of 62 (44.3%). It is important to investigate not only emergency knowledge but also perceived emergency knowledge which might increase by training (Knuth, Kehl, Hulse, & Schmidt, 2013). The rest 2.9% with the frequency of 4 knew about fire safety from other sources.

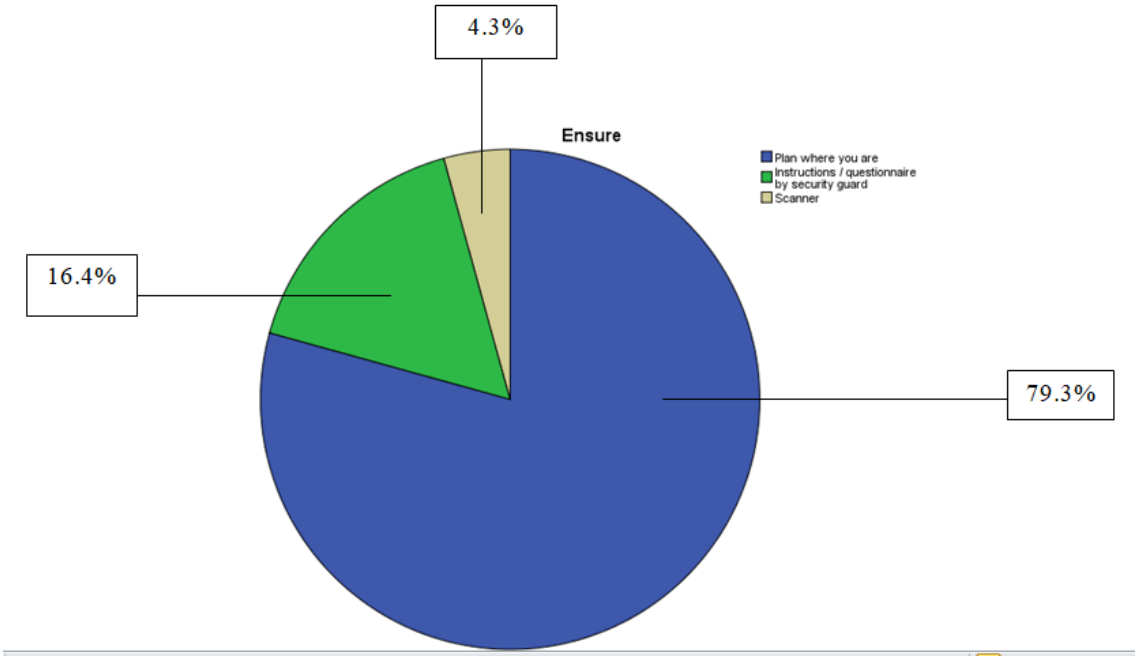


Figure 4.11:Pie chart about frequency on how to ensure safety in shopping mall

From Figure 4.11, it shows that 111 of the retailers (79.3%) agreed that in order to ensure their safety in shopping mall, a plan about their location in the shopping mall can be helpful. Thus, during an emergency, they will know the exit route. Other than that, 23 retailers (16.4%) agreed that instructions or direction from security guard would be helpful and 6 retailers (4.3%) agreed that scanner is needed to ensure their safety in this shopping mall.

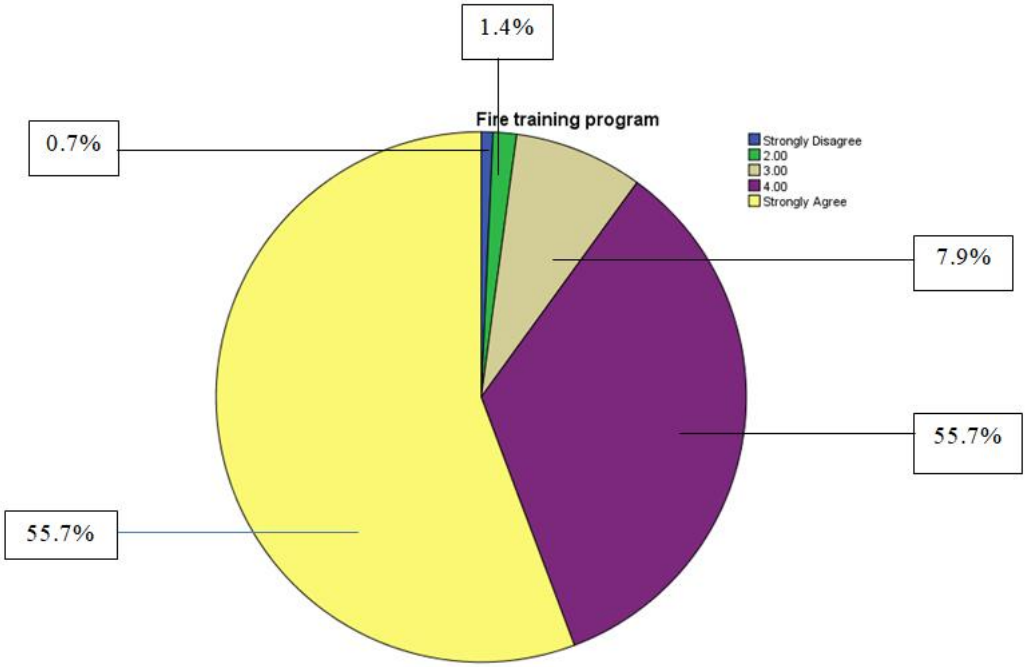


Figure 4.12: Pie chart about frequency on fire drill at shopping mall

Based on Figure 4.12, it shows that most of the retailers agreed that program related to fire emergency evacuation plan or fire drill training is required in this shopping mall with the number of 126 retailers (90%). Only 3 retailers disagree with the suggestion. Employer must designate and train employee to assist in a safe and orderly evacuation of other employees.

A successful outcome during an emergency hinges on the appropriate actions of the facility staff. In addition to requiring a written fire emergency plan to be prepared for a facility, fire and life safety codes require that staff personnel hold regular fire drills. The purpose of these drills is to ensure that the staffs are familiar with the plan and understand their individual roles when a fire is discovered. Employee should be able to implement the plan without direction from supervisory personnel. It is important that facilities review their fire and emergency plans regularly to determine if these are current, relevant, and appropriate.

4.7 ACTION DURING EMERGENCY

Emergency situations such as fires demand that various decisions be made, usually in a short period of time (Knuth et al., 2013). Most of people do not know how to deal in an emergency. It is difficult to determine the reaction of a person during emergency when it arises. The best action for individuals during emergency is to keep calm and focus on how to evacuate the building according to the training exposed to them.

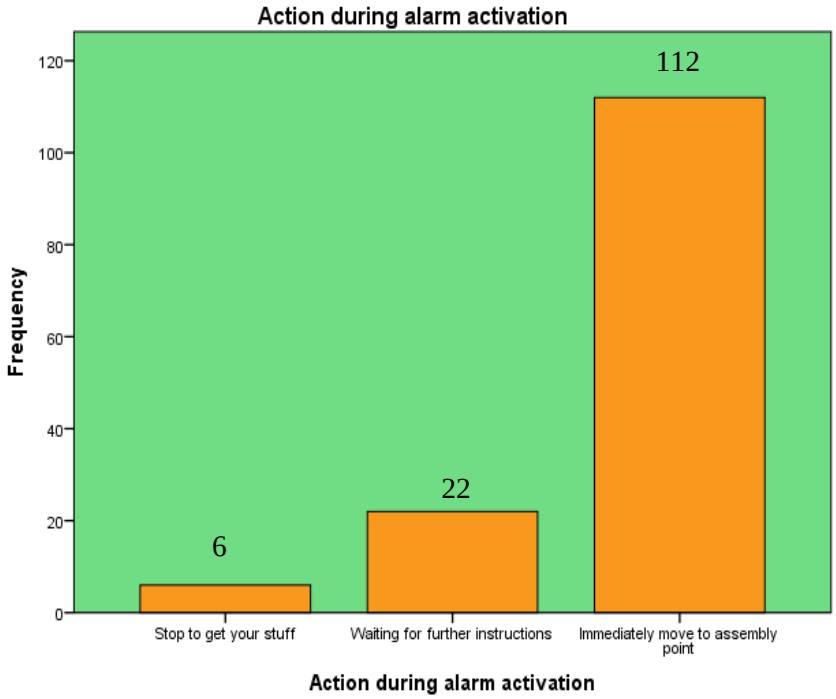


Figure 4.13: Bar chart about frequency on how retailers react after they hear fire alarm

Figure 4.13 shows the frequency of retailers reacts after they hear fire alarm. 112 of the retailers (80%) stated that they will immediately move to the assembly point during emergency, 22 retailers (15.7%) will wait for further instructions and the rest 6 retailers (4.3%) will stop to get their stuff first before decide what to do next. Other things that they possibly will do in term of stop to get their stuffs are switching off electrical appliances, close the roller shutter and clear the cash machine. Out of 140 retailers, only 81 with the percentage of 57.8% of them think that they can evacuate immediately from the building.

Table 4.4: Frequency on how retailers react during emergency

During emergency	Frequency					Total
	Scale					
	1	2	3	4	5	
Evacuate as soon as possible	12	16	31	65	16	140
Know the way out	19	32	25	40	24	140
Follow signage	26	21	14	47	32	140
Pathway to get out is smooth	15	34	29	49	13	140

Scale representation:

1: Strongly Disagree

2: Disagree

3: Neutral

4: Agree

5: Strongly Agree

Table 4.4 shows the scale of retailers' action during emergency. 81 retailers (57.8%) agreed that they can evacuate as soon as possible while most of the retailers with the number of 28 (20%) do not think they can evacuate as soon as possible from the building. During walkthrough inspection, it is proven that the internal environment of the building affect the duration of evacuation. Several components, which can be distinguished within the same group, are the furnishing, finishes, facilities and ergonomics. All these create the level of comfort within the spaces and normally being decorated or used according to the space functions or activities. This building does not use a lot of furniture and there are not many decorations, so actually there are a lot of spaces for movement but the usage of electrical equipment and gas supply might interfere the evacuation process.

