5.0 Fire Protection System

5.1 Introduction

Fire protection is a main concern in every building to ensure the safety of the building and prevent the unwanted effects of potentially destructive fires, protecting human lives and minimize the loss when incident occur. The Summit USJ mall is constructed and maintained accordance to the building code and local fire code. The implementation of the fire protection system in the mall is strictly monitored and obeyed under law enforcer and local law. Both active and passive fire protection system is used in the Summit USJ mall.

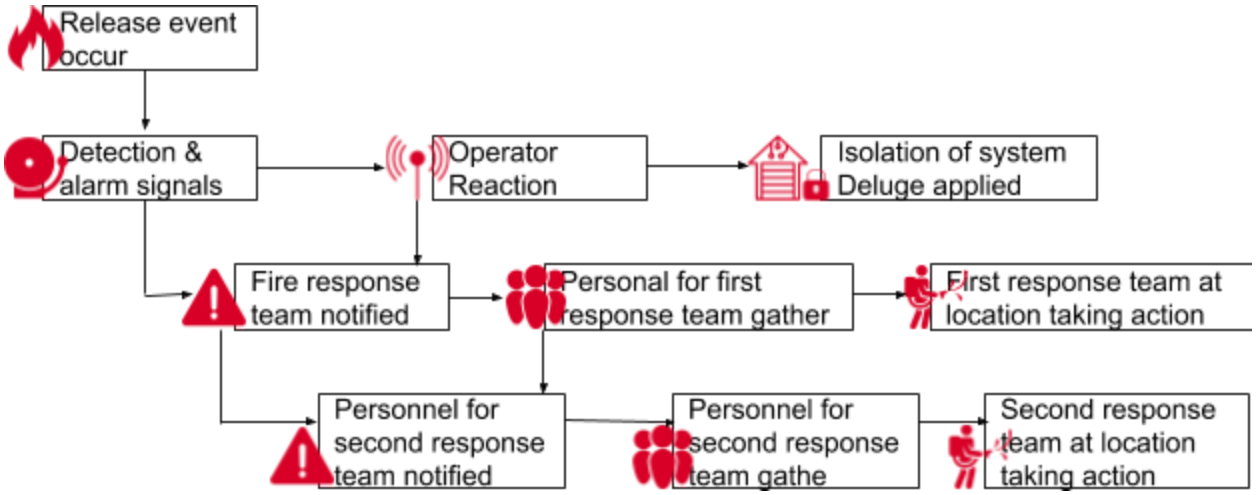


Diagram 5.1 *Explanation diagram of fire protection system inside a building*

5.2 Active Fire Protection

Active fire protection (AFP) is an integral part of fire protection system and required a certain amount of motion and response in order to operate. It is a combination of alarm system, smoke control system and the fireman intercom system in automated or manual way of operating system. The water-based system includes hose reel, wet riser, water sprinkler system, etc. The non water-based system includes sprinkler system using foam or chemical compound which prolong the fire spreading time. Besides, manpower is needed for the operation of manual active fire protection such as fire extinguishers. Fire alarm systems and smoke control system is crucial for a building in order to send signals for warning occupants in the building.

The active fire protection can be classified into 3 categories. First is water-based system, second is non water-based system and last is alarm and detection system and devices. The components of these three systems are stated below.

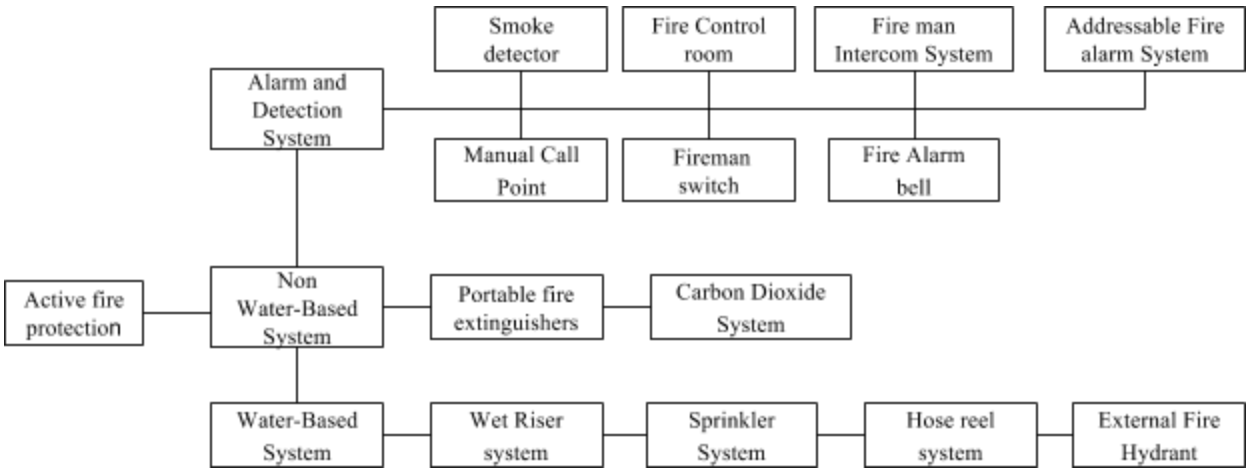


Diagram 5.2 *Summary of Active Fire Protection (AFP)*

5.2.1 Alarm and Detection System

Fire alarm and detection systems are automated electronic systems which automatically detect any possible fire incident and notify building occupants to take evasive action to escape the dangers of a hostile fire by sound the alarm. Moreover, it also served to inform the fire control operator to summon organized assistance to initiate or assist in fire control activities upon the fire incident. Usually, the detection of the fire is by sensing smoke and heat using integrated sensors. Types of alarm and detection system and devices which found in Summit USJ mall includes:

