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BACHELOR OF SCIENCE (HONOURS) IN ARCHITECTURE
BUILDING SERVICES (BLD 60903 / ARC 2423)
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Project 2 - Case Study and Documentation of Building Services Systems
In San Andreas Mall

Mechanical ventilation
Air-conditioning system
Fire protection system (active and passive fire protection system)
Mechanical transportation system

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1.0 Introduction

San Andreas shopping mall, and the first to be constructed in Subang Jaya, Selangor, Malaysia. The building has over 200 stores at a space of approximately 1,169,038 square feet (108,607.2 m2) distributed in three floors. It is located just off the Malaysian Federal Highway, and is within walking of the Darul Ehsan Mosque, Aeon Big (formerly Carrefour), Empire Shopping Gallery and the Subang Jaya Komuter station.

San Andreas was constructed between 1987 and 1988, and officially opened on 13 August 1988 by the late 8th Sultan of Selangor, Almarhum Sultan Salahuddin Abdul Aziz Shah. In 2003, Subang Parade was sold to The Hektar Group before being sold into the Hektar REIT (Real Estate Investment Trust).

San Andreas was the first 'regional' shopping centre in Selangor when it was opened on 13 August 1988. The centre is located in the heart of Subang Jaya's commercial district, a township 25 minutes' drive from Kuala Lumpur.

In 2008, San Andreas was recognized by International Council of Shopping Centers (ICSC) with a Silver Award for Development & Design at the ICSC Asia Awards due to its refurbishment of the building's exterior & interior features.

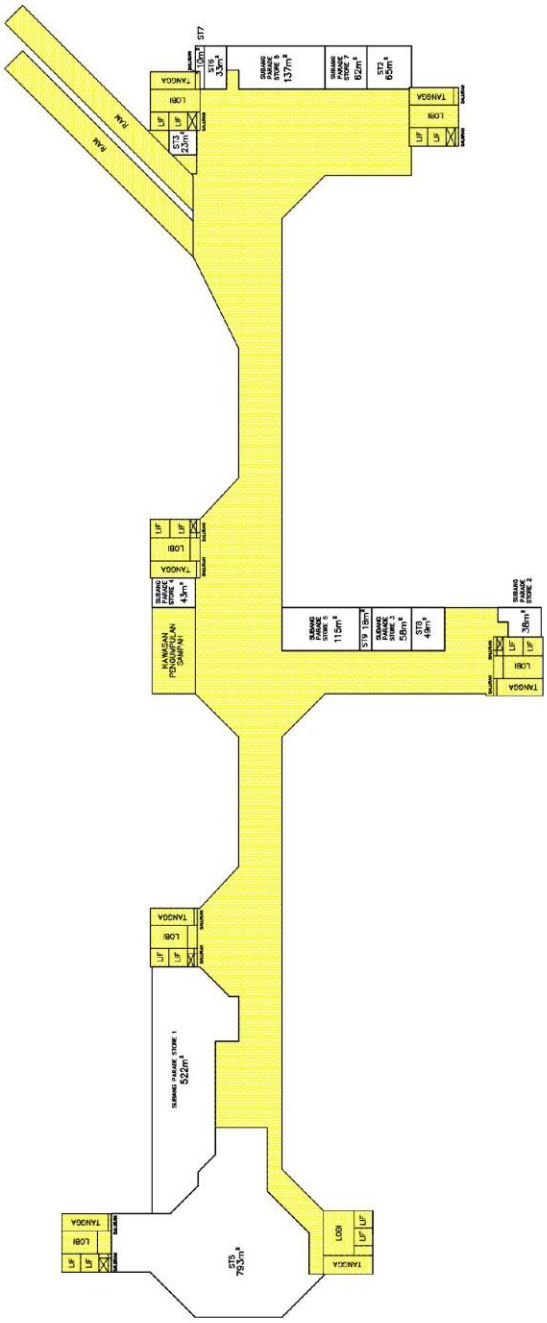
Until today, San Andreas are strategically positioned within the neighborhood-focused, with an emphasis on its primary trade area. This market focus provides the centre with a captive customer base, whose needs are met by a tenant mix offering value and convenience. In 2011, the introduction of MBO Cinemas and the Market Place have further enhanced the tenant mix of the centre, bringing us closer to our purpose in meeting customers' needs.

1.1 Location Plan

1.2 Objective

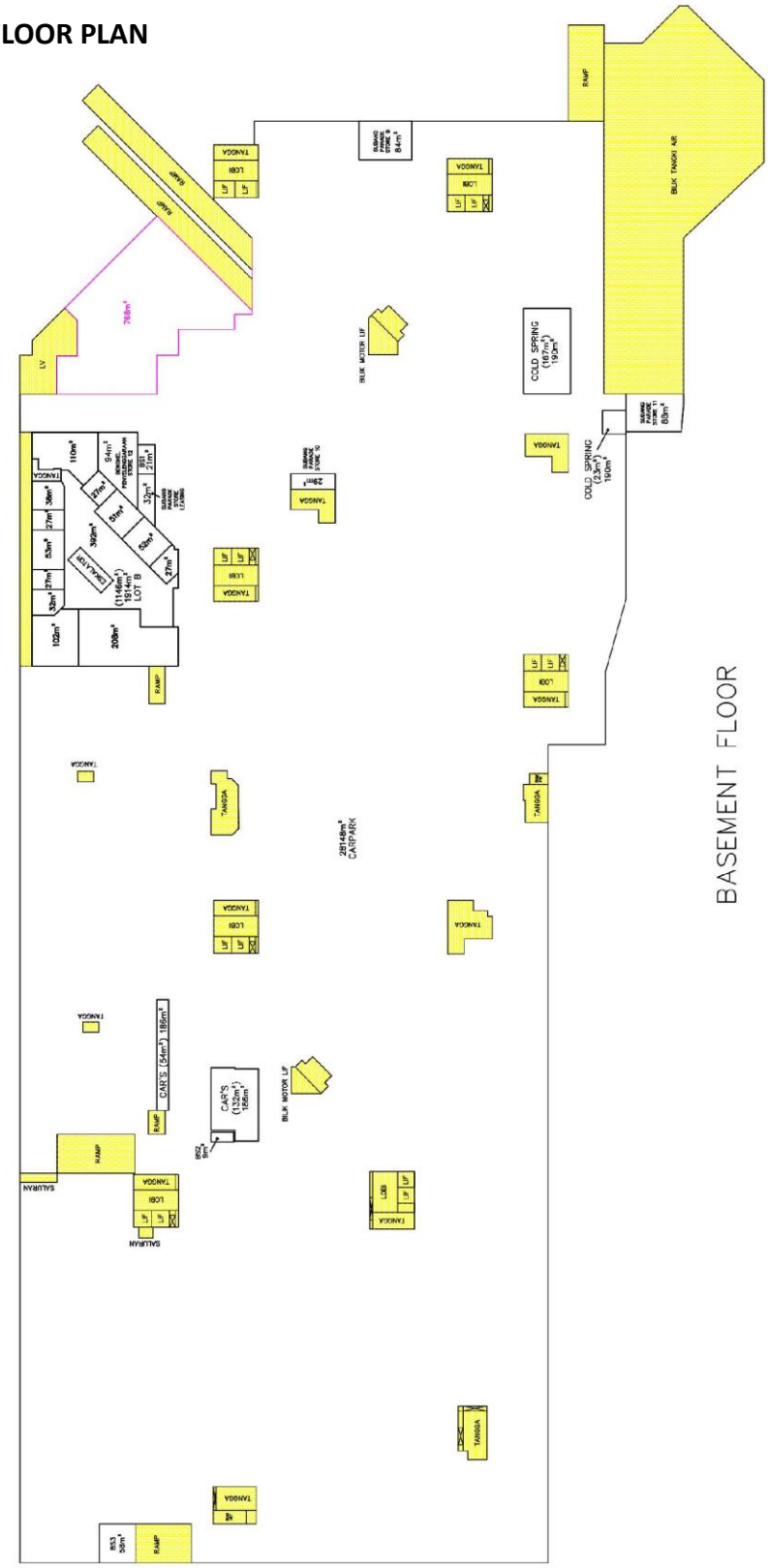
In this project we are required to observe into the functionality of the services systems in the San Andreas mall which are **air conditioning system, fire protection system, mechanical ventilation & mechanical transportation**. Our main focus in this report is to identify the required building services installed in the building & explain on how the components functioned together with the Uniforms Building by Law (UBBL) & Malaysian Standards (MS) requirements.