The total number of retailers knows the way out from the building during emergency is 64 (45.7%) and the rest 51 retailers (36.5%) do not know the way out. This is because they do not understand about evacuation plan. If they understand the

evacuation plan, they will know the quickest exit route out of the building. From the table, it shows that the number of respondents follow the signage while leaving out the building is 79 (56.5%) and 47 respondents (33.6%) will not follow signage. The signage at this shopping mall is however not adequate so it could not guide the building occupants directly to the exit route. Therefore, maybe the 47 retailers do not follow the signage because it could not guide them to the right direction. The total frequency for the retailers that think the evacuation pathway is smooth without any obstacles are 62 or the percentage is 44.3%. However, 49 retailers (35%) disagree that the evacuation pathway is smooth. On trying to escape or egress from an area of a building during emergency, they will have to go through several stages such as looking for exit doors followed by escape route that will be the corridors or staircases or ramp or emergency lift. From the observation, the corridors of the building's width in Figure 4.18 are adequate during normal situation. Yet, the floor is a bit slippery because they are made of tiles and there are some obstructions.

Figure 4.14: The corridor of the building with some obstruction

Table 4.5: Extension of merchandise

Obstruction	Agree/Strongly agree	Disagree/Strongly disagree	Total
For normal people	103	19	140
For OKU	121	4	140

Table 4.5 shows the number of respondents' knowledge regarding the extensions of the merchandise and kiosks in this building. 103 respondents (73.6%) agreed that the process of evacuation out of this building will become more difficult and 121 respondents (86.5%) agreed that it is harder for disable person (OKU) to evacuate from this building. During weekdays or weekends when the shops are full with activities and events, it is even harder for the disable person to evacuate.

The extension of merchandise and kiosk along the corridor and lobby will cause the evacuation pathway become narrower. Refer to Figure 4.15 and Figure 4.16, this shopping mall usually will have event during weekend and it will be filled with kiosk and crowded with people. This situation can contribute to a chance of increasing the evacuation time. Even the lobby is not the evacuation pathway, but during emergency, people can become panic and could not decide where exactly to go so they do not follow the right evacuation pathway. They might use the lobby as their pathway to evacuate from the building.

Figure 4.15: Situation of the lobby during weekday

Figure 4.16: Situation of the pathway during weekend (Event)

Refer to NFPA 101-2000, Life Safety Code (1910.35), exit route means a continuous and unobstructed path of exit travel from any point within a workplace to a place of safety or an exit route that consists of three parts: exit access; exit discharge and exit, all vertical and horizontal areas along the route. Therefore, it must be free and unobstructed. No materials or equipment may be placed, either permanently or

temporarily, within the exit route. Objects that project into the exit route must not reduce the width of the exit route to less than the minimum width requirements for exit routes. The capacity of an exit route must be adequate.

Table 4.6: Use stairs/life

Use stairs/lift		
	Frequency	Percentage
Lift	0	0
Stairs	100	100%

Everyone must evacuate the building by way of the safest and closest exit or stairway. Based on Table 4.6, from 140 respondents, all of them choose to use stairs during emergency evacuation instead of lift, which is correct and safer. However, if there are too many people crowded on stairs, they will pack closer together or even lead to some dangerous situations (Qu, Gao, Xiao, & Li, 2014). Lift cannot be used during emergency because the power is likely to fail and people will trap in the lift. In addition, in case of fire, lift cannot be used. All the elevators stop working by the order of the fire alarm panel and fire alarm system automatically shut down all electricity supply to the electrical system in order to prevent spreading of fire in the building.

Table 4.7: Respond to ways of evacuation using stairs

Ways to evacuate using stairs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I follow other people	61	43.6	43.6	43.6
	I follow KELUAR signage	56	40.0	40.0	83.6
	I know the way out	11	7.9	7.9	91.4
	I have been directed to use this exit	6	4.3	4.3	95.7
	I use the entrance path to this building to exit	6	4.3	4.3	100.0
	Total	140	100.0	100.0	

Based on Table 4.7, 61 of the retailers (43.6%) choose the stairs during egress are by following other people, 56 retailers (40%) follow the 'KELUAR' sign and 6 retailers (4.3%) said that they have been directed to use that stairs. 6 of the retailers (4.3%) use the entrance path of this building to exit and 11 retailers (7.9%) stated that they already know the way out. The group of people who follow KELUAR sign probably will be safe. 11 retailers who already know the way out are people that are people that are more confident. There are quite a lot but not too many. However, their way out could be right or wrong. The group who followed other people is the most unsafe group because they might follow the wrong direction, in case if the person they are following is in the wrong direction. For the group of people who choose entrance path evacuation pathway, the entrance probably lead them to the lobby or their shops are near to the exit door.

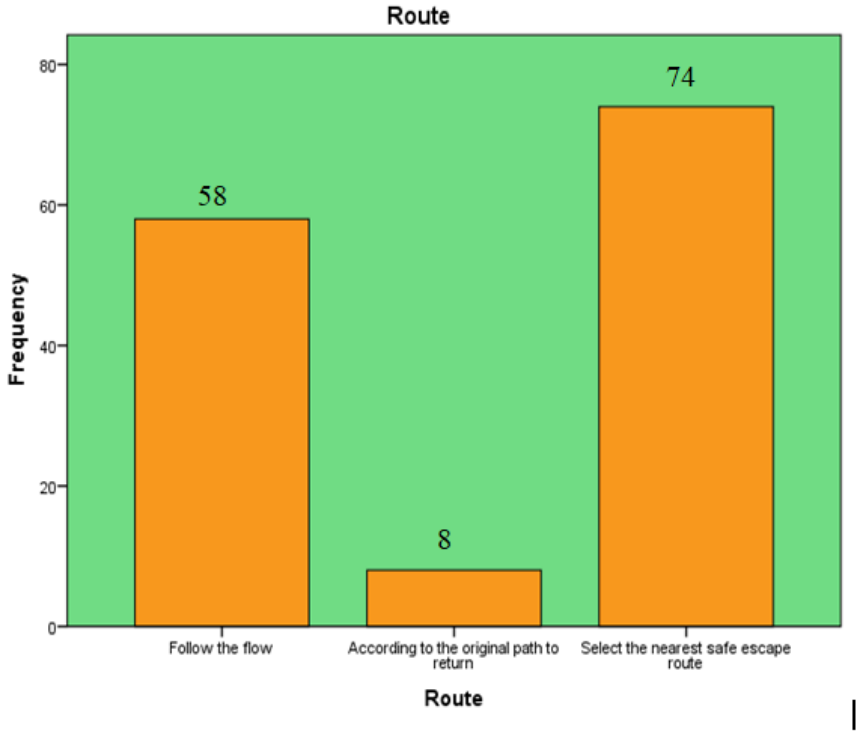


Figure 4.17: Bar chart about frequency on how retailers choose the exit route

The bar chart in Figure 4.17 shows the frequency of retailers chooses the exit route. Most of the retailers, with the number of 74 (52.9%) select the nearest safe escape route, 58 retailers (41.4%) follow the flow and the other 8 retailers (5.7%) choose the original path to go out from the building. Compliance with NFPA 101-2000,

Life Safety Code, the number of exit route must be adequate. At least 2 routes must be available and as far away from each other as practical in case one is blocked by fire or smoke.

4.8 EVACUATION PATHWAY

This section focuses on the evacuation pathway. This section is about the travel distance, size of stairs for total evacuation, escape route size and lighting system. The walkway, public way, or open space to which an exit discharge leads must meet minimum height and width requirements to accommodate the building occupants likely to use the exit route. The ceiling of an exit route must be at least seven feet six inches (2.3 m) high. Any projection from the ceiling must not reach a point less than six feet eight inches (2.0 m) from the floor. At the evacuation pathway, there are few things that need to be considered such as the lighting system along the pathway, the floor surface, the width of the corridor, the signage and distance travel in designing evacuation pathway. Recommendation by the guideline, all evacuation pathways are:

i) Size

ii) Floor surface

iii) Brightness

iv) Distance travel

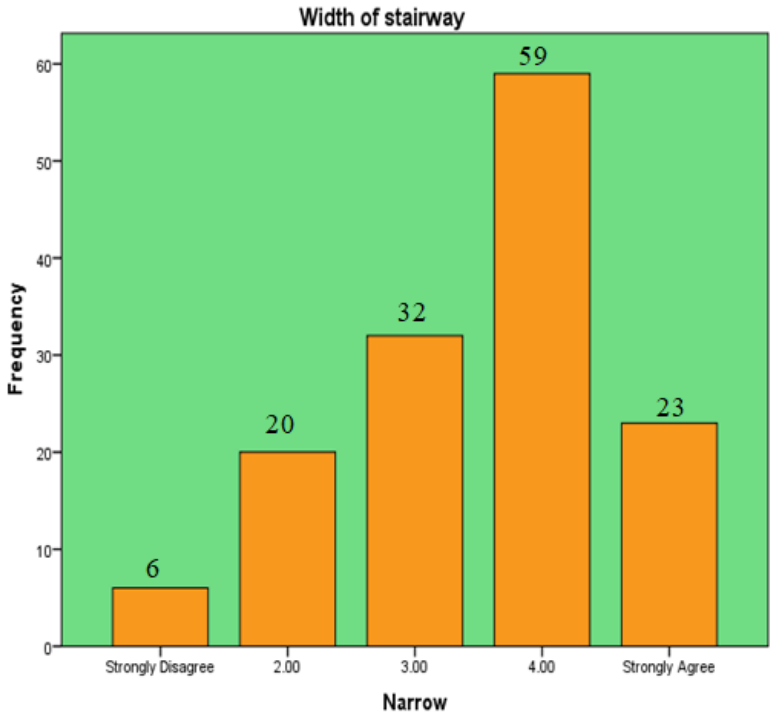


Figure 4.18: Bar chart about frequency on the narrowness of the stairway

A high-rise building that is not less than 10 storey height and without sprinkler system should be able to have a staircase (Nimlyat, Audu, Ola-adisa, & Gwatau, 2017).Figure 4.24 shows the amount of retailers that think the width of the stairway during evacuation is narrow. 26 of the retailers (18.6%) disagree that the width is narrow while the rest 82 retailers (58.5%) agree that the pathway is narrow and may cause an interruption during evacuation. However, during walkthrough inspection, the width of the stairway at this shopping mall is wide enough for evacuation process. Figure 4.19 is the stairway at the shopping mall.