5.2.1.1 Smoke and Heat Detectors

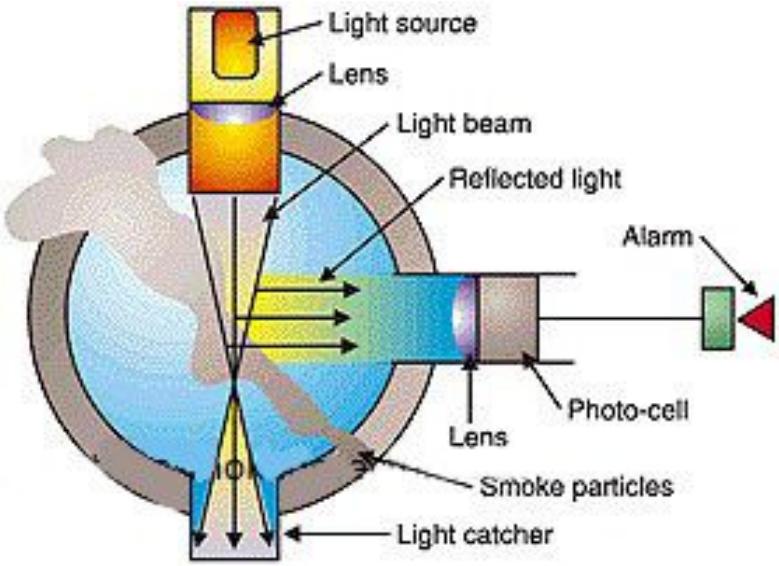
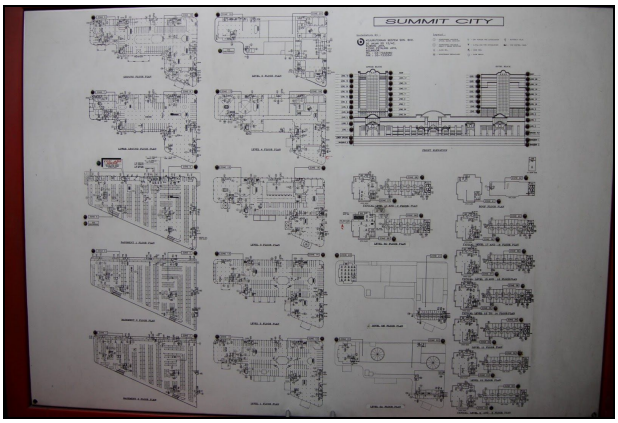


Diagram 5.3 *Photoelectric smoke detector used in Summit USJ (Left), Detection process (Right)*

Detectors with combined function that can detect both smoke and heat can be found in lift lobby, mechanical rooms and electric rooms of Summit USJ. The type of the detector used in the mall is photoelectric smoke detector . Its uses the light source to detect smoke. Under the normal circumstances the Infra-Red lens that shoots a light beam down to the light catcher chamber. When smoke is present in the room, it enters the optical chamber, the vertical light beam is interrupted and dispersed in all direction where reflected lights will then trigger the sensor and activate the alarm.

Uniform Building By-Laws 1984	Analysis
Section 153(1): **<u>Smoke detectors</u>** Smoke detectors for lobbies. All lift lobbies shall be provided with smoke detectors.	The Summit USJ Mall has fulfilled the requirement where photoelectric smoke detectors are made compulsory to be installed at all lift halls.

5.2.1.2 Fire control room



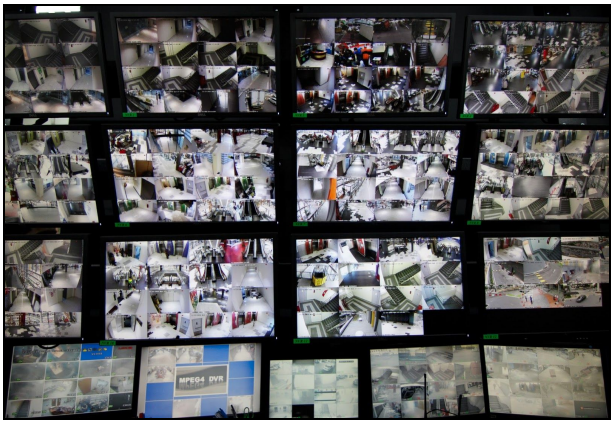


Diagram 5.4 and 5.5 *Fire indicator for each floor of Summit USJ mall, CCTV monitoring screen to observe the condition*

Fire control room of Summit Mall is located at basement one carpark. It function as **monitoring conditions, receiving signals, displaying actual situations and processing fire alarms.** Fire control room operates 24 hours by two security guards, one at a time, where their shift is interchangeable in order to monitor the system. When the control unit receives signals sent from the alarm system, the operator will immediately make decisions and take action according to the situation. If a fire incident is confirmed, digital alarm communication system will automatically send signals generated by the fire alarm to the nearest fire station.

Uniform Building By-Laws 1984	Analysis
Section 238: **<u>Command and control centre</u>** Every large premises or building exceeding 30.5 metres in height shall be provided with a command and control centre located on the designated floor and shall contain a panel to monitor the public address, fire brigade communication, sprinkler, waterflow	A control room is located at the basement car park of Summit Mall with all required systems.

detectors, fire detection and alarm systems and with a direct telephone connection to the appropriate fire station by-passing the switchboard.	

5.2.1.3 Fire Alarm System

An addressable fire alarm system is made up of a series of fire detectors and devices that are connected back to a central control panel. With addressable systems, each device has an address or location, enabling the exact detector that was triggered to be quickly identified. This makes addressable alarm systems ideal for large buildings, particularly commercial premises spread over a wide area. The Summit USJ Mall used the **addressable fire alarm** system due to its accuracy and reliable. Addressable fire alarm system consists of 3 components which are **manual call point, alarm bell and fireman's switch** and is designed to be attached on the wall at every lift lobbies and stairwell exits.