1.3 SERVICE TUNNEL FLOOR PLAN



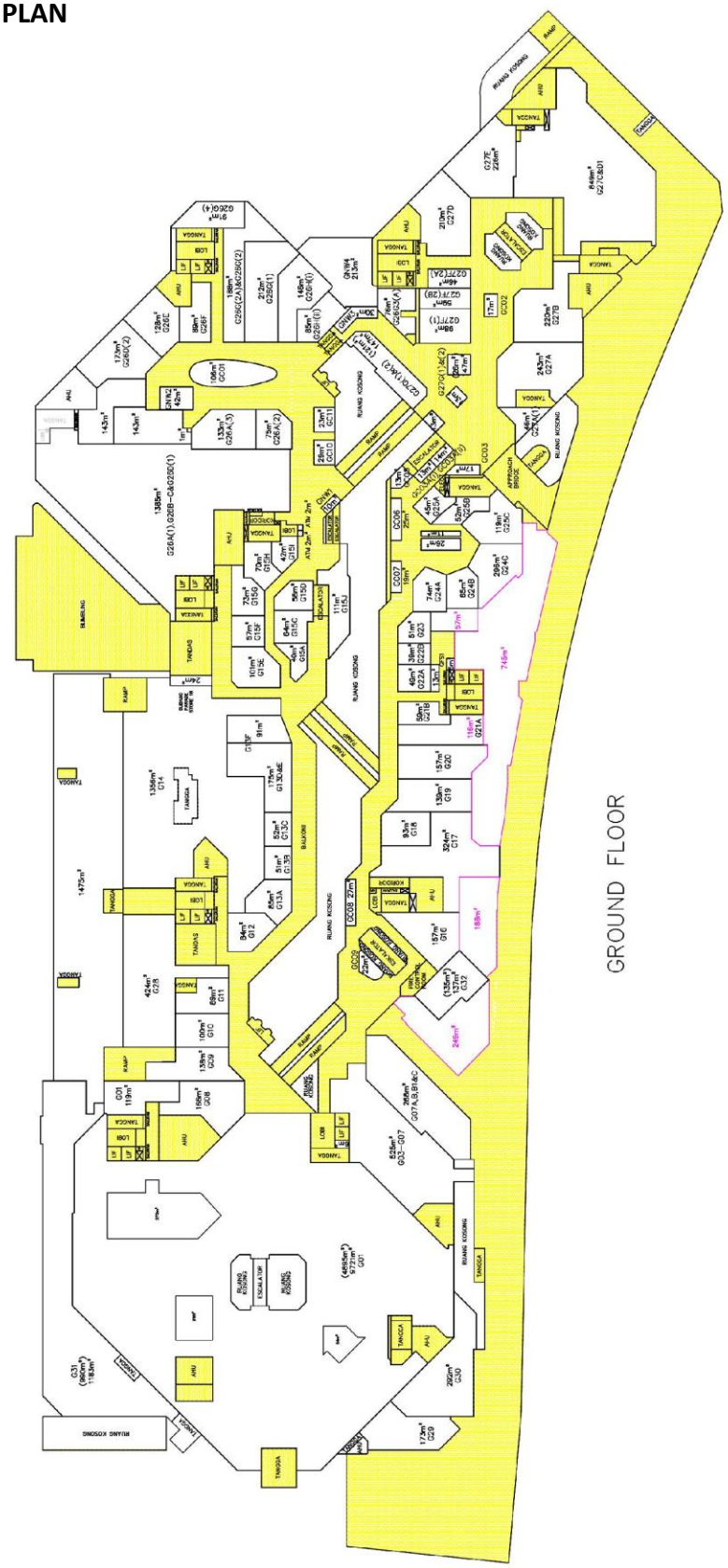
SERVICE TUNNEL FLOOR

1.4 BASEMENT FLOOR PLAN



1.5 LOWER GROUND FLOOR PLAN

1.6 GROUND FLOOR PLAN



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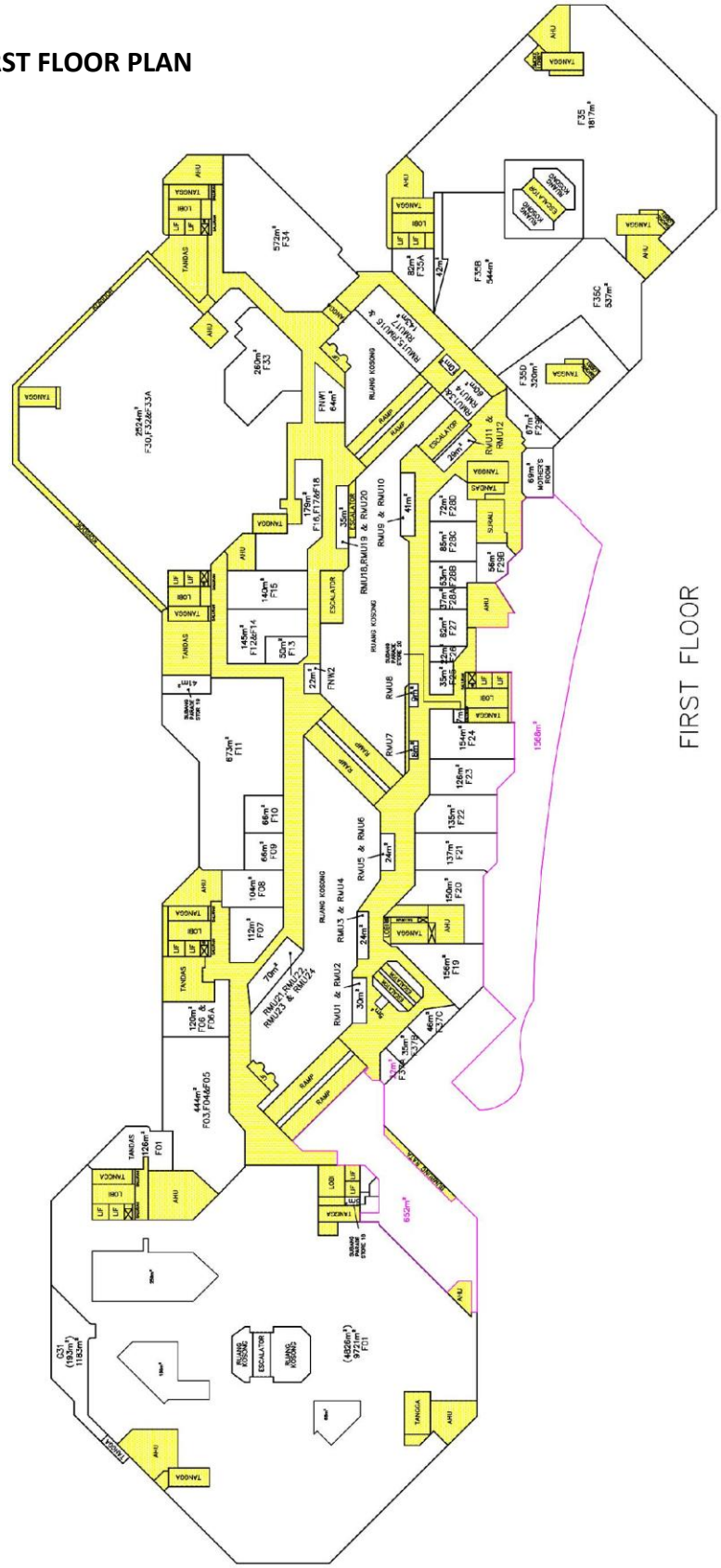
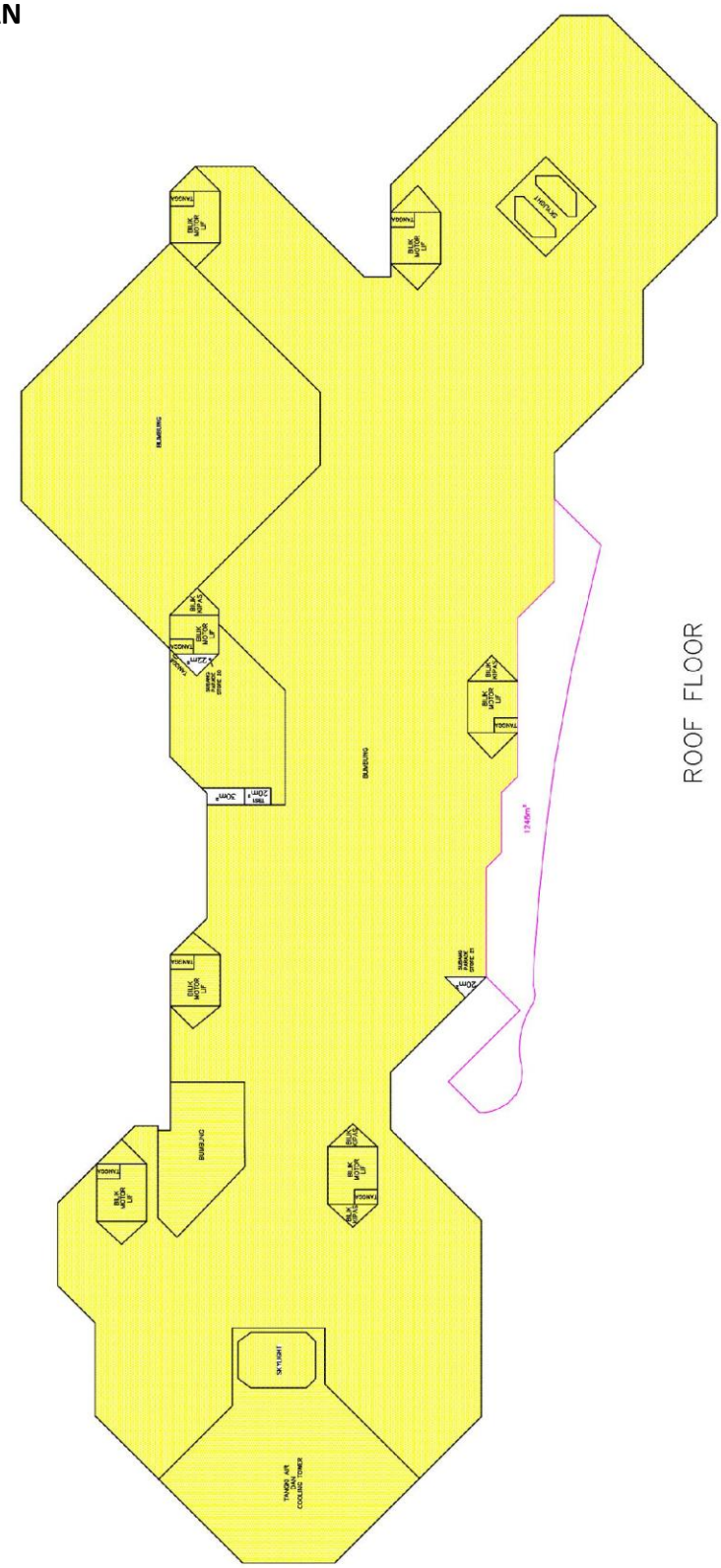