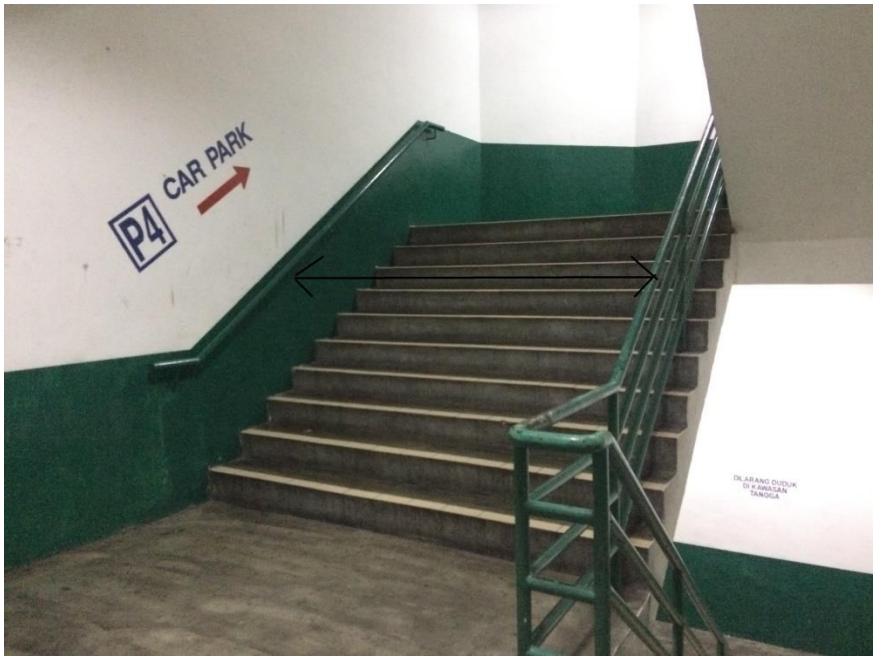


Figure 4.19: The stairway at the shopping mall

Table 4.8: Frequency about pathway obstruction

Pathway obstacles	Frequency					Total
	Scale					
	1	2	3	4	5	
The item in your store prevent lighting	72	30	24	8	6	140
Decorations in your store interfere with / close the signage	81	25	23	7	4	140
The management of the building prevent	55	33	23	18	11	140
You know your store bother evacuation pathway	49	37	25	24	5	140
Management of the building inform about emergency evacuation pathway	60	35	23	14	8	140

Table 4.8 shows the frequency of respondents' respond regarding the evacuation pathway obstacles. There is a question related to obstruction in the questionnaires. The amount of retailers disagree that the items at their store prevent the lighting along the pathway is 102 retailers (72.8%) which is half of the total respondents. Only 14 retailers

(10%) agreed that their merchandise blocks the lighting along the pathway. However, the extensions of their goods usually do not interrupt the lighting along the evacuation pathway based on observation during walkthrough inspection.

Each exit route door must be free of decorations or signs that obscure the visibility of the exit route door. The number of retailers agreed that the decorations at their stores interfere or close the signage is only 11 (7.9%) and 106 retailers (75.8%) disagree with the statement. This is because most of the shops do not hang their goods at the wall or ceiling and the ceiling's height is unreachable. Other than that, there are 86 retailers (61.4%) did not know their merchandise bothered the evacuation pathway while 29 retailers (20.7%) agreed the extension or addition of their shop with goods could bothered the evacuation pathway.

The management of the building plays important role in letting the people who stays in the building know about their safety especially related to fire safety because there are possibility for the incident to occur. From the questionnaire, it shows that only 29 retailers (20.8%) agree that the management of the shopping mall has prevented them from extend the goods out of their shops because the extension can block evacuation pathway. However, the amount of retailers disagree with the statement is higher which is 88 retailers (62.9%). The percentage of retailers disagree with the statement is more than half of the percentage which is 62.9% so most of the retailers stated that the management of the building did not prevent and did not state that they will return and impose action if the shop owner still puts the goods out of the boundary of the store.

There are 22 retailers (15.7%) agreed that the management of the shopping mall did inform them about emergency evacuation pathway plan and 95 retailers (67.9%) disagree that the management has already informed them. There are a huge number of respondents stated that the management did not give full care about fire emergency plan and did not have the intention to inform the building occupant about fire emergency plan especially on the pathway.

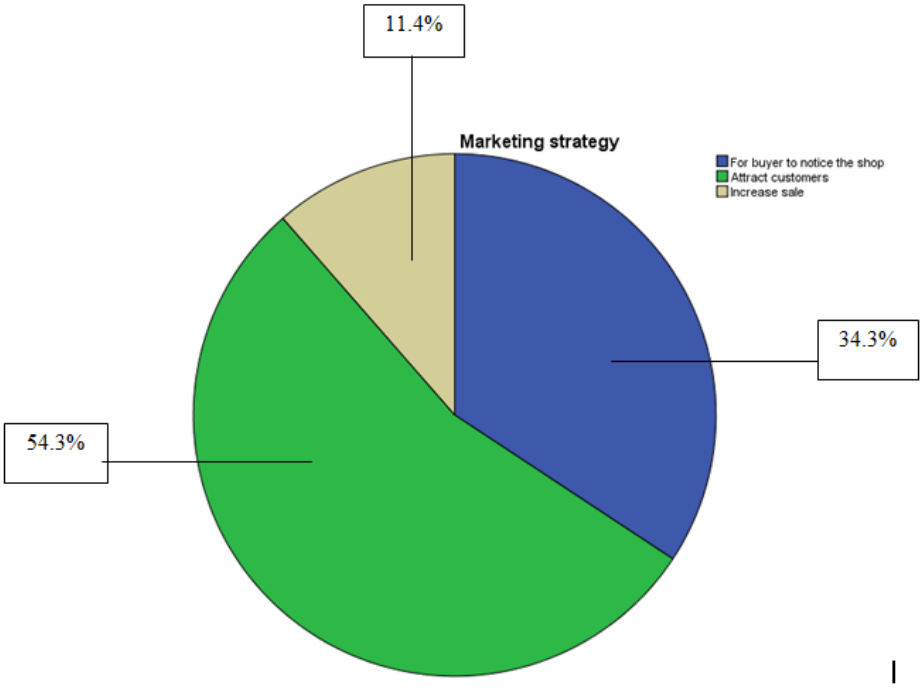


Figure 4.20: Pie chart about marketing strategy

Figure 4.20 shows the reason why retailers bring out the goods out of their stores. The highest reason for marketing strategy with the percentage 54.3% is to attract the customers to look at the merchandise or to enter the shops. The second highest reason is to make buyers notice their store so they can increase their sale. The last reason is to increase the profit with the percentage 11.4%. By looking at the merchandise, mostly the customer will at least buy the products and that will increase the sale for the day.

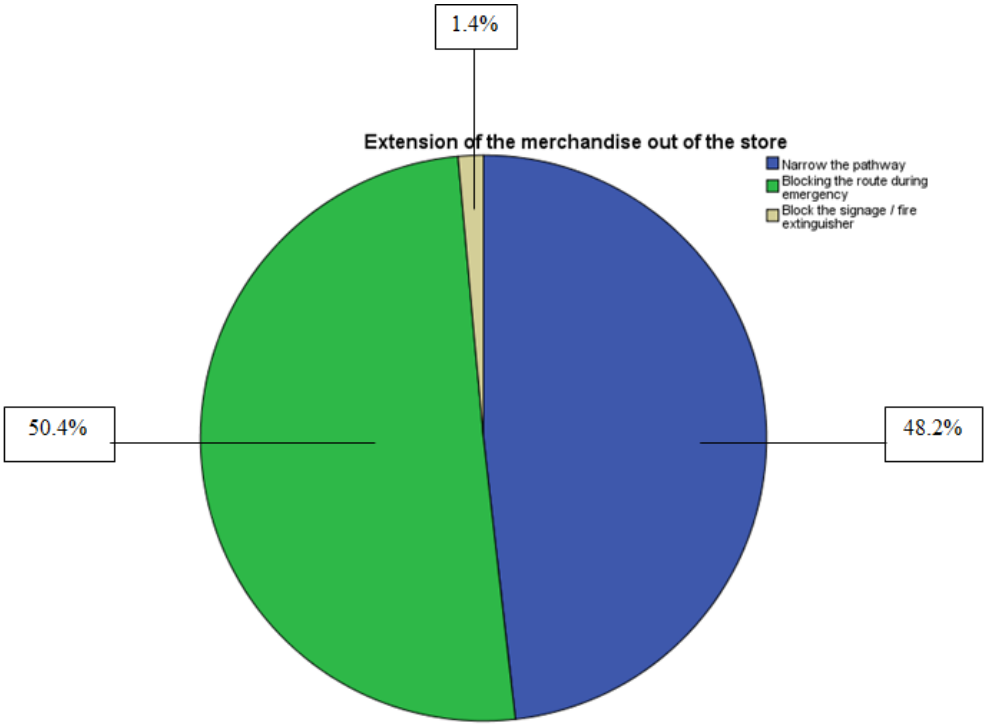


Figure 4.21: Pie chart about extension of merchandise

Figure 4.21 shows the extension of merchandise out of the store, which is the marketing strategy of the shop owners. The retailers need to know the additional of the goods might cause an interruption at the evacuation pathway. 70 retailers (50.4%) knows that the addition can block the emergency route, 67 retailers (48.2%) stated that the addition narrow the pathway and the rest 2 retailers with the lowest percentage, 1.4% think it can block the signage or fire extinguisher.