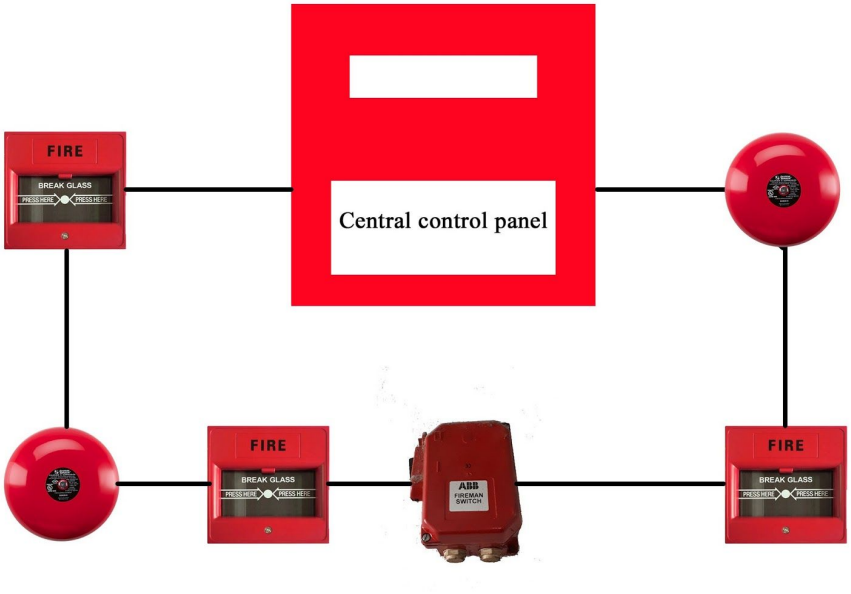


Diagram 5.6 *Above are addressable fire alarm system diagram.*

5.2.1.4 Manual Call Point

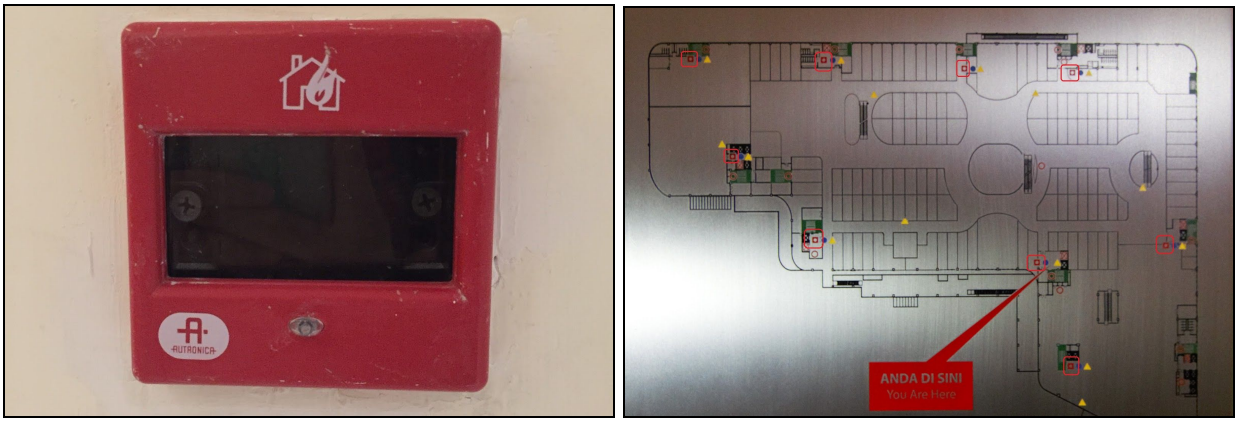


Diagram 5.7 and 5.8 *Manual call point (left), Location of manual call point (right)*

In emergency situation the manual call points serves the purpose of **raising awareness of public** by breaking the glass manually, it will trigger the alarm. There are a total of 9 manual call points for each floor, which are located at the same place in the lift lobby, each manual call point is installed on the wall at 1.4 metres high above the finished floor level to ensure it can be noticed easily and reachable.

Uniform Building By-Laws 1984	Analysis
Section 155 (1): **<u>Fire mode of operation</u>** The fire mode of operation shall be initiated by a signal from the fire panel which may be activated automatically by one of the alarm devices in the building or manually.	Manual call points are provided for the occupants to activate the fire alarm system manually during a fire or emergency case.

5.2.1.5 Alarm Bell

Diagram 5.9 *Alarm bell with a siren light installed.*

Alarm bell serves the function to alert the occupants by ringing constantly when it is activated. **Activation of alarm** bell can be **achieved by the manual call point, heat and smoke detector or fire control room**. In Summit Mall, there are 9 alarm bells which is located at lift lobbies. Alarm bells are also connected with a siren light which will light up when the alarm is activated.

Uniform Building By-Laws 1984	Analysis
Section 241: **<u>Special requirements for fire alarm systems</u>** In places where there are deaf persons and in places where by nature of the occupancy audible alarm is undesirable, visible indicator alarm signals shall be incorporated in addition to the normal alarm system.	Manual call points are provided for the occupants to activate the fire alarm system manually during a fire or emergency case.

5.2.1.6 Fireman's Switch

Diagram 5.10 *Fireman's Switch of Summit USJ*

The fireman switch is a **switch-disconnector/ isolator** for special applications. These switches is found at the corridor and stairway at every level in Summit USJ Mall. They are designed for easy to spot and are **used by firemen to detach the high voltage current** from the electrical supply or other **hazardous electrical equipment** in case of fire.

5.2.1.7 Fireman Intercom Station

Diagram 5.11 and 5.12 *Emergency phone (Left) and Intercom Station (Right)*

Fireman intercom system in Summit USJ mall is an alternating communication system during emergency which allows communication and giving instruction through the intercom handset station installed on every emergency exits and the main intercom handset in the fire control room. The intercom handset stations are located at emergency staircase at every level in Summit Mall.

5.2.2 Non Water-Based System

Sometimes, water is not the best way in active fire protection system. In certain cases, non water-based system is safer to use during an emergency such as fire incident in an electrical room. The non water-based system consists of carbon dioxide system and dry chemical agents. It is normally triggered by an electrical fire system and release of the gas agents rapidly to occupied the space in the air, push away the oxygen inside the space to lower down the oxygen level and extinguish the fire. The selection of gas agent is depending on the application, the level of risk and life safety factors. The Summit USJ mall used the carbon dioxide system for electrical room and motor room and ABC fire extinguishers.

5.2.2.1 Portable Fire Extinguisher

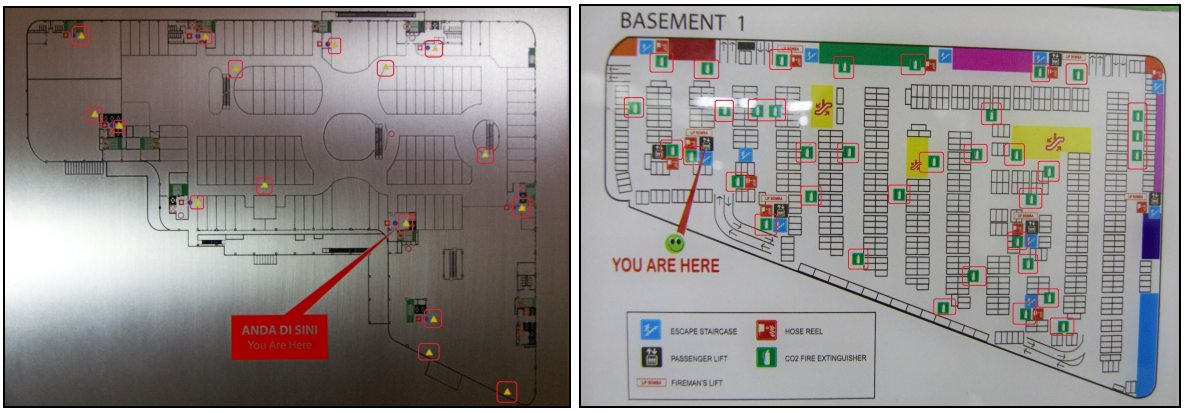


Diagram 5.13 and 5.14 *Location of fire extinguishers.*

Diagram 5.15, 5.16 and 5.17 *Container of extinguisher (Left), Extinguisher (Middle), Components of extinguisher (Right)*

Portable fire extinguisher is meant for extinguish fires caught in small areas but not for major fire incident. A standard fire extinguisher consists of a hand-held cylindrical pressure vessel containing an fire extinguishing agent which will be discharged to extinguish fire. There are two types of fire extinguishers used in Summit Mall which are ABC dry powder and carbon dioxide fire extinguisher. ABC dry powder fire extinguishers are located in both lift lobbies and inside the mall while carbon dioxide fire extinguishers are situated at the basement carpark and both electricity and machinery rooms. In Summit Mall, license of every fire extinguishers will be renewed once a year.