1.8 ROOF FLOOR PLAN



2.0 AIR-CONDITIONING SYSTEM

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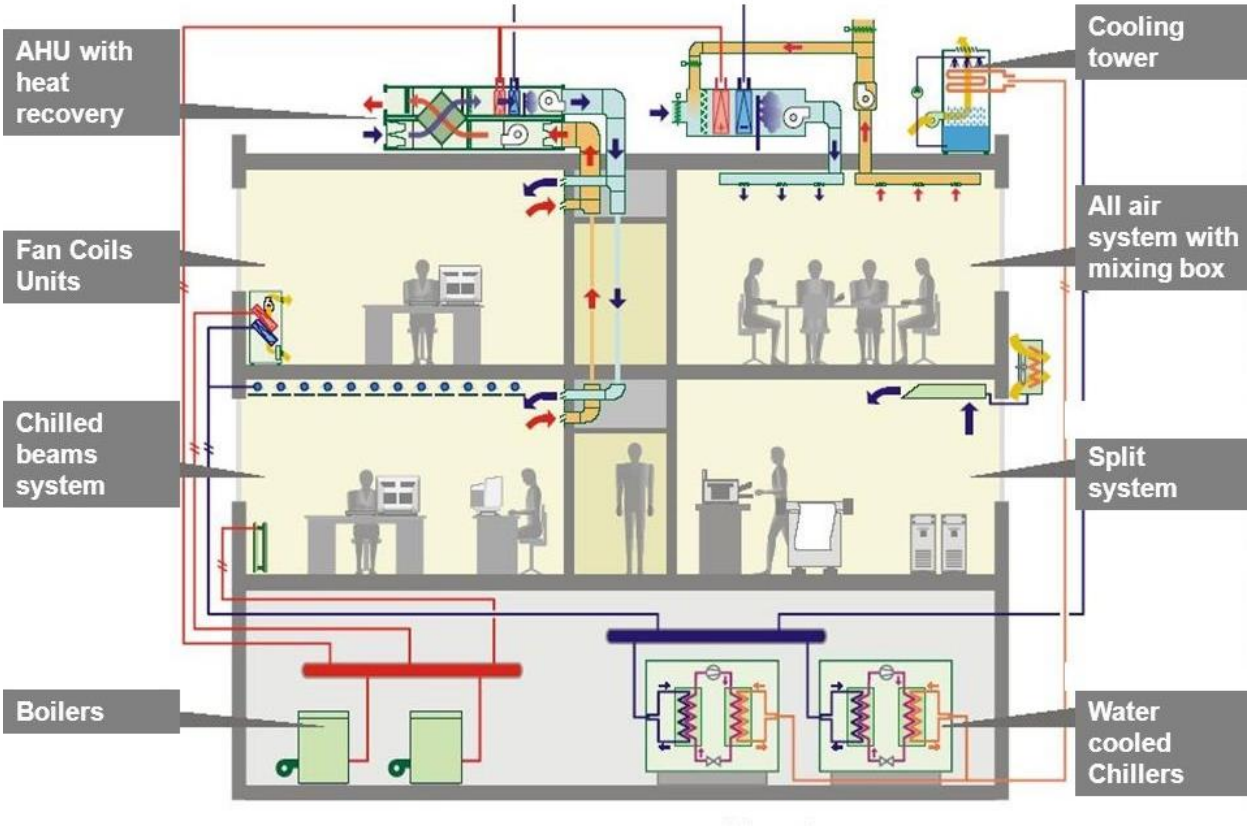


2.1 INTRODUCTION

Due to Malaysia's hot and humid climate, achieving thermal comfort in buildings through natural ventilation and other vernacular methods are nearly impossible. For that reason, alternative methods had to be considered. With the advancement of technology in our country, air-conditioning systems have been implemented in most of the buildings to ensure temperatures maintained within suitable range.

Through this system, thermal comfort can be achieved by drawing in natural air from the exterior and expelling stale air for ventilation purpose. There are to cycles involved in the treatment of interior air quality: refrigerant cycle and air cycle. The refrigerant cycle is a process to remove heat from one place to another by transferring it through the evaporator and was removed though a condenser to outside the building. On the other hand, the air cycle is a process that distributes treated air to different areas of the building.

The drawback from using this system is its massive power usage, requiring both electrical and water supply to function properly. Large amount of electricity is used to power the system while water cools down the heat from the machineries.

2.2 LITERATURE REVIEW

Air-conditioning system controls 4 different aspects that contribute to thermal comfort in buildings:

- Air temperature
- Air humidity
- Air movement
- Air purity

There are a few types of air-conditioning system that can be found in the industry, each with their own way of cooling the interior of buildings for different situations. These type of air-conditioning systems are:

- Room air-conditioner (window unit)
- Split unit air-conditioning system
- Packaged unit air-conditioning system
- Centralized/plant air-conditioning system

2.2.1 Room air-conditioner (window unit)

Room air-conditioner is known as the simplest form of air-conditioning system, suitable only for small rooms. These conditioners are usually installed at openings like windows in a room or the walls.

A residential window unit AC

2.2.2 Split unit air-conditioning system

These type of air-conditioning system is very common and can be seen in operation at many residential buildings. There are different factors that made it the most popular type of AC, it looks elegant, produces little to no noises and doesn't require a hole in the wall for it to be installed.

Split unit air-conditioning systems always have two separated units; an outdoor unit and an indoor unit. The outdoor unit works as a compressor and condenser, requiring a sufficient flow of air to remove heat. On the other hand, the indoor unit works as an evaporator that produces the cooling effect inside a room.

Split AC commonly found in residential buildings

2.2.3 Packaged unit air-conditioning system

Packaged air conditioners are used for places with larger spaces compared to the split type. It functions similarly to the split air conditioners and are commonly used it places like restaurants and event halls. Packaged air conditioners can be divided into two types: ones with water cooled condensers and ones with air cooled condensers.

Those with water cooled condensers is cooled by using water. Water must always be supplied in this kind of system to maintain its function to cool the interior spaces of the building.

Those with air cooled condensers is cooled using air from the atmosphere. The outdoor unit is kept at open spaces like terraces. This kind of system is more common than the water cooled type because the latter is harder to maintain.

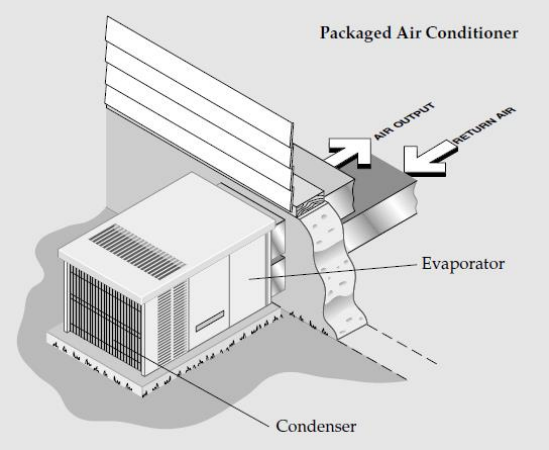
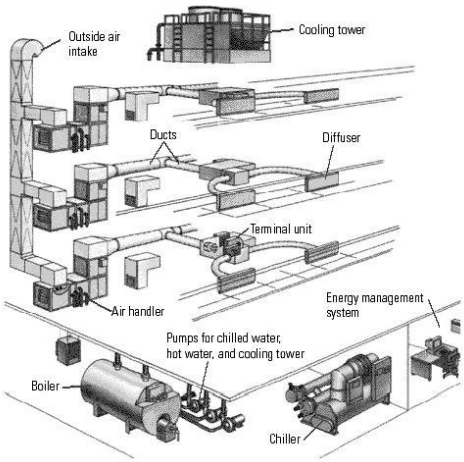


Diagram showing components of a packaged AC

2.2.4 Centralized/plant air-conditioning system

Centralized air-conditioning system are normally found in large buildings with multiple floors like hotels, hospitals and shopping malls, where high cooling loads are required so that all areas can be cooled completely. This kind of system is more suitable in these places because it is more economically viable when compared to the other type of air-conditioning system.

Large compressor, condenser, thermostatic expansion valve and evaporator are kept in a large plant room, where all functions of a refrigeration system are performed. In consequence, a larger space is required to store all the machineries which are several times larger than the normal ones.