CHAPTER 5

DISCUSSION AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, the findings of the research will discuss based on the data obtained and analysed throughout the research. The discussion and recommendation made based on the result obtained and supported by past researches or data analysed from the Chapter 4. Studies conducted in the form of descriptive data so researcher decided to analyse the data based on quantitative methods.

5.2 FIRE SAFETY AWARENESS AMONG RETAILERS

5.2.1 Knowledge on fire safety

Shopping mall is a place where people spend most of their time to hang out or to shop especially during weekend. Shopping mall's function is not only to boost the economic prosperity and provide the customers with convenience merchandise, but it also bring serious fire danger (Ying Peng& Hui Che, 2014). Therefore, the study of human evacuation pathways in shopping mall is a crucial issue. The focus of the building occupants for shopping malls is shop owners, retailers, cleaners and security guards. The clients or shoppers are considered as the visitors. Therefore, in this case, building occupants are chosen among the retailers because they spend time more than 8 hours a day at the shopping mall to earn a living. Human life either building occupants or the visitors is the most priority concern in fire safety because negligence of human error could cost human loss as well. Building occupants need to have knowledge and awareness on any disaster or possible incident that can happen in the building, in this case is fire incident.

Table 5.1:Frequency and mean of respondents' level of knowledge

Knowledge	Frequency					Mean	Total
	Scale						
	1	2	3	4	5		
Aware about fire emergency evacuation plan	24	33	26	45	12	2.91	140
Understand fire emergency evacuation plan	38	35	21	31	15	2.64	140
Written emergency procedures help	4	7	16	83	30	3.91	140
Emergency procedures written in large prints will be clearer	1	4	8	41	86	4.48	140
Know safety level at this mall	22	40	23	44	11	2.87	140
Know the signage function	2	8	12	67	51	4.12	140
Know how to use a fire extinguisher	4	13	16	60	47	3.95	140
Know where to gather during emergency	44	39	19	29	9	2.43	140

Scale representation:

1: Strongly Disagree

2: Disagree

3: Neutral

4: Agree

5: Strongly Agree

Descriptive statistics test is used to describe the pattern of sample as the frequency distribution, mean, median, and mode and measures of variability such as

range, variance, and standard deviation (Mohd Najib Ghafar, 2007). Interpretation of mean scores or the tendencies are shown in Figure 5.1.

Mean Score	Interpretation Level
1.00 – 2.49	Low
2.50 – 3.49	Moderate
3.50 – 5.00	High

Figure 5.1: Interpretation mean scores of statistic descriptive

Source : Wiersma&William, 2000

The data obtained from this study in Table 5.1 will represent other building occupants in Malaysia's shopping malls. Based on the data collected related to fire safety awareness, it shows that there are some of the building occupants have good knowledge about fire safety at shopping malls. Fire evacuation plan will show each building occupants the best and right way out of the building during fire emergency. The mean of building occupants aware of the existence of fire evacuation plan is moderate (2.91) and the mean for understanding evacuation plan among building occupant is moderate which is only 2.64. It shows that the building occupants aware about their surrounding but they are too lazy to spend some time to understand what they see. That is why they need to have an exposure about fire safety.

Researcher gave some information and explained about fire safety especially about the evacuation plan to the building occupants who did not know and asked about it. The mean for building occupants agreed that written emergency procedures help is 3.91 and the mean for building occupants supported and agreed that the larger size of evacuation plan would be useful and helpful is 4.48 as shown in Table 5.2. Both mean are high levels. It shows that once they understand the evacuation plan, the level of their awareness will also increase. However, during walkthrough observation, the evacuation plan in this shopping mall's size not placed at the corridor way as shown in Figure 4.4 in Chapter 4. Evacuation plan should be well placed and able to be seen clearly by building occupants.

Table 5.2: Frequency and mean for knowledge about signage

Knowledge	Frequency					Mean	Total
	Scale						
	1	2	3	4	5		
Know the signage function	2	8	12	67	51	4.12	140

Signage is the use of signs and symbols to communicate a message to exact group a people as a communication tool during emergency and as a directive without verbal or sound. A sign reading ‘KELUAR’ or ‘EXIT’ with an arrow indicating the direction shall be placed in every location to direct the occupants to a reach safe exit out of the building. Signage also affects the way building occupants find their way out. This will lead to the assembly point. Kobes, Helsloot, Vries, & Post (2010) said that there are five categories of environmental factors that affect the ease of way finding;

- Visual access and proper lighting
- The level of architectural differentiation
- Layout
- Familiarity with the building
- The presence of signage and location marking

The mean of building occupants know the function and meaning of the signage is 4.12 which is high level refer to Figure 5.1. This is a good sign and very significant for the building occupant to evacuate within a short time because more than half of total the respondent know about it. However, from walkthrough observation, the signage at this shopping mall is not adequately placed and no signage can be found at the escape route but only at the exit door as shown is Figure 5.2. Therefore, it did not follow By-Laws Section 172(2); a sign “KELUAR” with an arrow indicating the direction shall be placed in every location where the direction of travel to reach the nearest exit is not immediately apparent.

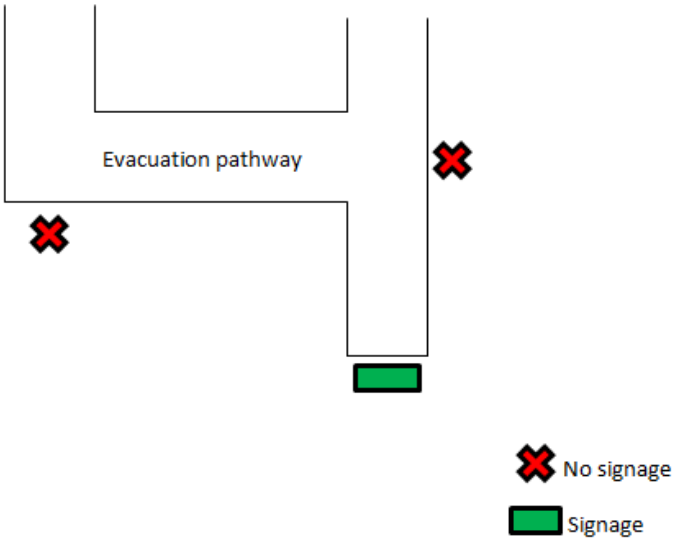


Figure 5.2:Not proper exit sign at the shopping mall

Fire extinguisher is one of the fire protection systems that were installed in the building. In Table 5.1, 76.5% of the building occupants with mean 3.95 know how to use fire extinguisher. The mean shows high level of knowledge about using fire protection system among building occupants. Then, we can assume that all building occupant know the "PASS" method using fire extinguisher to control fire. In case of any fire accident, the best method for building occupant is to be able to fight using fire extinguisher for those who are properly being trained but for those who are not confident enough, it is best for them to escape through the exit route.

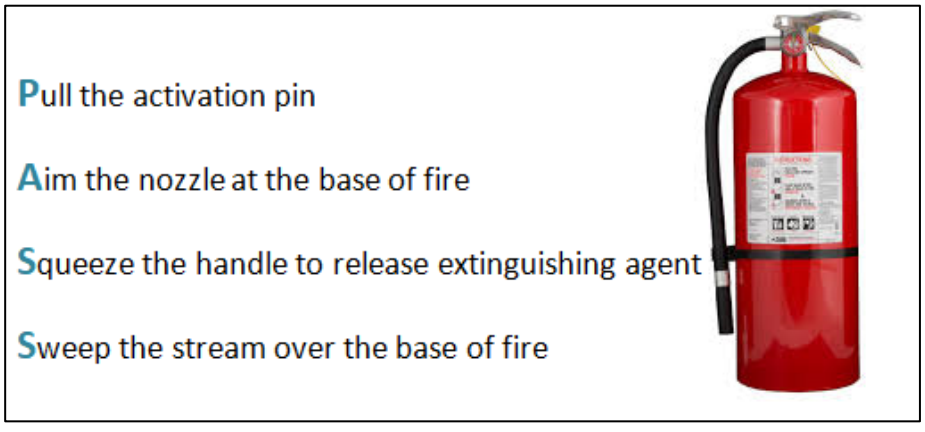


Figure 5.3: PASS method

Fire alarm system is another fire protection system that were installed in the shopping mall. A fire alarm system has a number of devices working together to detect and warn people through visual and audio appliances when smoke, fire or other emergencies are present. During fire alarm activation, 80% of the building occupant decided to move immediately to the assembly point. The other 15.7% building occupant decided to wait for further instruction from the security guard because they think fire alarm is activated only for testing and the rest 4.3% stop to get their stuffs first before decide what to do next.

Table 5.3:Frequency and percentage of retailers preventive measure

Know about fire emergency evacuation by	Frequency	Percentage
Know some fire-related knowledge in daily life	10	44.3
Video	15	10.7
Seminar or presentation	9	7.1
Attended fire drill	62	6.4
Others	4	2.9
Never attend any fire training	40	28.6

Training, knowledge and practical experience can cause behaviour to be modified and preparing people for how to deal with a fire. Most of building occupant had attended fire training. 44.3% of the building occupant attended fire drill and 10.7% learned about fire training through watching videos. 7.1% building occupants know some fire-related knowledge from their daily life, their family, friends or surrounding while 6.4% knew about fire training by attending seminar or presentation. However, 28.6% of building occupants never attended any fire drill. This affects the way that they react during any fire emergency. This shopping mall never provides program related to fire safety evacuation such as fire drill to the building occupants. Therefore, a very high percentage, 90% of building occupant agreed that this shopping mall should provide them with any fire safety related program.

The mean of building occupant that realised their safety level in this shopping mall is 2.87, which is in moderate level refer to Figure 5.1. Those who realize about

their safety level maybe came from the group of people who have attended fire safety training so they are more aware of things around them. The amount of building occupant that did not know about their safety level is slightly higher than the one who know. 79.3% of them agreed that in order to increase and ensure their safety level, a plan about their location in the shopping mall could be helpful especially during any emergency. The rest of the building occupants agreed that instruction or direction from security guard and scanner at the mall entrance can be applied to increase the level of this shopping mall's safety.