Classification and Use of Fire Extinguishers

The Summit USJ mall used dry chemical fire extinguishers. All the fire extinguishers used in Summit USJ mall are dry chemical fire extinguishers which is effective on Class A, B and C fires.

Class A Solid matters forming glowing reside. Wood, paper, textile, cloth, rubber, plastic etc.

Class B Flammable liquid fires. These can be fires where cooking liquids, oil, gasoline, kerosene, or paint have become ignited.

Class C Fire extinguishers with a Class C rating are suitable for fires in "live" electrical equipment. Computers and electricity apparatus can be found in the computer lab of elderly centre.

Uniform Building By-Laws 1984	Analysis
Fire Appliance Access **Section 140:** (1) All building in excess of 7000 cubic meter shall attach to access road or open area not less than 12 meters width and accessible to fire brigade appliances.	The access road to Summit Mall is more than 12 meters width which allows the accessibility of fire brigade appliances.

5.2.2.2 CO^2 Fire Suppression System

Diagram 5.18 and 5.19 *Carbon dioxide tanks connected to the system*

In area that is extremely sensitive or hazardous, water-based system is instead replaced with another system, and in Summit USJ, carbon dioxide system. Areas in Summit USJ that uses CO^2 fire suppression system includes:

- Cooler room
- Server room
- Electrical room
- AHU room

These spaces are occupied by machineries that are highly sensitive to water and cannot come into contact with them as they are running with high voltage of electricity and are not water sealed or water proof. That is why using water sprinkler as fire protection is not an option. Water are substituted by carbon dioxide gas, these gases are then compress to become liquid form and later stored into several tanks. The CO^2 gas is released when the smoke or heat detector is activated in those particular rooms or chamber. the CO^2 gas cools down the room temperature resulting in the flame being weaken and eventually dies out. Fire can't burn in a cool temperate room, this is an optimum way to extinguish the fire.

5.2.3 Water-Based System

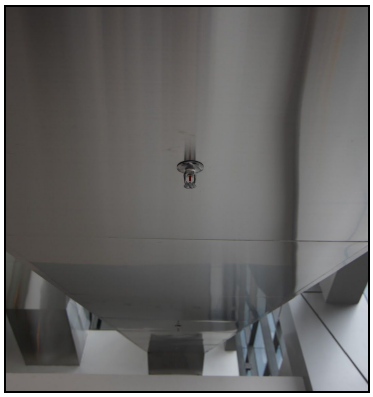
Water is the most commonly used fire extinguishing agents due to its natural properties that against the fire not only that it is also cost cheaper compare to other type of fire extinguishing agent. Besides, It also control the smoke spreading rate which helps to lengthen the escaping time for the occupants from the fire incident. There are four types of water based system that found in the Summit USJ mall which is wet riser system, automatic sprinkler system, hose reel system, and external fire hydrant.

5.2.3.1 Sprinkler Pump Room


Diagram 5.20 and 5.21 *Pump and tank (Left), Control panel (Right)*

The sprinkler pump room serves as the main control room for the water sprinkler system. It consists of switches for water pumps, water tank for the sprinkler water supply, and also water pumps. The sprinkler pump room will transmit pressurised water to the water sprinkler system at a predetermined pressure.

5.2.3.2 Water Sprinkler System



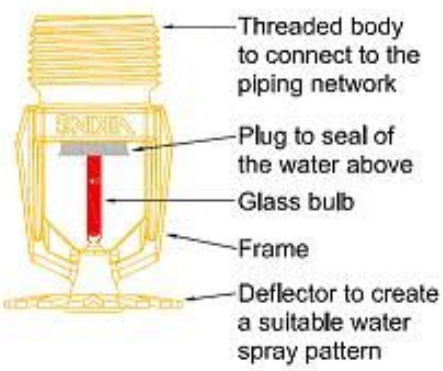


Diagram 5.22, 5.23 and 5.24 *Pendent Sprinkler (Right), Upright Sprinkler (Middle), Components (Left)*

The water sprinkler system in Summit USJ is connected to a sprinkler pump system that draws water from the water tank in Summit USJ. The mall uses **Wet Pipe Systems,** The sprinkler is activated when the heat-sensible bulb burst due to the expansion of its inner liquid due to absorption of heat. When activated, the sprinkler sprays water onto a 3m x 3m area beneath it, which helps slow down the spread of fire or even douse fire. In case of pump system failure, a breeching inlet located on the exterior wall of the mall can be connected to a closeby fire hydrant to supply water to the sprinklers.

5.2.3.3 Jockey Pump

Diagram 5.25 *Jockey Pump*

Jockey pump controlled specific pressure in sprinkler pipes and is connected to the water tanks. The function is to ensure the pressurized water is constantly provided to the sprinkler system risers while there is a pressure drop. Besides that, it also prevents the damage of sprinkler pipes due to a sudden change in water pressure when the fire pump is activated. If water sprinkler system works normally without any malfunction, the jockey pump does not have to be operated frequently, but always on standby.

5.2.3.4 Duty Pump

Diagram 5.26 *Duty Pump*

Duty pump is used to generate pressure to allow continuous water pumping process. It will also supply the pressurized water to office tower of Summit Mall if there are insufficient water supply.

5.2.3.5 Sprinkler Alarm Valve

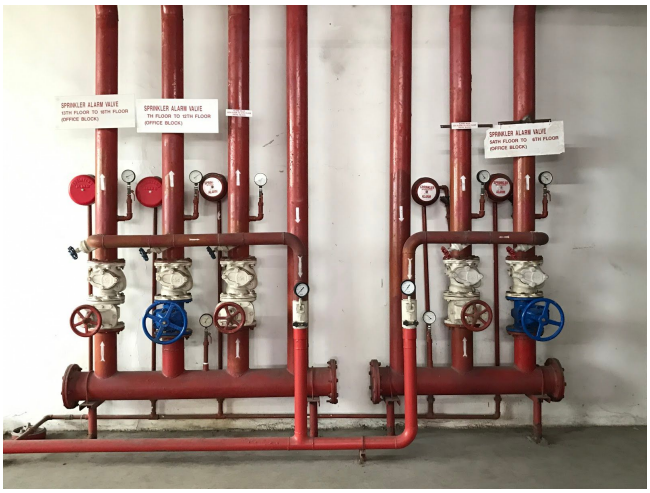


Diagram 5.27 *Sprinkler Alarm Valve*

The sprinkler alarm valve is located at the basement car park of the Summit USJ Mall. The alarm valve control the water supply and the cleaning process in the sprinkler pipe. The valve will be switched off when the water pressure achieved the required water supply pressure. When the water pressure inside the sprinkler pipes decreases, the valve is activated again to adjust the pressure to return to its optimum. The maintenance for the sprinkler pipe is carried out once every three months where water in the pipes are discharged thoroughly and filled back again.