Circulation of a centralized AC system

2.3 CASE STUDY

2.3.1 Introduction

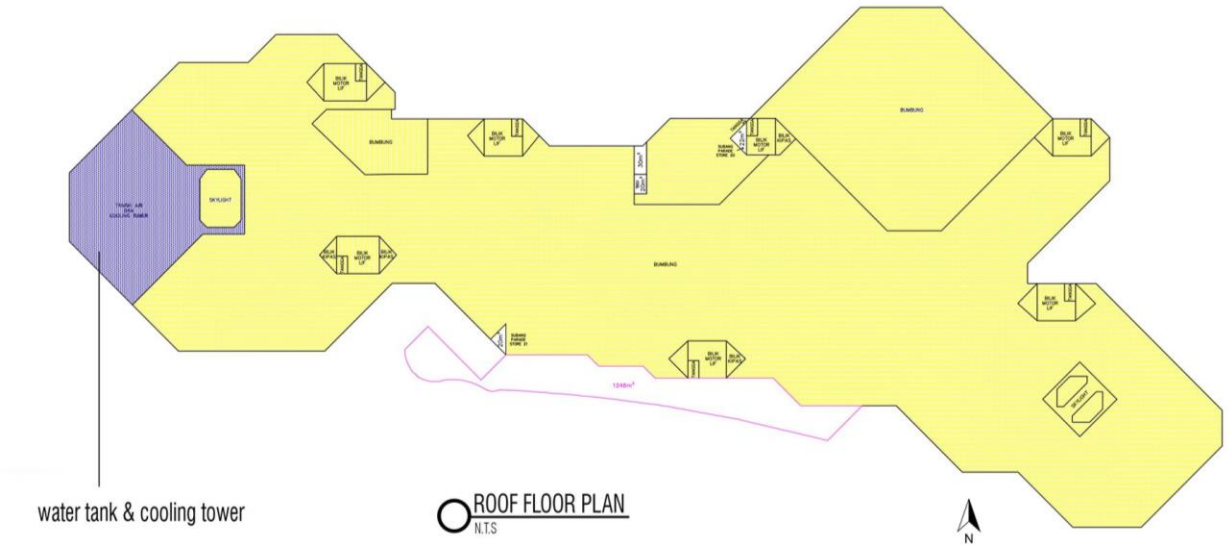
After the site visit to the San Andreas Mall located in Subang Jaya, we learned that the building uses centralized/plant air-conditioning system.

The centralized system or plant air conditioning system is suitable for the building as the system provide a high cooling load for a huge building like San Andreas Mall. Basically this system comes from a source called “A/C plant room” where the chillers are located to remove heat through the refrigerant cycle process. For the refrigerant cycle process, it starts at the cooling towers that are located at the rooftop of the building, cooling the water. Then it goes to the plant room for the chiller process and later from this plant room to the air handling units (AHU) that can be found in every floor of San Andreas Mall. AHUs are a place to control the temperature and generate the air to each of the shop and office units through the duct system.

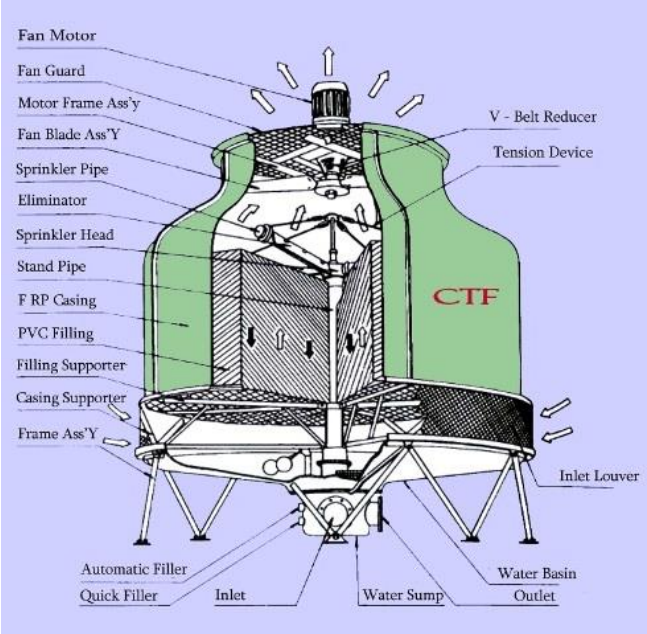
CENTRAL AIR-CONDITIONING SYSTEM

2.3.2 Cooling tower

Cooling towers function as a heat extractor, removing heat from the hot waters and at the same time sending the cooled waters back to the chiller at the lower ground floor. There are a total of 6 cooling towers, located at a single point on the roof top of the San Andreas Mall. Each of the cooling tower is connected to different chiller located in the AC plant room. The towers were not covered with a roof in order to maximize its contact with the atmospheric air around it, achieving the maximum rate of heat exchange of the cooling tower to its surrounding.



Position of the cooling tower and water tank on the roof top of San Andreas Mall



The interior components of a packaged type cooling tower

Nihon Spindle Cooling Towers Sdn Bhd is the factory responsible in the assembling of the cooling towers used in San Andreas Mall. The cooling towers used is a packaged type with limited capacity, which is the most suitable for a mall with low heat rejection requirements. The main issue with packaged type cooling towers is the sound level control, which we find it not a serious problem during the visit as the noise of the fan is not very deafening.

The cooling towers

Not only that, the type of cooling tower used is the mechanical draft cross flow cooling tower. The fan diameter and the speed of the tower's operation affects the cooling rate and can be adjusted based on the needs of the mall. In San Andreas Mall, condensed water is pumped from the chiller room located at level LG 2 straight to the roof top's cooling towers. Double-flow towers are used in the mall as to maximize the heat exchange between the water and the air at opposite sides of the tower. An induced draft fan draws air from the surrounding across the wetted fill and expel the collected hot air through the top of the tower. The basin at the bottom of the cooling tower collects the cooled water and send it along a pipe to the chiller room.

Water tank located right beside the cooling towers

MS1525:2007 Balancing The system design should provide means for balancing the air and water system such as but not limited to dampers, temperature and pressure test connections and balancing valves.

2.3.3 Chiller

Water cooled chillers are used in San Andreas Mall. Compared to air-cooled and evaporatively cooled chillers, water cooled chillers are intended for indoor installation, cooled by a separate condenser water loop. There are 3 chillers inside the plant; 1 chiller is filled with 750 tons of water that operates from 10.30 a.m. to 7 p.m., while the other 2 chillers are filled with 1500 tons of water, operating from 9.30 a.m. to 9.30 p.m. These chillers had been in used for over 26 years and had not encounter any overheating problems.

These chillers are connected to different AHUs located at every levels of the mall in order to circulate the chilled water. These chillers are also linked to the cooling towers on the rooftop to circulate the condensed water. Pumps are used in both the circulation to maximize the system's efficiency. The chilled water is responsible in the transportation of heat energy between the refrigerants and the AHUs.

The chiller consists of three components: evaporator, compressor and condenser.

One of the three chillers found in the plant room

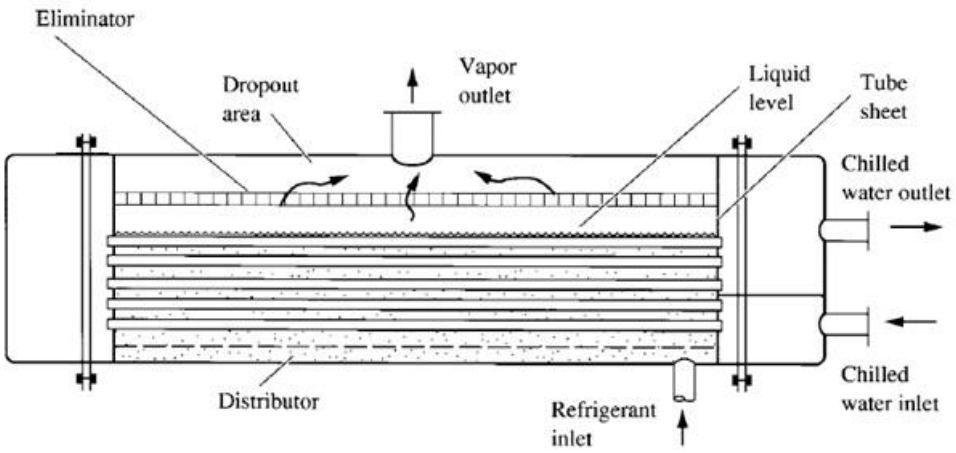
MS1525: 2007

8.2.2

Where chillers are used and when the design load is greater than 1000 kWr, a minimum of two chillers or a single multi-compressor chiller should be provided to meet the required load.

2.3.3.1 Evaporator

Evaporator works as a heat exchanger, removing heat from the water by the boiling of the refrigerant. The heat energy stored in the water is removed by letting the refrigerant to flow over the machine's tube bundle, evaporating it. This cause the water to become chilled and flow back to the AHUs. The evaporated refrigerant produces vapor, which is drawn out of the system by a compressor to the condenser.



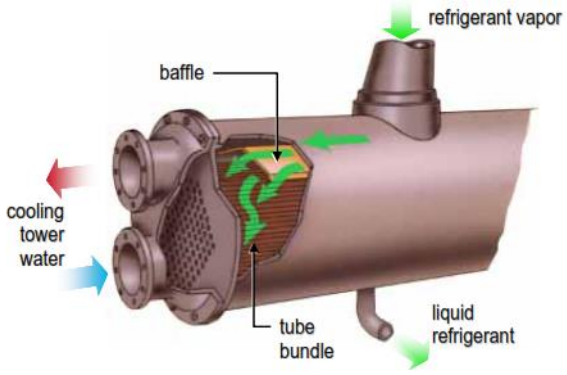
The interior of a chiller's evaporator

2.3.3.2 Compressor

The vapor produced by the evaporation of refrigerant is drawn here, where it is turned from a gas low in both pressure and temperature to a high pressure and temperature gas. The gas is compressed until it hits the required temperature and then it flows into the condenser.

2.3.3.3 Condenser

Like the evaporator, the condenser also functions as a heat exchanger, where the heat from the compressed refrigerant gas is transferred to the atmosphere. The cooled water from the cooling towers is sent to the condenser in order to absorb heat from the gas. The refrigerant gas, losing its heat, is turned back to liquid state and is transferred back to the evaporator. At the same time, the heated water circulates back to the cooling towers on the rooftop to be cooled.