5.2.2 Action during emergency

Table 5.4: Frequency on how retailers react during emergency

During emergency	Frequency					Total
	Scale					
	1	2	3	4	5	
Evacuate as soon as possible	12	16	31	65	16	140
Know the way out	19	32	25	40	24	140
Follow signage	26	21	14	47	32	140
Pathway to get out is smooth	15	34	29	49	13	140

This shopping mall is equipped with modern fire detection systems and it is possible to alert people to a fire. However, this gives no clues for building occupant on to how to escape. During emergency, building occupants will become panic and lost control. Refer to Table 5.4, 57.8% of building occupants decided that they will evacuate as soon as possible during any emergency but there is no guarantee that they can evacuate successfully if they did not know the way out. This is because from 100%, only 45.7% of the building occupants know the way out of the shopping mall. It justify that the retailers were not well exposed about the evacuation plan. The other 36.5% building occupants that know the way out was probably because they are familiar with the building or they have been working at the shopping mall for quite long time.

Table 5.5:Respond to ways of evacuation using stairs

Ways to evacuate using stairs	Frequency	Percentage
Follow KELUAR signage	61	43.6%
Follow other people	56	40.0%
Know the way out	11	7.9%
Have been directed to use this exit	6	4.3%
Use the entrance path to this building to exit	6	4.3%
Total	140	100%

Even though they understand the meaning of signage, yet during emergency evacuation, not all of them follow the KELUAR exit sign. From Table 5.5, 43.6% of the building occupants clarify that they will follow the signage because they believe the exit sign will lead them to the right exit door. The rest will not follow the signage because on panic situation, they will behave in an emotional manner rather than a thoughtful manner. 40.0% will follow other people, 7.9% already know the way out. And both 4.3% of the retailers will use the entrance path and have been directed to use this exit.

Table 5.6: How retailers choose exit route

How choose the exit route	Frequency	Percentage
Follow the flow	58	41.4%
According to the original path	8	5.7%
Select nearest safe escape route	74	52.9%

There are also few ways how building occupants choose the exit route. Based on Table 5.6, the highest choice among the building occupant is by selecting the nearest

safe escape route. This is because some of the building occupants' line of sight may simply not have taken in the signage, which was located above their heads over the exit. Therefore, they may not have had the opportunity to be affected by the signage information. Other building occupants will follow the flow and escape out of the building according to the original path. The safest group of building occupant is the one that follow the exit sign along the evacuation pathway.

Galea, Xie, Deere, Cooney, & Filippidis (2017) stated that safe evacuation could be even more challenging as the safe evacuation time may be limited and evacuation routes may be compromised due to the deteriorating environment. 44.3% of the building occupant thinks that the emergency escape route is smooth without any obstacle. The other 35% of the building occupants did not think the pathway is smooth because they have more knowledge regarding the emergency evacuation plan. Table 5.7 shows that 73.6% of the building occupant agreed that the extension of the store's merchandise and kiosk along the corridor would cause the width of the evacuation pathway become narrower and might increase the evacuation time during an emergency. From walkthrough observation, the finishing for the floor is made of tiles, it is a hazard because it can be a bit slippery especially in case of evacuation during emergency.

Table 5.7:Extension of shop

Obstruction	Agree/Strongly agree	Disagree/Strongly disagree	Total
For normal people	103	19	140
For OKU	121	4	140

Moreover, disable people (OKU) are affected by the extension of merchandise because they might use wheelchair will get confused will cause a delay during evacuation process. Every weekend, this shopping mall will be filled with people because many events are held there. The lobby and the corridor in the building will become crowded and packed with shoppers and visitors. This situation contributed to the increasing time of evacuation because in an emergency, the building occupants rush

to the same exit, so they will use the same pathway. The lobby is not the right route to evacuate during the emergency, but based on the discussion before, they mostly escape out of the building by the nearest exit so it was impossible for them to use the lobby as their exit route.

5.2.3 Evacuation pathway

On trying to escape or egress from an area of a building during emergency, building occupants will have to go through several stages such as looking for exit doors followed by escape route, which will be the corridors, staircases or emergency lift. All the egress effort will be dealt easily if everyone involved know their escape route and the best way to get to the open space outside the building from their original location. Of course, the occupants' vulnerability counts in the whole process of egress. However, having a direct external egress from an area to the outside open space will be an advantage to the occupants.

The requirement of evacuation pathway consists of:

i. Accessible means of egress: A continuous and unobstructed way of egress travel from any accessible point in a building to a public way.
ii. Corridor : An enclosed exit access component that defines and provides a path of egress travel to an exit
iii. Stairway: One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.
iv. Merchandise pad: Merchandise pads contain elements such as non-fixed and moveable fixtures, cases, racks, counters and partitions.

From the questionnaire in Section D, 70% of the building occupants agreed that lighting in this shopping mall is adequate. The adequacy of lighting system in shopping mall is important as interior lighting quality influences people’s visual comfort and satisfaction with a space. A lux is the illumination of an area of one square meter produced by a luminous flux of one lumen. In terms of evaluating the light environment, the results of differential analysis may vary in different types of buildings

(Jin et al., 2017). Based on Angeles (2007), the recommended light levels for indoor partially at the corridors and lobby is 200 lux.

There are 14 components on fire safety components (Idris, 1997). Some of the components are building occupants, fire prevention, preparedness for fire emergency, internal environment and escape or egress. The sub-components for escape or egress are horizontal movement, vertical movement, escape route and travel distance.

In case of fire emergency, all the electrical supply will shut down. Emergency lighting, which automatically illuminates during power outages, is required in all buildings except those with ample natural light that are occupied only during daylight hours. Emergency lighting facilities shall be arranged to provide initial illumination that is at least an average of 1 foot-candle (11 lux) and a minimum at any point of 0.1 foot-candle (1 lux) measured along the path of egress at floor level (International Building Code, 2015). From walkthrough observation, this shopping mall installed the emergency lighting system and they are placed along the evacuation pathway. The emergency lighting is connected to sub generator and easily seen.

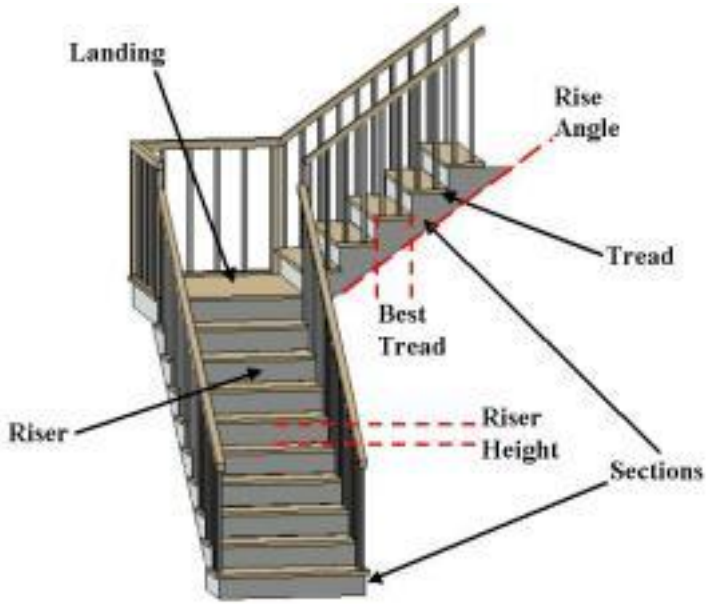


Figure 5.4: Components of staircase

Source: ww.scribd.com

As stated in the checklist components by Idris (1997), under vertical movement egress, stairway is one of the sub-components. The components of the stairways in Figure 5.4 are the width, rise height, tread depth, rise, run and pitch line. During walkthrough observation, the stairways in the shopping mall are adequate in term of its width. The width of stairway shall not be less than 44 inches (1118 mm) and the width are maintained throughout its length including at landings. In addition, based on By-Laws 168, the upper floor shall have means of egress via at least two separate staircases. There are two stairways in each level of the building and each stairway is placed at the end of the floor. The surface of the stairway is not slippery because the surface material is made of cement so the stairways are safe to use during emergency. Therefore, it shows that building occupants did not have the understanding about the narrowness of stairway because 82% of the building occupants with the mean 3.52 (high) agreed that the stairway at this shopping mall is narrow.

Table 5.8:Frequency about pathway obstruction

Pathway obstacles	Frequency					Total	Mean
	Scale						
	1	2	3	4	5		
The item in your store prevent lighting	72	30	24	8	6	140	1.90
Decorations in your store interfere with / close the signage	81	25	23	7	4	140	1.77
The management of the building prevent	55	33	23	18	11	140	2.26
You know your store bother evacuation pathway	49	37	25	24	5	140	2.27
Management of the building inform about emergency evacuation pathway	60	35	23	14	8	140	1.23

In the questionnaires, there are questions related to obstruction of the pathways. That questions' intention are to investigate the building occupants whether they know

exactly the importance of pathways as an escape route. Table 5.8 shows that 72.8% of the building occupants disagree that the extensions of their merchandise block the lighting system along the pathway because they did not hang their merchandise on the ceiling as the ceiling is unreachable. In addition, there are 75.8% of the building occupants disagree that their goods and merchandise hinder the exit signs. From walkthrough observation, it is proved that their merchandise indeed did not interrupt any lighting and signage along the pathway because no stuff was hanging on the wall.

The management need to try their best to prevent any fire accident from happening and in case emergency, they need to ensure the process of evacuation through horizontal and vertical movement runs smoothly so that everyone can egress from the building safely. Table 5.8 shows that 20.8% of the building occupants agreed that management of the building already prevented them from do the extension of promoting their merchandise because that has become an obstruction at pathway. and 15.7%. of the building occupants agreed the management of the shopping mall did inform them about emergency evacuation pathway. Those who agreed with the statement may have been exposed to fire safety and were given a brief about fire safety evacuation plan during approval prior to employment. Moreover, maybe most of the retailers are only part timers at the store so they always miss any important information. It also shows that the management did not emphasize the issue about fire safety to the retailers.