Uniform Building By-Laws 1984	Analysis
Section 228: **<u>Sprinkler valves (2):</u>** All sprinkler systems shall be electricity connected to the nearest fire station to provide immediate and automatic relay of alarm when activated.	The alarm valve controls the flow of water into the fire sprinkler system. When a fire sprinkler is activated due to a fire, the alarm valve will open, water will flow through the system, and an alarm will sound.

5.2.3.6 Wet Riser

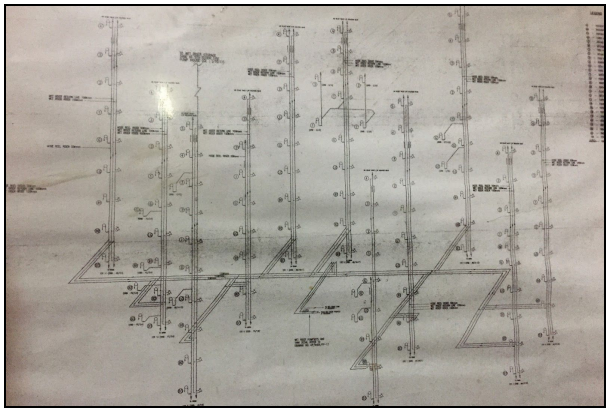


Diagram 5.28 and 5.29 *Riser Pipe (Left), Drawing of riser pipe system (Right)*

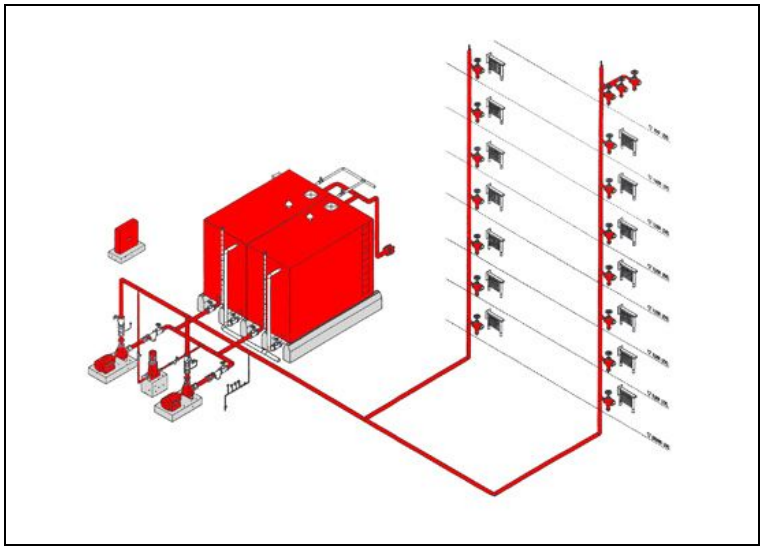
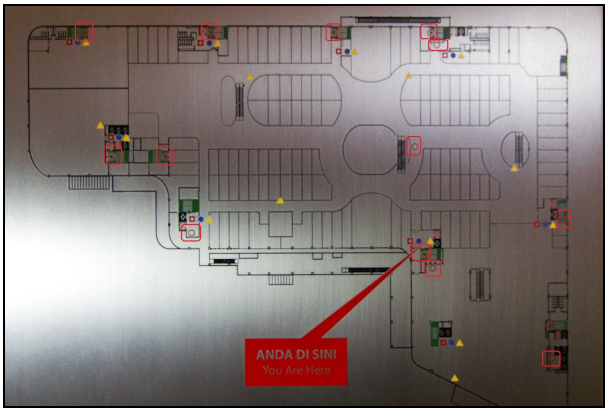


Diagram 5.30 *Illustration of a Wet Riser system*

Wet riser is a piping system which serves as an internal fire hydrant which draws water from the water tank dedicated to fire protection. Unlike its counterpart, the dry riser, wet riser is permanently charged with water, which allows immediate water flows upon activation of fire hose or sprinkler. The wet riser system is generally installed in building taller than 18 meters, which is fulfilled by The Summit USJ as it is a 5-storey building (not including basement).

5.2.3.7 Fire Hose Reel System



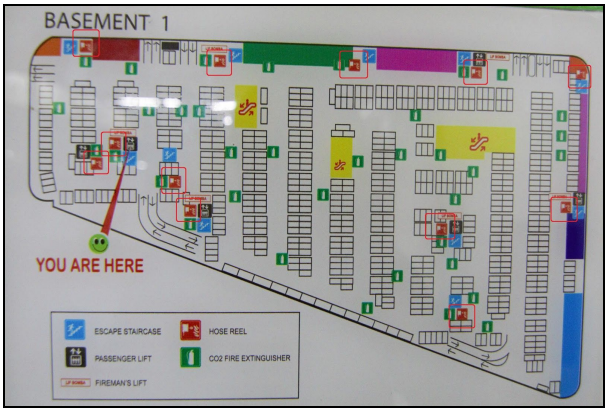


Diagram 5.31 and 5.32 *Location of Fire Hose Reel*

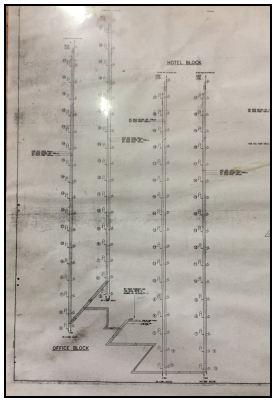


Diagram 5.33 and 5.34 *Fire Hose Reel (Left), Fire Hose Reel System drawing (Right)*

A fire hose reel serve as a fire fighting tool, it is a hose that carries high-pressured water to help fire brigade extinguish fire. Sometimes the hose carries some other fire retardant such as foam rather than water. When indoors, it is permanently attach to the building's standpipe or plumbing system. When it is outside of the building, it is use to attach either to a fire hydrant or a fire engine. When the fire hose reel system is activated, the hose goes under a pressure of 116 to 290 PSI(Pounds per Square Inch) units. In Summit USJ, the length of the fire hose is 30 meters with 19mm diameter. Fire hose reels in Summit USJ are located at every floor of lift lobbies, emergency staircases and in the mall itself. Each floor consists of 11 nos. of fire hose reel in the mall and 12 nos in the basement.