Function of a chiller's evaporator

2.3.3.4 Refrigerant

R-22 or HCFC-22 is the type of refrigerant used in the chiller of San Andreas Mall. This type of refrigerant is more commonly seen in use in developing countries like ours. The R-22 is an alternative to CFC, which is a highly ozone depleting substance. In more developed countries, this kind of low ozone depletion refrigerant is no longer acceptable because it causes global warming.

2.3.4 Pumps

Two types of pumps are in use in this chilled water system: condenser water pump and chilled water pump.

2.3.4.1 Condenser water pump

This pump transfers the hot water from the condenser, where the heat is absorbed from the refrigerant gas, back to the cooling towers. The water then returns to the condenser after it is cooled, continuing the cycle of heat exchange.

Condenser water pumps

2.3.4.2 Chilled water pump

This pump transfers the chilled water from the chiller to each AHUs, returning it back to the chiller once it turns warm to repeat the chilling process.

Chilled water pumps

2.3.5 Control panels

The control panel in the diagram is located in the plant room with the chillers. This machine controls the entire air-conditioning system of the mall. It also shows the temperature and pressure of the chillers.

The control panel completed with the schematics of the entire air-conditioning system

2.3.6 Air-handling unit (AHU)

AHUs are rooms scattered along each level of the mall. There are a total of 68 AHUs operating manually, each controls the air-conditioning system of 5 shops. These many AHUs are needed as the mall is quite big in size as well as to satisfy the air flow requirements.

AHU is a big machinery used to circulate the air flow, which is part of the heating, ventilating and air-conditioning system. In the mall, air is drawn back from the shop and office units, passing through cooling coils, mixing with fresh air before it is returned to each units under the AHU's control.

Through this, cool air is provided constantly to each unit, forming a constant airflow system. Each AHU is equipped with a control panel so that the temperature can be adjusted depending on the need of the user. Not only that, the AHUs are enclosed in their individual rooms as to protect the machinery from external forces or pressure that may disrupt the components within.

An air-handling unit

2.3.6.1 Air filter

Every AHU has its own air filter, which is responsible in providing a clean dust-free air to each controlled shop and office units. The air returned from the units pass through air grilles to the air ionizer before the air filter. The air ionizer removes dirt and impurities in the air by using charged electrical surfaces to generate electrically charged air. The air is then only transfer to the air filter to improve the quality of the air.

Air filter of an AHU

2.3.6.2 Fan

Two fans are present in each AHU's room; a fan that blows the air through the cooling coil, and a fan that blows air into the supply duct.

2.3.6.3 Cooling coil

The filtered air is blown to the cooling coil, where the air is cooled by contacting with the coil. The coil is made with copper pipes, coiled up in order to increase its surface area, maximizing the heat exchange rate of the air.

Cooling coils of an AHU

2.3.6.4 Mixing box

The air collected from each shopping unit will be carrying carbon dioxide. When the carbon dioxide in the air exceed a preset amount (500pm), the sensor in the mixing box will detect it, exhausting some of the collected air and mix it with fresh air from the exterior. This process occurs automatically to keep the air in the building fresh.

2.3.7 Pipe system

Pipe system is the system that carries and transfer water from water tank to the cooling tower at the roof top of the building. From the cooling tower the pipe system then transfers the cooled water to the chiller. After the water has been cooled by the chiller it goes to the pump and straight to the AHU room. The pipe system in this building is being colored to indicate different function of the pipes.

Pipe system at cooling tower on the roof top

MS1525: 2007 Piping insulation All piping installed to serve building and within building should be adequately insulated to prevent excessive energy loses. Additional insulation with vapor barriers may be required to prevent condensation under some condition.

2.3.8 Ductwork system

Ductwork system is a system that transfer cooled air to the diffuser in the building, basically the system is controlled by AHU and had been hidden inside the suspended ceiling of the building. For San Andreas Mall there use galvanized steel for ductwork system material because of insulation purpose, allowing the cooled air to keep its cool when it is being transferred.

MS 1525: 2007 Air handling duct system insulation All ducts, plenums and enclosures installed in or on buildings should be adequately to prevent excessive energy lost. Additional insulation with vapor barriers may be required to prevent energy lost.

2.3.9 Diffusers

2.3.9.1 Supply air diffusers

Diffusers or supply air diffusers is where the cooled air come into to the shop units or any space inside the mall. This system is unique because it been designed to balance the space between cool air and also hot air, if the space is too hot it will reduce the temperature and if it too cold the temperature will rise up. The diffusers are being controlled in AHU room. There's two type of diffusers that had been applied in this building, the first one is linear slot diffuser and the other is square diffuser.

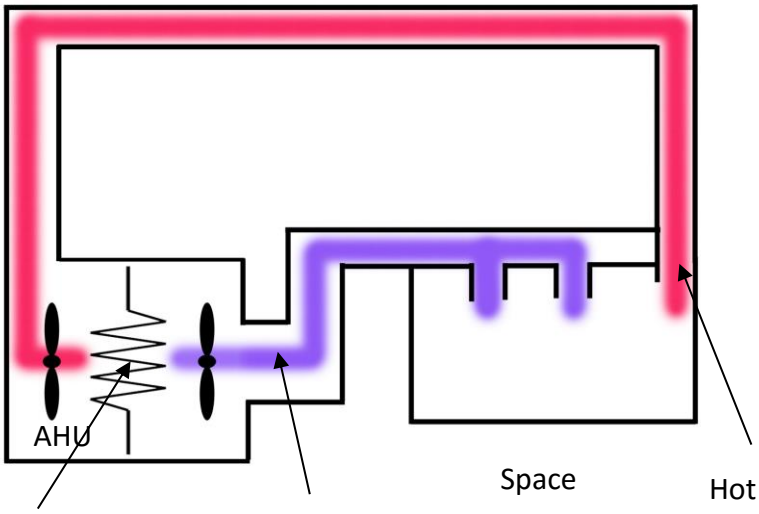
The linear slot diffuser can be found along the corridor of the building. For square diffuser it can be found most all the place such as office, cafeteria, shop lot and another space.

Square diffuser (right) and linear diffuser (left)

2.3.9.2 Return air grilles

Return air grilles is used to suck hot air from the space and transfer it to AHU room to be recycle the hot air into cool air. This system is important for balance the temperature in the space.

Return air grilles



The air cycle from AHU to space

2.4 ANALYSIS

2.4.1 Air Quality

The dry bulb temperature that we get from the analysis of our case study, San Andreas Mall, is a temperature constant at 25°C, which fulfils the following requirement:

MS1525: 2007

Indoor design conditions section 13a

"At normal comfort room temperature (23°C to 26°C), the acceptable air velocity would be in the region of 0.15m/s to 05m/s. The indoor design conditions of an air-conditioned space for comfort cooling is recommended to have dry bulb of 23°C to 26°C. he recommended deign relative humidity is 55-70%. The recommended air movement is 0.15m/s to 0.5m/s. According to Department of Malaysian Standards, the maximum air movement is 0.7m/s."

This concludes that the thermal control requirements in San Andreas Mall complies with the MS1525: 2007.

2.4.2 Air Distribution System

The separated air distribution system of the San Andreas mall leads to the offices' non-simultaneous operation for more than 750 hours per year, fulfilling the following requirement from the Malaysian Standard:

MS1525: 2007

Separate air distribution system

"Zones which are expected to operate non-simultaneously for more than 750 hours per year shall be served by independent air conditioning system."

2.4.3 Energy Saving

San Andreas Mall saves energy by shutting down the ACMV system after office hours automatically, which fulfils the Malaysian Standard requirement:

MS1525: 2007

Off-hour control

"ACMV system should be equipped with automatic controls capable of accomplishing a reduction of energy use for example through equipment shutdown during periods of non-use or alternative use of the spaces served by the system."

2.4.4 Controls

There are thermostats installed at the top floor so that the temperatures can be checked and maintained at an average of 23°C. This fulfils the following requirement:

MS1525: 2007

Temperature control

"Each system should be provided with at least one thermostat for the regulation of temperature. Each thermostat should be capable of being set by adjustment or selection of sensors over a minimum range of between 22°C to 27°C. Multi-stage thermostat should be provided for equipment exceeding 35/65 kWr in conjunction with 8.2.4."

2.5 CONCLUSION

In conclusion, thermal comfort is achieved in the San Andreas Mall by fulfilling certain by-laws in terms of air quality, air distribution system, energy saving and controls. Not only that, by using a centralized air-conditioning system, which is the most suitable out of the other systems, ensures a constant temperature to be maintained in a large space. The entire system runs smoothly and it is able to save a large amount of energy because each component was placed in their appropriate levels.

3.0 MECHANICAL VENTILATION

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3.0 MECHANICAL VENTILATION

3.1 LITERATURE REVIEW

Mechanical ventilation is a method of induced ventilation by using mechanical air handling systems, commonly called HVAC systems. Mechanical ventilation systems circulate fresh air into the building by mechanical means for examples by using ducts, fans and air-conditioning rather than just from the openings such as windows and doors of the building. It helps in controlling the humidity, contaminants, air borne particles, and general air quality built up in the building
There are three types of mechanical ventilation system, the extract system, supply system and combination system.