It also shows that 20.7% of the building occupants agreed that the extension of their merchandise could bother the evacuation pathway and contribute to the increasing of travel distance to evacuate. Almost all the movement and escape requirement will have to consider the distance of traveling from original location to the final exit which is the open space outside the building. The things that will include escape route, building occupants, rescuer and hydrant or fire brigade hose.

Table 5.9:The extension of their merchandise

Extension of merchandise	Frequency	Percentage
Block the emergency route	70	50.4%
Narrow the pathway	67	48.2%
Block the signage/fire extinguisher	3	1.4%

The reasons why they extend their merchandise out of the store are to make buyer notice their shop, to attract customer and to increase their sales. Based on Table 5.9, 48.2% of the building occupants know the extension have been narrow down the pathway. 50.4% of the building occupants agreed that their merchandise block the route during an emergency and 1.4% of the building occupants agreed the merchandise block the signage or fire extinguisher. Nevertheless, they still did that because the management did not warn or prevent them. In addition, the needs to attract customers and increase the sale are the most important things for them.

5.3 FIRE SAFETY AWARENESS AMONG MANAGEMENT TEAM

Person that is responsible for managing a fire emergency may lack in understanding of how they should move occupants in response to any fire emergency. The management team of this shopping mall did not have much knowledge about fire safety because fire accident never happen at the shopping mall and they think it is impossible for that incident to happen. Then again, actually it is always possible for a fire accident to happen at this building because there are sources of ignition which are from cooking gases at the restaurants, cigarettes from the storage bay and electrical current from the stores and restaurants.

The management of the shopping mall must look into the evacuation pathway to ease the public to reach the safe place in the short period. Usually the escape route will be provided with emergency lighting, it will be pressurized if it is an enclosed area, and sometimes one will have to go through several inner accesses in order to get to the escape route. The size of the evacuation plan in this shopping mall should be checked and updated regularly by the management team. Also, there is no exit sign that should guide every building occupant to the exit door in case of emergency

Nonetheless, from walkthrough observation, the size of the emergency evacuation plan at this shopping mall is small and could not be seen clearly as the evacuation plan were not placed at the corridor.. Without they realise, they put the building occupants' life in danger because most of them did not know how to read emergency evacuation plan and during emergency, nothing will lead them to follow the right exit route to get out from the building. All the features of having fire doors, exit doors, emergency lighting, signage and exit direction including the surfaces of the route and its sizes do act as an assistant to the building occupants during emergency

The building has fire protection systems such as smoke detector, fire alarm and flame detector and the number of them within area is two, which is adequate because the building's space is not that big. It also has emergency lightings that are easily can be seen and will become the source of lighting during emergency. From the interview with the management team, they stated that the maintenance of all the protection system is well enforced. For firefighting, this building has portable extinguisher, hose reel and hydrant. However, the management did not realise that the portable fire extinguisher is not placed at the corridor way and hard to be find by the building occupants.

If a fire breaks out in the building, the highest priority is to get everybody out of the building as quickly, efficiently and carefully as possible. In order to make building occupant prepare to any fire emergency at shopping malls, proper training should be provided to them. Based on the interview, the management of the building said that they only did fire evacuation training will the building occupants once a year. It is not sufficient because the retailers of the shopping mall always varying from time to time. The development of safety skills in response to all forms of emergency situations

represents potentially important sources of training within community settings (Russell T. Jones, Alan E. Kazdin & Janell I. Haney, 1981).

Without proper training, the building occupant will have no exposure on how to deal with any emergency incident. Training should be designed to teach building occupant the evacuation skills to improve their knowledge of emergency responses. More information and training would be useful to make people understand that immediate response to an alarm is important for their own safety and the safety of others (Guyl ne Proulx, 1995). Building owner did not emphasize and educate the building occupants well about the egression in case of any emergency. Full evacuation drills, however, are rarely practiced and have never been studied in such buildings to determine how and how much life safety is provided (Guyl ne Proulx, 1995).

After some explanation given to the building occupant about the evacuation pathway, some of them think and realise that the pathway is not smooth due to the extension of merchandise from some stores. Even during an emergency, it is harder for them to evacuate as soon as possible. This is due to lack of safety awareness and responsibility among the management. The interior finishes for the walls and partitions in this mall are from paint, while the floor is from tiles and ceiling is plaster. The floors are a bit slippery because they are made of tiles so it is dangerous during emergency evacuation. The slippery floor and the narrower pathway due to the extension of the merchandise will increase the danger and cause delay during any emergency evacuation.

Every weekend, there will be events held at the shopping mall. The number of visitors and shoppers will increase than the usual. As showed in the figure on the previous chapter, the situation of this shopping mall is very crowded. The pathways, the corridors and the lobby are so crowded. If fire emergency suddenly happen, it will cause a chaos. The management has a crowd management. Crowd management will prepare for emergency evacuation, security, guided announcement and will give a clear direction to building occupants in case of emergency.

Management of the building knew about the extension but they never think about the effect of the extension during an emergency especially for disable people

(OKU). They never realise that the action actually makes it harder for disable people especially for those who are on wheelchairs to pass the pathway. The management also did not regularly inspect or check whether the extension has become over limit until it turn out to be an obstruction at the evacuation pathway which will increase the time of evacuation.

5.4 RECOMMENDATIONS

The retailers are the building occupants that spend most of their time at shopping mall and the management team of the shopping mall is responsible to ensure the safety, health and welfare of building occupants. Therefore, it is important for both building occupants and management team to have knowledge about fire safety and evacuation plan because it is always possible for fire accident to happen in shopping mall. The source of ignition in shopping mall can come from the restaurants and storage bay. So, a few recommendation and suggestion were made to increase the level on awareness about fire safety evacuation plan within the building among the building occupants. The building occupants are the management, the retailers, shop owner and as well as the shoppers. Among the recommendation to reduce future losses due to inadequate escape pathways in shopping mall are as follows:

I. Fire safety education and training

II. Digital screen display

III. Provide fire protection system at each store

IV. Compounding action from management

V. Installation of fire resistant roller shutter

VI. Install proper signage

VII. Further research

5.4.1 Fire Safety Education and Training

All individual from the early age should understand fire safety exposure. At the earliest possible age of schooling, all children should know the dangers of fire and should know exactly the action taken during fire emergency accident. Fire safety subject or courses can also be included in their learning at school. At the workplace, in order to inform workers about the risk of fire in the building, flyers and fire safety related magazines should be distributed to them. In addition, the management of the shopping mall also should provide information about how to assess, handle and being prepared for emergency. These can be done through training, family gathering induction courses or morning toolbox meeting.

Emergency training can improve behavioural responses in an emergency. This training educates building occupants in correct evacuation response procedures to be used in the event of an emergency. Management team is recommended to conduct fire evacuation training or fire drill to all employees including the management team at least twice a year in co-operation with local authority such as Fire and Rescue Department of Malaysia. Training can increase the awareness and preparedness among building occupants for any emergency. In addition, being well-prepared for an emergency will pay off when it’s time to handle any emergency situation and will reduce emotional distress during a fire.

“First Attack” as a fire training program to fight against fire is differs from emergency evacuation training.. An appropriate type of fire extinguisher should be available and used for the specific type of fire incident. Fire extinguishing training is known by PASS. Pull the activation pin, aim the nozzle at the base of fire, squeeze the handle and sweep the stream. This comprises of theory and practical components in the use of fire extinguishers and blankets. After this training, building occupants will be qualified to safely execute first response procedures. This means using the appropriate fire equipment correctly in fire related emergencies. If the wrong extinguisher agent is used on certain fires, it may exacerbate the situation. Its important building occupants know what to do.

5.4.2 Digital screen display

Management team can put digital screen displaying fire safety evacuation in the shopping mall. The display screen can be vary in many forms such as images, videos or animation. It will also display the right action during the emergency, how to egress from the building following the correct pathway and where the exit doors are located. The screens will be placed at the corridors so it can easily be seen by all the building occupants including the shoppers and visitors.

Figure 5.5: Example of digital screen display at shopping mall

If management team invest in digital screen display they can save a lot by eliminating the need to print out the old evacuation plan every time a minor change occurs. With this freedom, they are more likely to indulge in any ideas regarding fire safety they may have and also save a lot of time. Other than that, communicating via digital screen offers many opportunities for marketing and advertising.

People recognize an attractive graphic instantly and they find it is more interesting. Digital screen is more interactive to modern settings particularly among all generation of shoppers. A good design communicates effectively. The digital screen captures building occupants' attention in a few seconds by the use of action words and active voice. The duration should not be greater than 10 seconds and can be arrange to repeat automatically at some time interval.

5.4.3 Provide fire protection system at each store

Fire extinguisher is the most familiar and easy to use protections equipment. Fire extinguishers are provided for a ‘first attack’ firefighting measure, generally undertaken by the occupants of the building before the fire service arrives. It is important that occupants are familiar with the type of extinguisher type to use on the source fire.

Fire can ignite from electricity consumption. Therefore, the negligence of retailers using excessive electrical power can ignite small fire. By extinguishing a minor fire using a fire extinguisher, it can prevent from major fire accident happen in this mall. Indirectly, this has prevented the loss of uninsured cost such as product, material and equipment damage.

5.4.4 Compounding action from management

Management of the shopping mall need to limit the extension of the store merchandise. They will allow the shop owner to do the extension of the merchandise, but the extension limit need to be standardised and apply to all stores on all floors.

Regular inspection by the security and safety team at the shopping mall will ensure no shop owner exceeds the permitted limit and is found to disturb and narrow the common route. Compound will be imposed on shop owner who still violates this rule after being warned more than once.

5.4.5 Installation of fire resistant roller shutter

Installing roller shutters is perhaps the most affordable and efficient solution to protect an indoor space. They are not only strong and durable, but also occupy a little space and are very easy to clean and maintain, which makes them even more efficient.