5.2.3.8 External Fire Hydrant

Based on the site analysis, there are four fire hydrants found on site, two located outside the Summit Mall and the Summit Hotel, and the other two are at the back of each building. Fire hydrant is the instant water supply which provides a powerful pressurised water to any point of the building once the hose is attached to the fire hydrant with the valve switched on.

Diagram 5.35 and 5.36 *External Fire Hydrants located outside the mall*

Uniform Building By-Laws 1984	Analysis
Section 225: **<u>Detecting and extinguishing fire</u>** (1) Every building shall be served by at least one fire hydrant located not more than 91.5 metres from the nearest point of fire brigade access.	All the fire hydrant located behind the Summit building and hotel, also as well as the assembly points where the hydrants are all accessible by the fire brigade. Each location of the fire hydrant provided sufficient clearance space for fire brigade to conduct their duty, as there are placed in an open space area.

(2) Depending on the size and location of the building and the provision of access for fire appliances, additional fire hydrant shall be provided as may be required by the Fire Authority.	Four fire hydrants is provided as required by the fire authority. Located at the four corners of the Summit Mall and Hotel in combined helps enlarge the radius of fire extinguish coverage.

5.3 Passive Fire Protection (PFP)

Passive fire protection (PFP) is an integral component of the three components of structural fire protection and fire safety in a building. PFP attempts to contain fires or slow the spread, through use of fire-resistant walls, floors, and doors (amongst other examples). PFP systems must comply with the associated listing and approval use and compliance in order to provide the effectiveness expected by building codes.

5.3.1 Emergency Evacuation Route

Diagram 5.37 and 5.38 *Signages indicating the direction of fire exit*

Diagram 5.39 and 5.40 *Informative floor plans are located on walls of lift lobbies.*

A floor plan with fire escape route can be found located in the lift lobbies in every floor of the building. The floor plan consist of important information such as the location of fire extinguishers, fire staircase and the closest fire assembly point. In addition to that, emergency escape signages are also placed strategically on walls to help guide occupants to the allocated safe zone in case of emergency.

Uniform Building By-Laws 1984	Analysis
Section 172: **<u>Emergency exit signs</u>** (1) A sign reading "Keluar" with an arrow indicating the direction shall be placed in every location where the direction of the travel to reach the nearest exit is not immediately apparent.	'Keluar' signs can be seen above every fire door on towards the exiting direction.
(2) Storey exits and access to such exits shall be marked by readily visible signs and shall not covered by any decorations, furnishings or other equipment.	Red signages can be seen on walls to indicate the direction of closest fire exit. In addition to that, the management team made sure that the signs are not obscured by anything.
(3) All exit signs shall be illuminated continuously during periods of occupancy.	Exit signs are to be lighten up for a better stimulation towards occupants eyesight, to help indicate more obviously of where the emergency exit is.
(4) Illuminated signs be provided with two electric lamps.	In case one of the lamps blow out or is malfunctioning, the other one still works and acts as a backup, so that part of the sign still illuminates.

5.3.2 Assembly Point

Diagram 5.41 *Highlighted area shows assembly point of Summit USJ*

An empty space in front of the mall has been allocated as a fire assembly point. It is an open ground used mainly for evacuating occupants. The safety requirement for the assembly point must be distanced from the building at a minimum of 30 meters or 100 feet.

Uniform Building By-Laws 1984	Analysis
Section 179: **<u>Classification of places of assembly</u>** Each place of assembly shall be classified according to its capacity as follows: Class A - Capacity: 1000 persons or more Class B - Capacity: 300 to 1000 persons Class C - Capacity: 100 to 300 persons	The Summit Mall's assembly point can house a total of 300 occupants, but they are using two class C assembly point. One located in front of the mall and the second is in front of the hotel.

Section 182: **<u>Rate of discharge</u>** The rate of travel per floor of persons shall be sixty persons per minute through doors or along level passageways and forty-five persons per minute down stairs.	The faster the rate of discharge, the lesser the casualties. The assembly point is an open air ground located directly outside of the main entrance of the mall, shortening the distance needed to travel from the building to the safe zone.

5.3.3 Fire Emergency Staircase

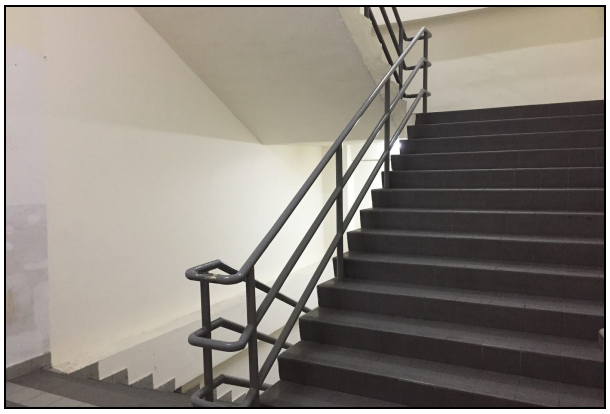


Diagram 5.42 *Fire emergency staircase*

Emergency staircases are required for high rises as mechanical transportations will not function during fire. In Summit USJ, a total of 12 emergency staircases can be found. The staircases are built wider than conventional staircases so it can fit more occupants while also reduce the risk of people falling and hurting themselves due to panic. The landings of the staircases are also fitted with proper lighting to ensure the safety of occupants. Furthermore, pressure fans are installed in every stairwell to prevent smokes from entering into the area, as it is important for the stairwell to stay smoke-free. To further make sure that the stairwell stays smoke-free, every entrance to the stairwell is fitted with fire retardant doors that are always kept closed.