UBBL Section 41 Mechanical ventilation and air-conditioning

1) Where permanent mechanical ventilation is intended, the relevant building bylaws relating to natural ventilation, natural lighting and heights of rooms may be waived at the discretion of the local authority.
2) The provisions of the Third Schedule to these By- Laws shall apply to the buildings which are mechanically ventilated or air- conditioned.
3) Where permanent mechanical ventilation in respect of lavatories, water closets, bathrooms or corridors is provided for an maintained in accordance with the requirements of the Thirds Schedule to these By Laws, the provisions of these By Laws relating to the natural ventilation and natural lighting shall not apply to such lavatories, water-closets, bathrooms or corridors.

3.1.1 The Extract System

Figure 3.1: Extract system located on the roof top drawing out the dirty air from the basement

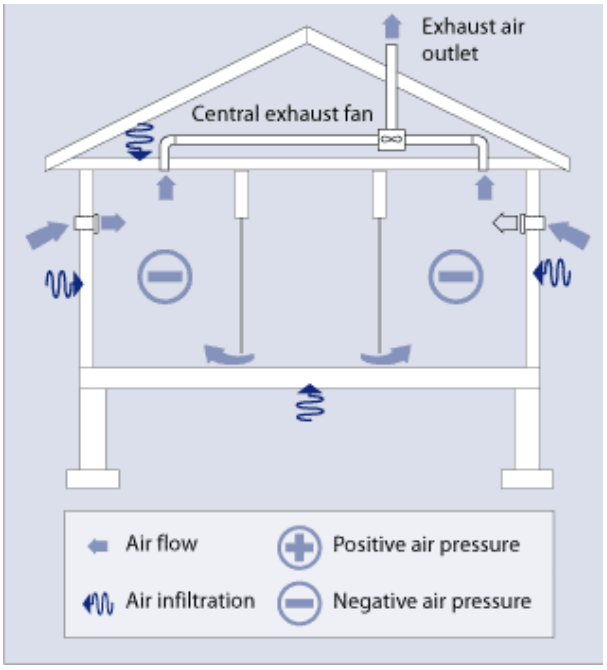


Figure 3.2: Diagram shows how the air flows in the building.

Indoor air is continuously exhausted to the exterior. Due to the continually hot air inside the room drawn out, it is depressurized on the interior which allow fresh air to enter the building. This system is commonly seen in basements, kitchen, attic and bathrooms. It is perfect in dwellings, offices, factories or public buildings.

3.1.2 The Supply System

Figure 3.2: Extract system located on the roof top

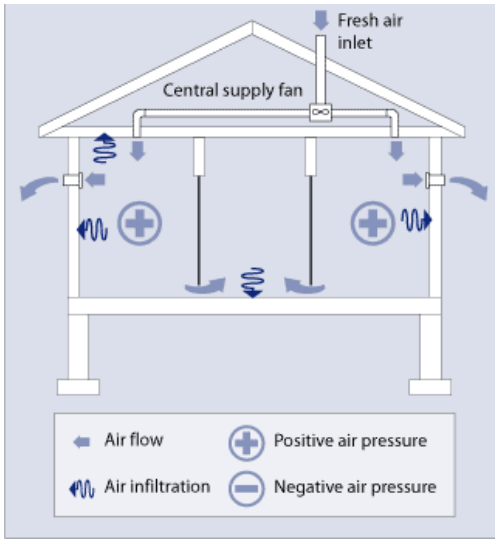


Figure 3.3: Diagram showing the outside air is forced into the building while air leaks out of the building through holes in the shell, bath and rangefan ducts, & international vents.

Fresh air is drawn into the building through an air vent by a fan and duct system. A fan and set of ducts dedicated solely to ventilation is used to allow the distribution of fresh air. It helps the outdoor air be air conditioned or dehumidified before it is introduced into the internal space. This flow creates a positive pressure inside which forces stale air to flow out naturally through openings and cracks in buildings or louvers. This system is usually used in cold weather, boiler rooms or factories.

3.1.3 The Combination System

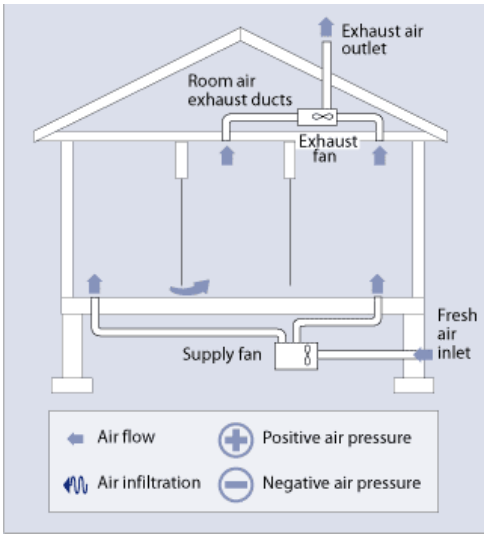


Figure 3.4: Shows how it introduce and exhaust approximately equal quantities of fresh outside air and polluted inside air.

3.2 Extract System

In an extract system, the central exhaust fan channel out stale air to create negative pressure in the building causing the cool and fresh air to move in and expel stale air out of the building naturally. Three types of extract system are being used in San Andreas Mall, exhaust fan, ductwork system and fire extraction system. Fan plays an important role in the distribution system as its purpose is crucial in circulating the indoor air when the air in the building is cooler than the outside air.

3.2.1 Propeller Fan

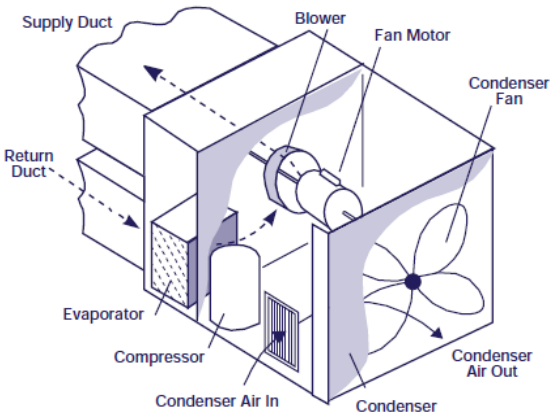


Figure 3.5: Components of the propeller fan

In San Andreas Mall, the propeller fan is allocated in the services room to ventilate the air. The temperature is usually higher in the services room than other rooms in the building. On the other hand, the machines in the services rooms will only function in a certain temperature in order to function. Thus, with propeller fan, it helps to extract the hot air in the out of services rooms, which can maintain the temperature to ensure that the machines in the room can be function.

According to MS1525 Code 8.4.1 Temperature Control

Each system should provide at least one thermostat to regulate the temperate. Each of the thermostat has to be either adjustable or it has the selection of sensors over a minimum range of between 22degree Celsius.

3.2.2 Ductwork

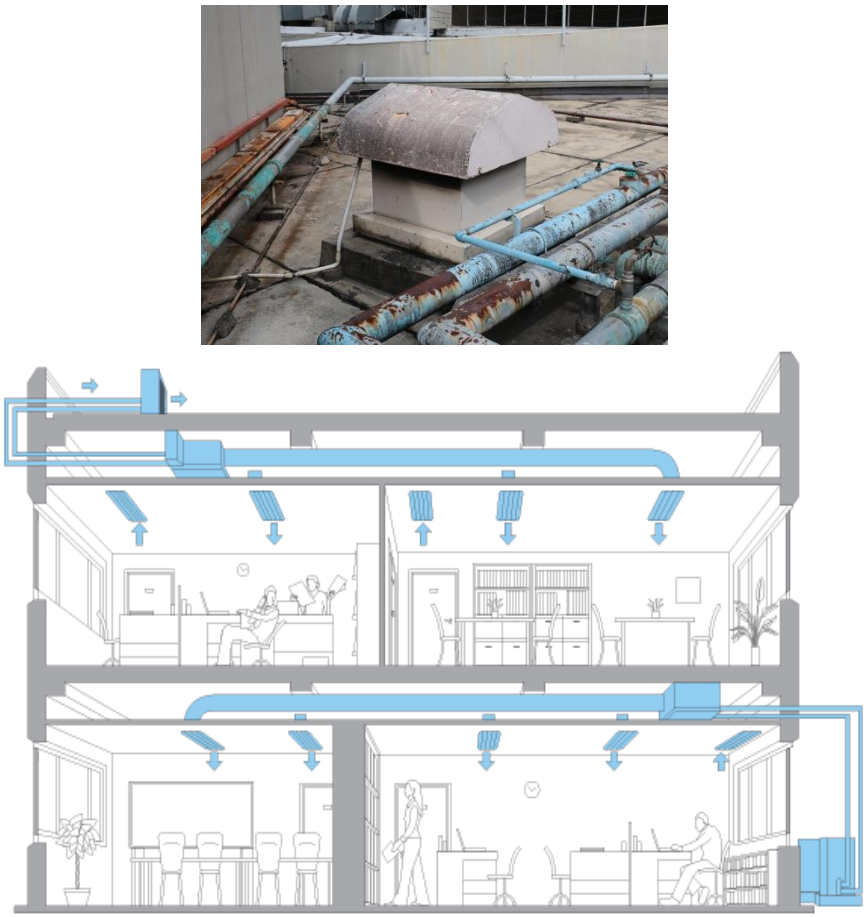


Figure 3.6: The ducted systems increase variation in airflow options ensuring the systems operating in a way that best suits virtually all spaces layout.

Ductwork system is an important device to channel gas across the building to ensure better interior air quality. Ductwork system is usually being applied in the carpark, shops and the toilets. The stale airs is transport through the pipes and tunnels and expel the stale air to the exterior. Each space uses a different and separate ductwork system. In San Andreas Mall itself, three kind of ductwork network is being applied in order to provide better ventilation for each space.