Figure 5.6:Fire resistant roller shutter

In the event of fire, the fire resistant shutter will automatically close down and this will slow and prevent the spread of fire. By keeping the fire contained, the fire resistant shutter may allow more occupants to safely exit from building during emergency. It will also help to protect property and assets while firefighters work to put out the flame. Roller shutters can act like insulators and they protect a space from rain, light, heat or sound. The advantage of this roller shutter is that it can stand against fire between 1 to 5 hours (Seng Kong Shutter Industries) .

5.4.6 Install proper signage

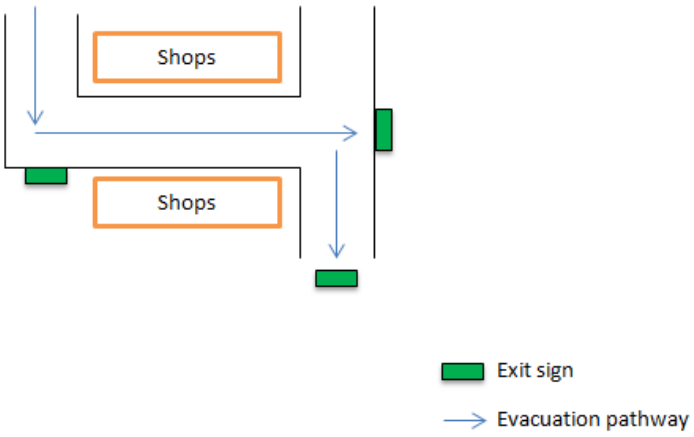


Figure 5.7: Correct signage location

Instead of just placing the exit sign at the exit door, as required, it is recommended that signage to be place at each of the corner of the corridor. Management team should ask consultation from Fire and Rescue Department of Malaysia regarding the signage installation in the shopping mall. Researcher's suggestion for the placement of signage in shopping mall based on substitution By Law 172 is in the Figure 5.7.

5.4.7 Further research

The last recommendation would be about carry on further research regarding the building occupants' knowledge about building design. Based on the discussion on Chapter 4 in Figure 4.18 about the narrowness of stairway, the building occupant are found not to know very well about building design because the width of the stairways is actually adequate but more than 50% of the building occupants agreed that the stairway is narrow. Other than that, the study about practice and action among building occupants is necessary to know their level of awareness. Lastly, do more than one case study to ensure the significance of this study.

CHAPTER 6

CONCLUSION

6.1 INTRODUCTION

In this chapter, the findings of the research will be concluded based on the data obtained and analysed throughout the research. The conclusions were made based on the statistical analysis supported by past researches. Conclusion will prove that hypothesis that has been stated in Chapter 1 are accepted or not.

Based on Chapter 1, the objectives of this research are:

1. To identify the level of knowledge of building occupants including the management of the shopping mall regarding fire evacuation plan particularly in shopping mall.
2. To determine the preventive measures among building occupants to accelerate the evacuation time out of the building.
3. To observe the adequacy of fire protection and prevention installed within the evacuation pathway in the mall.

6.2 CONCLUSION

The statistics obtained in Chapter 1 shows that fire accident can happen in shopping malls. According to articles and news, fire accident can cause injury and fatality to the building occupants due to the failure during evacuation and property damage.

The method to collect the data mentioned in Chapter 3 are through giving questionnaires, interview and walkthrough observation. The results show the level of awareness regarding fire safety evacuation among building occupant is moderate because based on discussion in Chapter 4; the average mean score for level of

knowledge on fire safety evacuation is 3.41. However, this issue need to be considered because obstructions at the evacuation pathway still exist. Therefore, a drastic action should be taken to reduce over crowded of merchandise condition in the pathways.

Next, the fire protection systems in this shopping mall are not adequately installed because the exit sign indicating the direction is not properly provided. The fire extinguisher is installed in the mall but cannot be found easily by building occupants. It was confirmed by walkthrough observation during the assessment. The management also did not prevent the extension of merchandise out of the store. These are very crucial for fire safety control mechanisms in reducing fire incident and increasing the speed to egress out the shopping mall.

Training is one of the preventive measures that the building management can provide to the building occupants to accelerate the evacuation time out of the building. However, it is not properly delivered to the building occupants so in order to increase the quick time to evacuate the building, building occupants must be exposed to fire drill, training, courses and many more.

By referring to Chapter 1, the hypothesis stated, that management does not have knowledge and does not supervise about fire safety is accepted. This has been supported from the research showing that most of the respondents agree in Table 4.8. The second hypothesis or expected outcome regarding the level of knowledge among building occupant was low. However, through the research, this outcome was not supported due to respondents' result that is actually moderate and not low. The last expected outcome related to fire safety preventive and protection measure is not adequate at the shopping mall is accepted due to the data that support this statement.

REFERENCES

Ahn, C. (2016). An Analysis of Evacuation under Fire Situation in Complex Shopping Center Using Evacuation Simulation Modeling. *Procedia - Social and Behavioral Sciences*, *218*, 24–34. https://doi.org/10.1016/j.sbspro.2016.04.007

Angeles, C. O. F. L. O. S. (2007). DESIGN STANDARDS AND GUIDELINES, (May).

Available online at www.sciencedirect.com. (2014), *71*, 22–27. https://doi.org/10.1016/j.proeng.2014.04.004

Evacuation Time and Movement in Apartment Buildings * Guyl ne Proulx. (1995), *24*, 229–246.

Galea, E. R., Xie, H., Deere, S., Cooney, D., & Filippidis, L. (2017). Evaluating the effectiveness of an improved active dynamic signage system using full scale evacuation trials. *Fire Safety Journal*, (February), 1–10. https://doi.org/10.1016/j.firesaf.2017.03.022

Jin, H., Li, X., Kang, J., & Kong, Z. (2017). An evaluation of the lighting environment in the public space of shopping centres. *Building and Environment*, *115*, 228–235. https://doi.org/10.1016/j.buildenv.2017.01.008

Khalili, A. (2004). Gender Differences in Emotional Intelligence Among Employees of Small and Medium Enterprise : An Empirical Study, (1998).

Knuth, D., Kehl, D., Hulse, L., & Schmidt, S. (2013). Perievent distress during fi res e The impact of perceived emergency knowledge. *Journal of Environmental Psychology*, *34*, 10–17. https://doi.org/10.1016/j.jenvp.2012.12.002

Kobes, M., Helsloot, I., Vries, B. De, & Post, J. G. (2010). Building safety and human behaviour in fire : A literature review. *Fire Safety Journal*, *45*(1), 1–11. https://doi.org/10.1016/j.firesaf.2009.08.005

Kuligowski, E. D., & Mileti, D. S. (2009). Modeling pre-evacuation delay by occupants in World Trade Center Towers 1 and 2 on September 11, 2001. *Fire Safety Journal*, *44*(4), 487–496. https://doi.org/10.1016/j.firesaf.2008.10.001

Maluk, C., Woodrow, M., & Torero, J. L. (2017). The potential of integrating fire safety in modern building design. *Fire Safety Journal*, *88*(October 2016), 104–112. https://doi.org/10.1016/j.firesaf.2016.12.006

Massart, T. (2016). Footway Evaluation. *Transportation Research Procedia*, *14*, 2449–2457. https://doi.org/10.1016/j.trpro.2016.05.295

Mohd Najib Ghafar. (2007). Personal Digital Assistant),.

Morgan, D. W., & Krejcie, R. V. (1970). Determining Sample Size for Research Activities. *Educational and Psychological Measurement*, *30*, 607–610. https://doi.org/10.1177/001316447003000308

Nimlyat, P. S., Audu, A. U., Ola-adisa, E. O., & Gwatau, D. (2017). An evaluation of fire safety measures in high-rise buildings in Nigeria. *Sustainable Cities and Society*, *35*(August), 774–785. https://doi.org/10.1016/j.scs.2017.08.035

Pauls, J. (1987). Calculating evacuation times for tall buildings. *Fire Safety Journal*, *12*(3), 213–236. https://doi.org/10.1016/0379-7112(87)90007-5

Protection, F., Systems, D. S., & Telephone, A. (1981). 14) 249-260, *3*(3), 249–260.

Pu, S., & Zlatanova, S. (2005). Evacuation Route Calculation of Inner Buildings. In P. van Oosterom, S. Zlatanova, & E. M. Fendel (Eds.), *Geo-information for Disaster Management* (pp. 1143–1161). Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/3-540-27468-5_79

Qian-li, M., & Ting-lin, H. (2011). Analysis of and Study on the Difficulties in the Fire Protection Design of Large Commercial Complex. *Procedia Engineering*, *11*, 302–307. https://doi.org/10.1016/j.proeng.2011.04.661

Qu, Y., Gao, Z., Xiao, Y., & Li, X. (2014). Modeling the pedestrian ' s movement and simulating evacuation dynamics on stairs. *Safety Science*, *70*, 189–201. https://doi.org/10.1016/j.ssci.2014.05.016

Rahman, O., Kwong-Kay Wong, K., & Yu, H. (2016). The effects of mall personality and fashion orientation on shopping value and mall patronage intension. *Journal of Retailing and Consumer Services*, *28*, 155–164. https://doi.org/10.1016/j.jretconser.2015.09.008

Rodrigues, E. E. C., Rodrigues, J. P. C., & da Silva Filho, L. C. P. (2017). Comparative study of building fire safety regulations in different Brazilian states. *Journal of Building Engineering*, *10*(March), 102–108. https://doi.org/10.1016/j.jobe.2017.03.001

Rozelle, S. (2002). Chapter 4, *1*(Nsbc 2010), 22–86.

Sagun, A., Anumba, C., & Bouchlaghem, D. (2013). Designing Buildings to Cope with Emergencies: Findings from Case Studies on Exit Preferences. *Buildings*, *3*(2), 442–461. https://doi.org/10.3390/buildings3020442

Tancogne-Dejean, M., & Laclémence, P. (2016). Fire risk perception and building evacuation by vulnerable persons: Points of view of laypersons, fire victims and experts. *Fire Safety Journal*, *80*, 9–19. https://doi.org/10.1016/j.firesaf.2015.11.009

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach ' s alpha, 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

The, G. (2013). Chapter 2 MEANS OF ESCAPE intentions for determining the design , construction , protection , location , arrangement and maintenance of exit facilities to provide erected , altered or changed in occupancy ., (c).