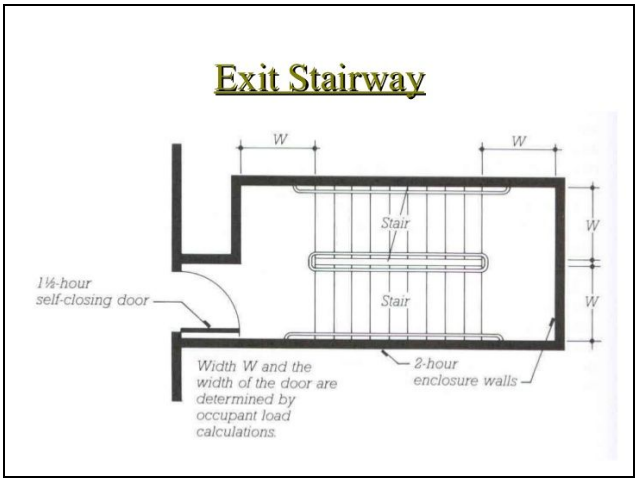
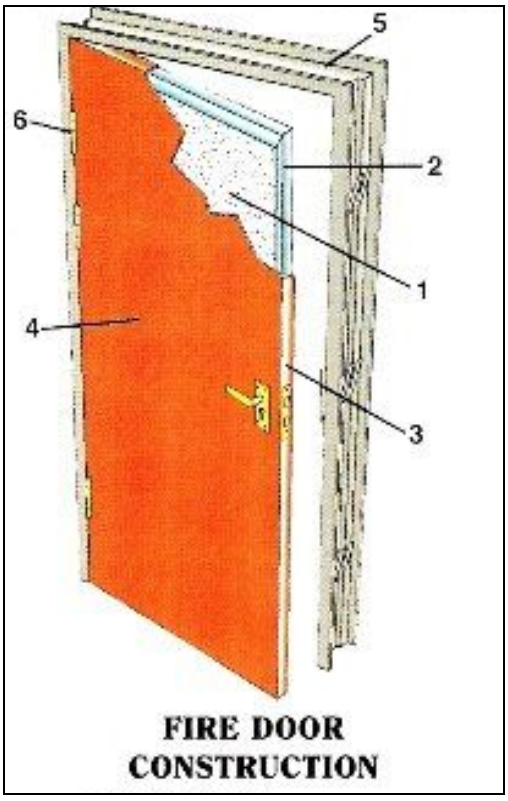


Diagram 5.43 *Floor plan of emergency staircases showing the radius of door opening does not interfere the flow of movement.*

Uniform Building By-Laws 1984	Analysis
Section 157 : **<u>Protected shaft consisting of staircase</u>** A protected staircase or a protected shaft containing a staircase shall not contain any pipe conveying gas or oil or any ventilating duct other than a duct serving only that staircase of shaft.	The emergency staircase in Summit USJ are made sure to have its own piping system throughout its entire shaft so that no smoke will be able to flow into the shaft during in event of fire.
Section 168: **<u>Staircases</u>** (1) Except as provided for in By-Law 194 every upper floor shall have means of egress via at least two separate staircase.	There are 12 staircases leading up to and every floors in the mall.
(2) The required width of a staircase shall be maintained throughout its length including at landings.	
(3) Doors giving access to staircases shall be so positioned that their swing shall at no point encroach on the required width of the staircases or landing.	The landings of the staircases are wide enough that opening the door/door clearance will not obstruct the path.

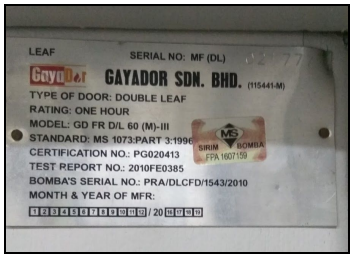
5.3.4 Fire Retardant Door

Diagram 5.45 *Fire door.*



< Diagram 5.44 *Composition of fire door*

1. Insulative core
2. Reinforcing core channel
3. Timber edging
4. Door finish
5. Mild steel frame
6. Hinges



< Diagram 5.46 *Steel plate with information of fire door.*

Fire retardant doors (or fire door for short) are specially made doors that can resist direct fire from damaging it for a certain amount of time, therefore slowing down the spread of fire and smoke. The time needed to fully burned through the door is determined by the fire-resistance rating and can be altered depending on the need. Inside the fire retardant door contains a layer of insulative core (gypsum board). Its non-combustible core contains roughly 21% chemically combined water, which under high heat, will slowly released out as steam. It effectively restraint the transfer of heat and the spread of fire. Even when the core is dried up from the released of water, gypsum board continues to serve as a heat-insulating barrier. Moreover, gypsum board has a low flame-spread index and a low smoke-density index. When installed in combination with other materials, gypsum board serves to effectively protect building elements from fire for a period of time.

Uniform Building By-Laws 1984	Analysis
Section 162: **<u>Fire doors in compartment walls and separating walls</u>**	
(1) Fire doors of the appropriate Fire-Rated Protection (FRP) shall be provided.	The fire doors in Summit USJ are designed to have FRP of an hour, with the information listed on the top-right of the door.
(2) Openings in partitions enclosing a protected corridor or lobby shall be protected by fire doors having FRP of half hour.	All doors used to in mall are fire doors therefore having FRP of an hour.
(3) Fire doors including framed will be constructed to be specification which can be shown to meet the requirements for the relevant FRP when tested in accordance with section 3 of BS 476:1951.	All fire doors and also frames in Summit USJ are constructed to specification and met the requirements.

5.3.5 Fireproof Structure Material

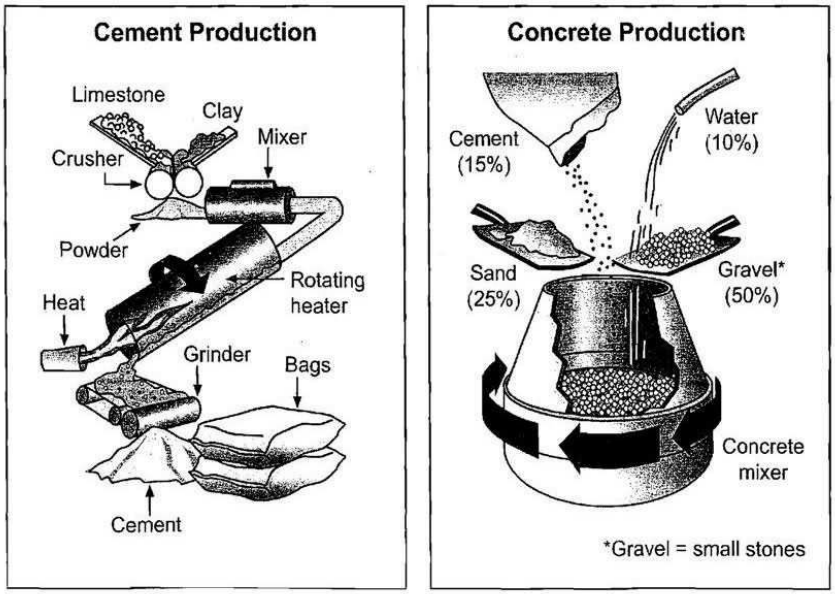


Diagram 5.47 *The composition of Cement and Concrete.*

The Summit USJ uses concrete as its main structural material, as concrete is known to have high degree of fire resistant. This is because concrete is made of cement which is a combination of limestone, clay and gypsum, added with aggregate materials, all of which are chemically inert and practically cannot be ignited. However, concrete can still be deformed if exposed to high heat over a long time, and thus, the time limit for evacuation activity is set to 6 hours.

Uniform Building By-Laws 1984	Analysis
Section 143: **<u>Beam or column</u>** Any beam or column forming part of, and any structure carrying, and external wall which is required to be constructed of noncombustible material shall comply with the provisions of paragraph (3) of by-law 142 as to non-combustibility.	The Summit USJ uses concrete as its structural material which is non-combustible.