Viechtbauer, W., Smits, L., Kotz, D., Bud, L., & Spigt, M. (2015). A simple formula for the calculation of sample size in pilot studies, *68*, 1375–1379. https://doi.org/10.1016/j.jclinepi.2015.04.014

Yeturu, S. K., Annapurani, R., Janakiram, C., Joseph, J., & Pentapati, K. C. (2016). Assessment of Knowledge and Attitudes of Fire Safety – An Institution Based Study, *8*(11), 1281–1284.

Zhang, L., Liu, M., Wu, X., & AbouRizk, S. M. (2016). Simulation-based route planning for pedestrian evacuation in metro stations: A case study. *Automation in Construction*, *71*(Part 2), 430–442. https://doi.org/10.1016/j.autcon.2016.08.031

Seng Kong Shutter Industries. (n.d.). Retrieved Sunday December, 2017, from http://www.sk-shutter.com/2010/06/sk-fire-resistant-roller-shutter.html

UBBL. (1984). Uniform Building By Laws.

Idris, M. F. (1997). *The Development Of A Fire Safety Evaluation Procedure For the Educational Establishment.* Edinburgh: Department of Civil and Environmental Engineering The University of Edinburgh.

APPENDIX A
GANTT CHART OF FINAL YEAR PROJECT I & II

Activities	SEMESTER 2 2016/2017					SEMESTER 1 2017/2018					
	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
Brainstorming											
Preparing Research Proposal											
Submission of Research Proposal											
Presentation of Research Proposal											
Data Collection											
Preparation for PSM II and Research											
Data Analysis											
Preparation of Thesis											
Submission of Report											
Final presentation											

APPENDIX B
QUESTIONNAIRE

FIRE EVACUATION QUESTIONNAIRE

Sila lengkapkan soalan-soalan berikut untuk melontarkan pendapat anda dengan tepat dan untuk menjawab soalan fakta sepanjang pengetahuan anda.

* Required

A. MAKLUMAT UMUM

1. 1.1 Umur *
   Check all that apply.
   - [ ] Bawah 18
   - [ ] Antara 18-30
   - [ ] Lebih 30
   - [ ] Other: _____

2. 1.2 Jantina * *Check all that apply.*
   - [ ] Lelaki
   - [ ] Perempuan
   - [ ] Other: _____

3. 1.3 Pendidikan *
   Check all that apply.
   - [ ] SPM
   - [ ] STPM
   - [ ] Matrikulasi/Asasi
   - [ ] Diploma
   - [ ] Ijazah
   - [ ] Master
   - [ ] PhD
   - [ ] Other: _____

4. 1.5 .Adakah anda menggunakan lebih dari satu LOKASI di dalam bangunan ini? *
   Check all that apply.
   - [ ] Ya
   - [ ] Tidak
   - [ ] Other: _____

B. KESEDARAN PROSEDUR PEMINDAHAN SEWAKTU KECEMASAN

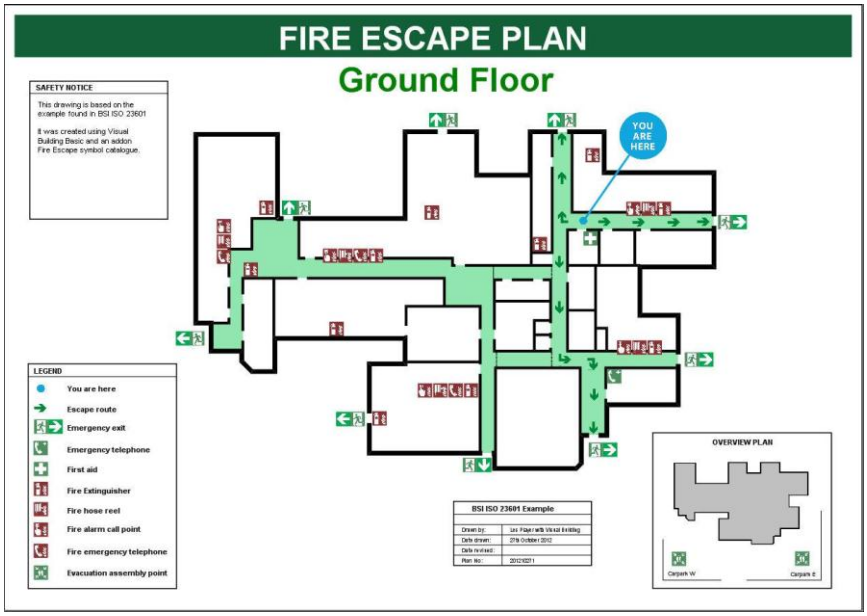
5. B.1 Anda sedar tentang prosedur pemindahan kecemasan yang beroperasi di pusat membeli-belah *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

6. B.2 Anda memahami prosedur kecemasan yang beroperasi dalam pusat membeli-belah *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

Contoh Pelan Keselematan Kebakaran



7. B.3 Prosedur kecemasan yang ditulis membantu *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

8. B.4 Prosedur kecemasan yang ditulis dalam cetakan besar akan lebih jelas untuk dilihat dan berguna *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

9. B.5 Anda tahu tahap keselamatan anda di pusat membeli-belah ini *
   Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

10. B.6 Anda tahu fungsi dan maksud signage di dalam pusat membeli-belah *
    Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

Contoh "Signange"

11. B.7 Anda tahu menggunakan alat pemadam api *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

12. B.8 Anda tahu di mana perlu berkumpul sewaktu kecemasan *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

13. B.9 Adakah anda pernah menghadiri latihan kebakaran / latihan api? *

Mark only one oval.

- ◯ Tidak
- ◯ Jika ya, bagaimana anda menerima latihan kecemasan api?
- ◯ Tahu beberapa pengetahuan yang berkaitan api dalam kehidupan harian
- ◯ kita Risalah atau panduan
- ◯ Video
- ◯ Seminar atau pembentangan
- ◯ Latihan pemindahan / latihan amalan
- ◯ Lain-lain

14. B.10 Apa yang diperlukan untuk menjamin keselamatan anda dalam pusat membeli-belah? *

Mark only one oval.

- Plan dimana anda berada
- Arahan /disoal selidik oleh pengawal
- Scanner

15. B.11 Apabila anda mendengar penggera pemindahan anda mesti... *

Mark only one oval.

- Berhenti untuk mendapatkan barang-barang anda
- Menanti arahan lanjut
- Segera berpindah ke lokasi berkumpul sewaktu kecemasan

16. B.12 Program'' berkenaan dengan 'fire safety' di dalam mall ini perlu diadakan *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju						Sangat setuju

C. DALAM KES KECEMASAN

17. C.1 Anda rasa anda boleh keluar dari bangunan ini secepat mungkin *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju						Sangat setuju

18. C.2 Anda rasa laluan keluar anda dari bangunan ini lancar tanpa sebarang halangan *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju						Sangat setuju

19. C.3 Anda tahu laluan keluar dari bangunan *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju						Sangat setuju

20. C.4 Anda ikut signage ketika keluar dari bangunan *

Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju						Sangat setuju

21. C.5 Dengan adanya penambahan kedai dan kiosk di dalam bangunan ini, anda rasa proses pemindahan anda dari bangunan ini menjadi lebih sukar *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

22. C.6 Anda rasa laluan untuk Orang Kelainan Upaya (OKU) terutamanya yang menggunakan kerusi roda, akan menghadapi kesukaran untuk bergerak keluar dari bangunan apabila laluan keluar menjadi sempit *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

23. C.7 Laluan tangga sempit *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

24. C.8 Pencahayaan di dalam bangunan ini mencukupi *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

25. C.9 Anda memilih untuk menggunakan tangga atau lif? *
Check all that apply.

- [ ] Tangga
- [ ] Lif
- [ ] Other: _____

26. C.10 Bagaimana anda menjumpai tangga/lif keluar yang anda gunakan untuk keluar dari bangunan ini? *
Check all that apply.

- [ ] Saya ikut orang lain
- [ ] Saya mengikut tanda KELUAR
- [ ] Saya tahu jalan keluar
- [ ] Saya telah diarahkan untuk menggunakan jalan keluar ini
- [ ] Saya gunakan laluan masuk ke bangunan ini untuk keluar
- [ ] Other: _____

27. C.11 Bagaimanakah anda pilih jalan keluar? *
Check all that apply.

- [ ] Mengikut arah aliran
- [ ] Mengikut jalan yang asal untuk kembali
- [ ] Pilih jalan keluar selamat yang terdekat
- [ ] Elakkan jalan keluar selamat yang terdekat
- [ ] Other: _____

MAKLUMAT TAMBAHAN MENGENAI LALUAN EVAKUASI

28. D.1 Anda tahu kedai anda boleh mengganggu laluan pemindahan semasa kecemasan *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

29. D.2 Hiasan di kedai anda mengganggu/menutup signage di pusat membeli belah *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

30. D.3 Pemilik/pembangunan bangunan memaklumkan anda tentang rancangan pemindahan api *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

31. D.4 Pihak pengurusan bangunan telah menghalang dan akan kembali dan kenakan tindakan jika peniaga masih letakkan barang jualan di luar kedai *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

32. D.5 Barang di kedai anda menghalang pencahayaan di dalam bangunan *
Mark only one oval.

	1	2	3	4	5	
Sangat tidak setuju	◯	◯	◯	◯	◯	Sangat setuju

33. D.6 Strategi pemasaran : Meletakkan barang perniagaan luar dari kedai sehingga mengganggu laluan awam di dalam bangunan adalah untuk *
Check all that apply.

- [ ] Supaya pembeli kenal pasti
- [ ] Tarik pelanggan
- [ ] Meningkatkan keuntungan
- [ ] Other: _____

34. D.7 Adakah anda tahu bahawa penambahan tersebut telah... *
Check all that apply.

- [ ] Sempitkan laluan umum
- [ ] Halang laluan semasa kecemasan
- [ ] Tutup signage/alat pemadam api
- [ ] Other: _____