Section 217: **<u>Fire resistance of structural member</u>** Any structural member or overloading wall shall have fire resistance of not less than the minimum period required by these By-laws for any element which it carries	Concrete structures used in Summit USJ can last approx. 6 hours before collapse, while the walls/floors it carries can only last approx. 1 hour.

5.3.6 Fire Brigade Access

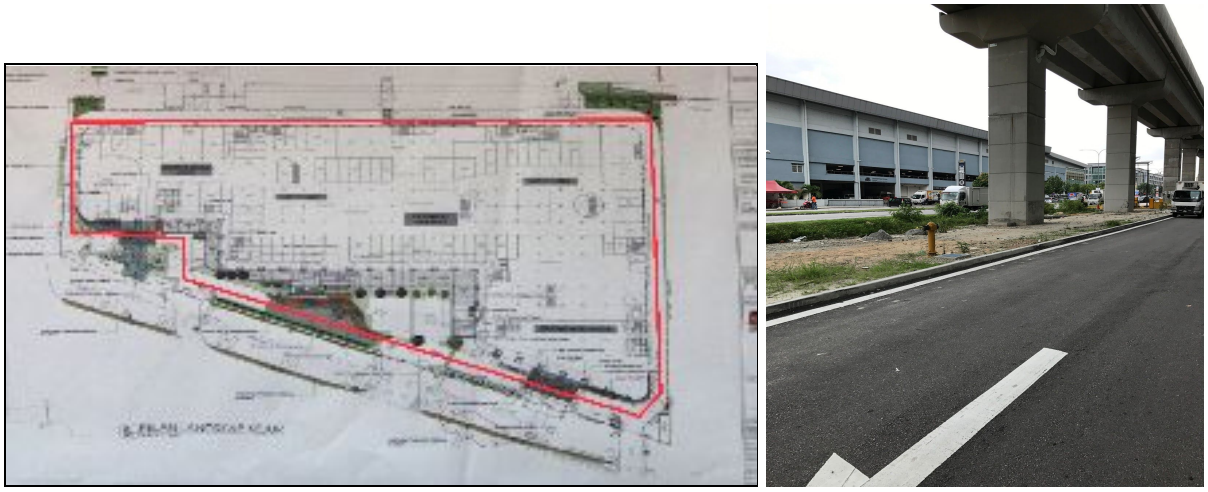


Diagram 5.48 and 5.49 *Plan indicating the fire brigade access (Left) and photo of the road (Right).*

Access for fire brigade appliances to the exterior of a building is necessary to enable high reach appliances, such as ladders and hydraulic platforms to be used and to enable pumping for fire fighting and rescue activities. Access requirements increase with the building size and height. According to the landscape plan of Summit Mall, the red line indicates the access road for the firemen and fire engines to enter the mall for emergency rescue operations.

Uniform Building By-Laws 1984	Analysis
Section 140: **<u>Fire appliance access</u>** All building in excess of 7000 cubic meter shall attach to access road or open area not less than 12 meters width and accessible to fire brigade appliances.	There is an access road built specifically for the fire authority around the mall which is more than 12 meters, fully equipped with external fire hydrants

5.3.7 Compartmentation

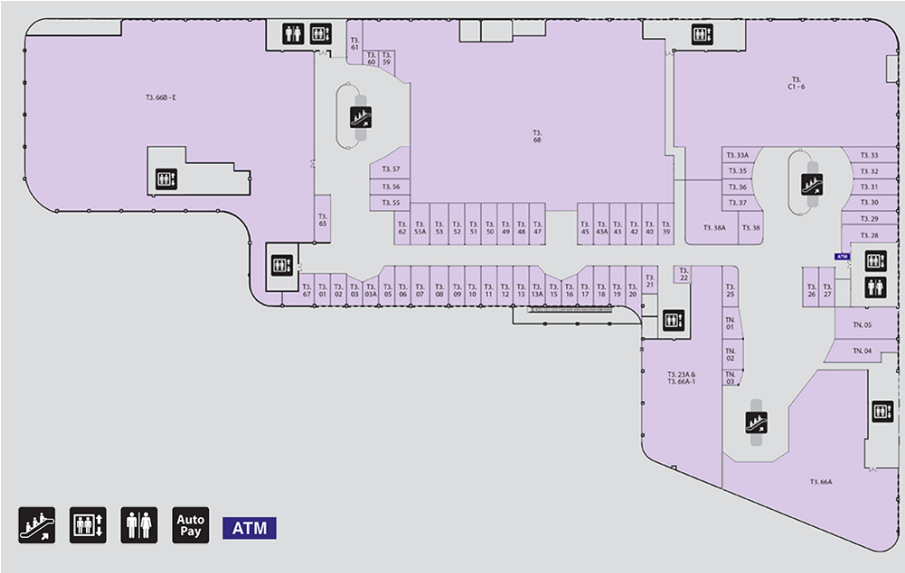


Diagram 5.50 *Plan showing compartmentation of the building*

Fire compartmentation is a vital part of any fire safety design, it limits the size of the fire, confining it to minimize the risk of loss of occupants. One of the compartmentation system is fire roller shutter door, it is an important component to have in passive fire protection. By installing fire roller shutter door, its function will further divide the building into several spaces and fully isolate each space in order to prevent the fire from spreading throughout the whole building.

Uniform Building By-Laws 1984	Analysis
Section 218: **<u>Compartment, Wall Separating and Maisonette</u>** Any compartment wall separating a flat or maisonette from any other part of the same building shall not be required to have fire resistance exceeding one hour unless	The emergency staircases are located in an entire different room, with a fire door as the entry point.

(a) the wall is a load-bearing wall or a wall forming part of a protected shaft; or (b) the part of the building from which the wall separates the flat or maisonette is of a different purpose group and the minimum period of fire resistance required by this Part for any element of structure in that part is one and a half hours or more.	Each shop unit in the mall is divided into several compartment with firewall and sealed by roller shutter.

5.3.8 Confinement

Diagram 5.51 *Roller shutter in the basement parking*

The fire roller shutters are a range of fire protection barriers that automatically operate in an emergency situation once a signal is received from a fire alarm system. The fire roller shutter has 1-4 hours of fire rating protection. Made from Galvanised steel standard and polyester powder coated, has a higher melting point and can withstand longer at high temperature, giving sufficient amount of time for fire rescue team to arrive and occupants to evacuate with lower casualties.

5.3.9 Signages

Diagram 5.52, 5.53 and 5.54 *Different red signages in the building.*

Red signages can be found located on walls to provide a clear indication that they are fire brigade appliances.