According to MS1525 Code 8.6: Air Handling Duct System Insulation
All ducts, plenums and enclosures installed in or on buildings should be adequately insulated to prevent excessive energy losses. Additional insulation with vapour barriers may be required to prevent condensation under some conditions.

3.3 Smoke Extracting System

Smoke is more dangerous to everyone in fires than heat, flames or structural collapse. In order to increase the safety of occupants in a fire, an efficient smoke extraction system is being provided in the building. Such system can reduce the property damage, life as the system helps control smoke more from fire area to adjacent zones. Provide conditions both within and outside the fire zone to help firemen in conducting rescue and extinguish operation. Smoke extraction systems are on its standby mode, as it will only function when a concentration of smoke is being detected.

3.4 Control Room

Two exhaust system control room can be found in Subang Parade. One of the exhaust system control room is allocate at the rooftop which controls the exhaust fans in the services room. Where by the other one is place inside the shopping mall, which controls the overall interior exhaust fans.

According to :

MS1525 Code 8.4.1.2.1 Control Setback and shut-off

Each system should be equipped with a readily accessible means of shutting off or reducing the energy used during periods of non-use of alternate uses of the building spaces or zones served by the system.

MS1525 Code 8.4.4.1 Off-hour Control

ACMV system should be equipped with automatic controls capable of accomplishing a reduction of energy use for example through equipment shutdown during periods of non-use or alternative use of the spaces served by the system.

MS1525 Code 8.4.5 Mechanical Ventilation Control

Each mechanical ventilation system (supply and/or exhaust) should be equipped with a readily accessible switch or other means for shut-down or volume reduction when ventilation is not required. Examples of such devices would be including timer switch control, thermostat control, duty cycle programming and CO/CO2 sensor control.

3.5 Conclusion

According to the UBBL, San Andreas Mall achieved the sufficient yet permanent mechanical ventilation in the building which includes the pantry, toilets as well as atrium, corridors which include the services area. It has the complete mechanical ventilation system consisting of the exhaust fans, duct work and smoke extraction system. The system allows the circulation of air and controls the temperature internally. With all the components, San Andreas Mall has achieve to be a sustainable mall.

4.0 MECHANICAL TRANSPORTATION SYSTEM

Prepared by: Mohamad Hafizi 0315470

4.1 ELEVATOR

4.1.1 INTRODUCTION

This segment of the report covers the mechanisms and components that are used in mechanical transportation that are used in the San Andreas Mall, Subang Jaya with the highlights of the functions and specifications of these machineries. Furthermore, the analysis on this segment of mechanical transportation system will be referred to the Malaysian Uniform Building By-Law (UBBL), which is required to follow.

Due to the development of technology and the increasing population of people, buildings are erecting vertically to contain more users and reducing wastage of space by minimizing the built area. Mechanical transportation systems play an important role to allow users reach one destination to another with ease. Not only it helps users to go horizontally, it also allows them to move vertically – different floors.

According to Malaysian Uniform Building By-Law (UBBL), clause 124:

- A lift shall be provided for non-residential building, which exceeds 4 storeys above or below the main entrance.
- Essential in buildings less than 4 storeys if access for the elderly or disabled is required.
- Minimum walking distance to lift shall not exceed 45 meters.
- Lift should be position in the central area of the building to minimize horizontal travel distance.
- A smoke detector to be provided at the elevator's lobby.
- Elevator's lobby should be broad enough to grant traffic access in two (2) directions.

4..1.2 LITERATURE REVIEW

An elevator can be described as vertical transport equipment that efficiently moves people between floors or levels of a building, vessels or other structure. They are generally powered by electric motors that drive by traction cable and counterweight systems like a hoist or a hydraulic pump.

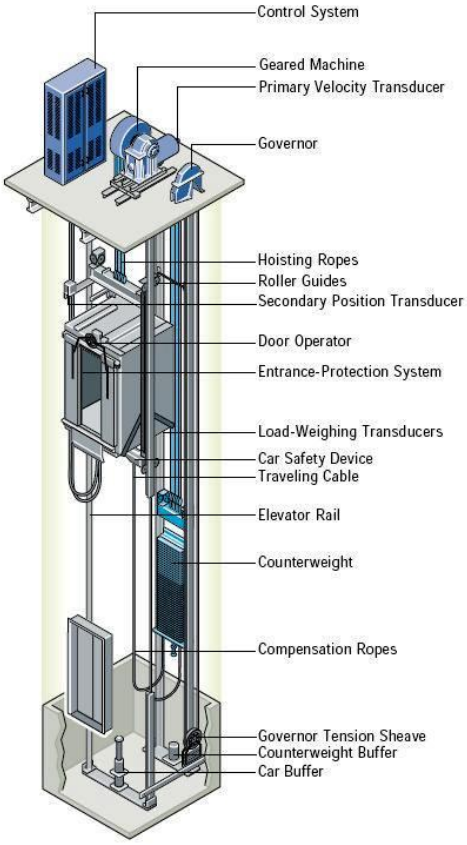
Elevators consist of two types – which are geared traction elevator and hydraulic elevator. Geared traction elevator can be parted in two categories where one is gearless and the other is geared elevator. The performance and efficiency of the elevator are the most essential. The performance and effectiveness of the elevator set up is achieved by calculating the round trip time (RTT). This is calculated by the ordinary period of time for one elevator to circulate, assimilating statistical data for the time lost during stops. The measuring starts when the doors begin to open at the main fatal until they reopen when the lift car completes it cycle.

4.1.3 CASE STUDY

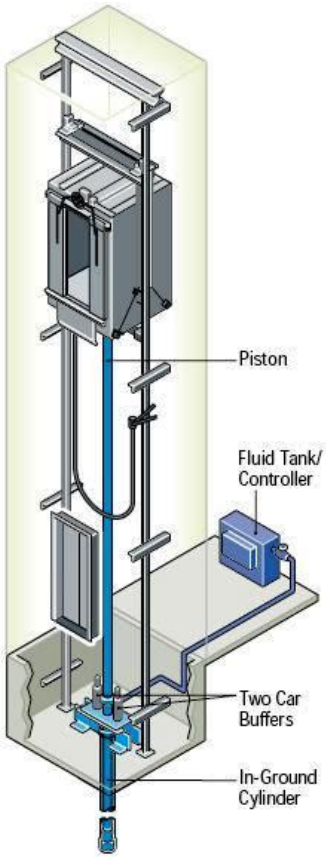
San Andreas Mall, Subang Jaya has integrated with mechanical transportation systems to transport its users and also its stocks.

There are two types of elevator systems, which are being used in the mall that are:

- Geared Traction Elevator
- Plunger Hydraulic Elevator

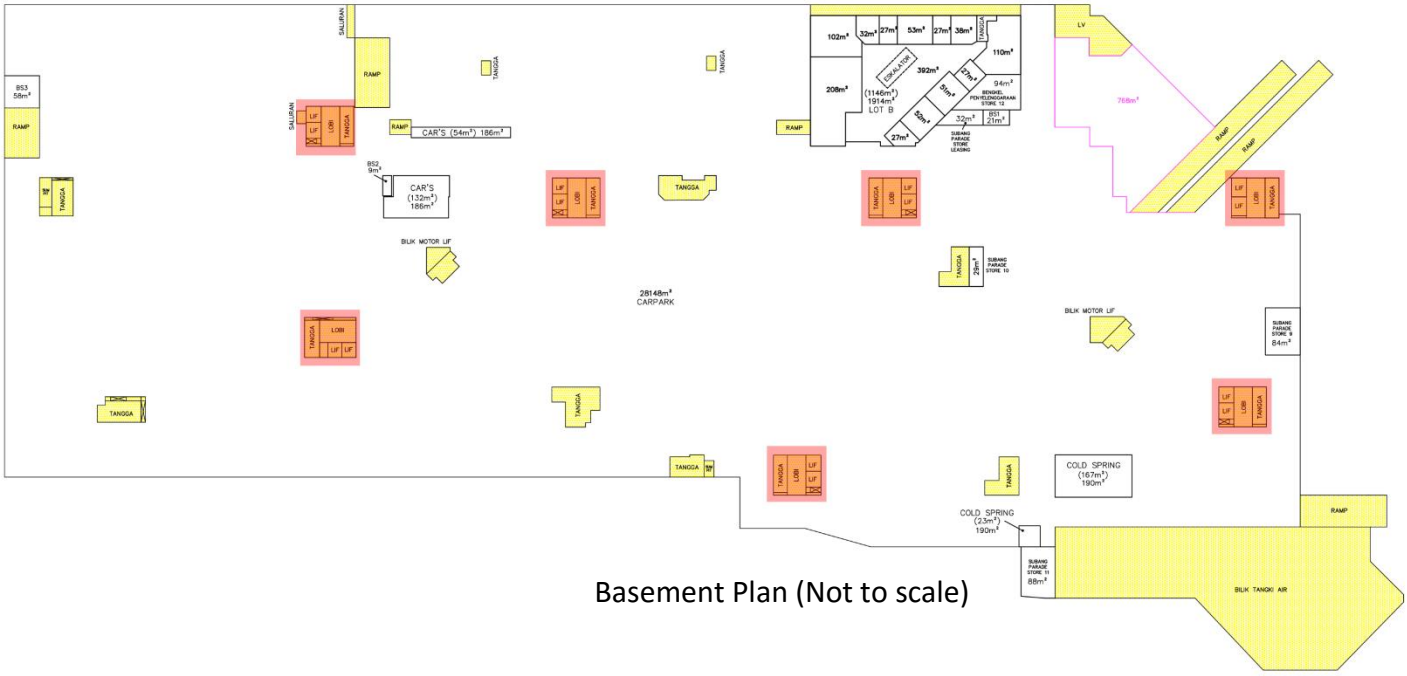


Geared traction elevator

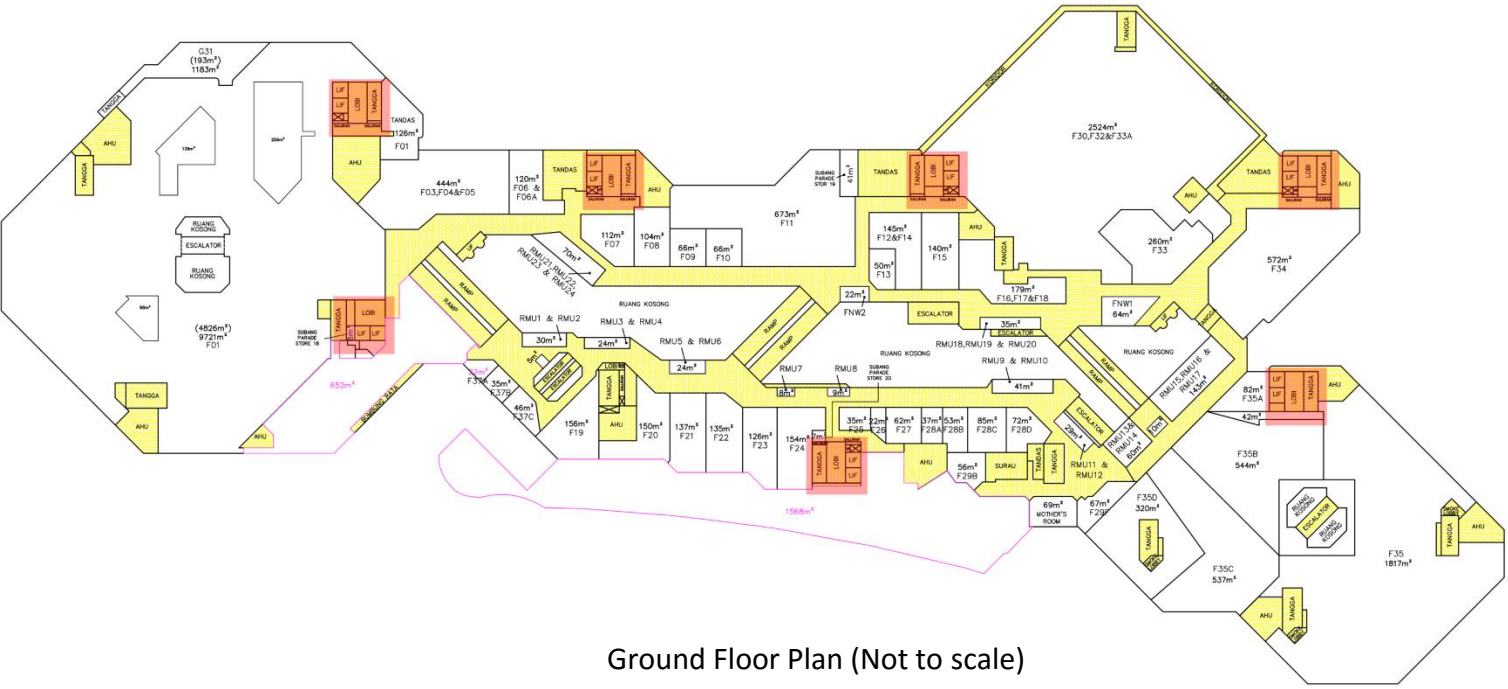


Hydraulic elevator

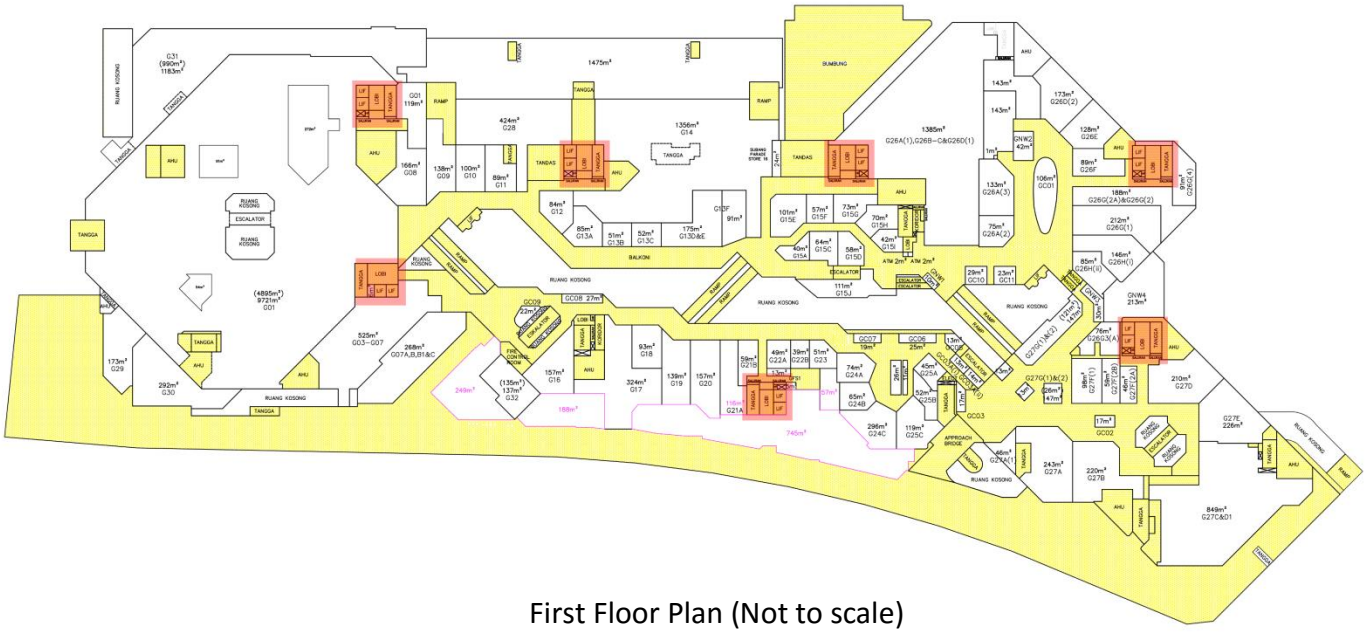
Photos below show the location of elevators, which are highlighted in red.



Basement Plan (Not to scale)



Ground Floor Plan (Not to scale)

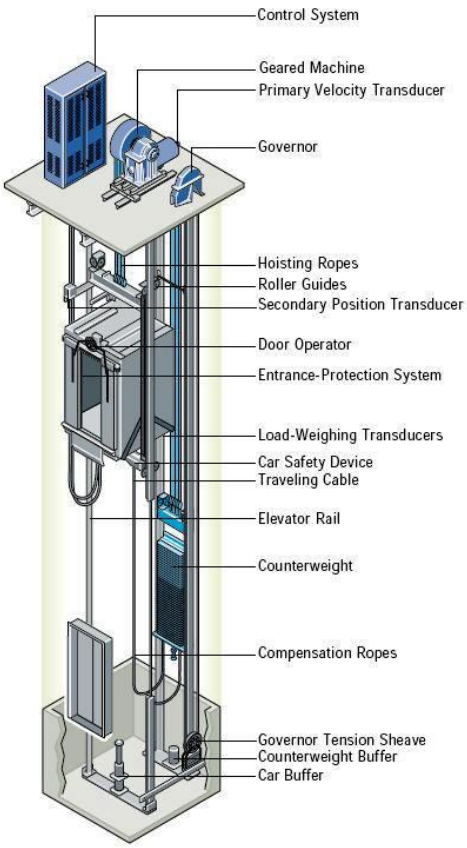


First Floor Plan (Not to scale)

4.1.3.1 GEARED TRACTION ELEVATOR

Geared traction elevators normally work at speeds greater than 500 feet per minute (2.54 meters per second). The elevator is lifted by ropes, which pass over the wheel attached to the electric motor above the elevator shaft. It is used for mid and high-rise applications and have much faster speeds compared to the hydraulic elevators. The counterweight makes the elevator much more efficient by offsetting the weight of the car and occupants so that the motor does not have to move as weight.

4.1.3.2 COMPONENTS



The components of a geared traction elevator consist of a car, cables, elevator machine, control equipment, counterweights, hoistway rails, penthouse and pit.

Car

The car is the only component that is familiarized by the passengers. The lift's car is basically a cage that is fire-resistant material, which is supported on a structural frame, to the member of which the lifting cables are locked so that the side members are protected and also the vertical members. The car is equipped with fire-safety doors, operating control equipment, floor level indicators, lights, emergency exits and ventilation. The car is designed for a long lasting operation life, low maintenance and soft operations.

Figure 7.1.3.2b: Car components.

Cables

Cables are ropes that are made out of steel wires distinctively design to withstand the weight of the lift car and its live load. The cables are connected from the crosshead – top beam of the elevator. The cables are positioned in parallel and the amount of the cables depends on the car speed and its capacity to hold users inside. The cables from the top of the car cross over the motor-driven cylindrical sheave at the traction machine and downward to the counterweights.

Counterweights

The counterweights are made up out of steel plates stacked on top of each other in a frame attached to the opposite ends of the cables to which the car is locked. It travels up and down the shaft, which is guided by the guide rails that are bolted in the back wall of the shaft. It also functions as:

- A grip to the lift's car.
- Reduce the power of the generator.
- Reduce the brake to stop the car lifts.

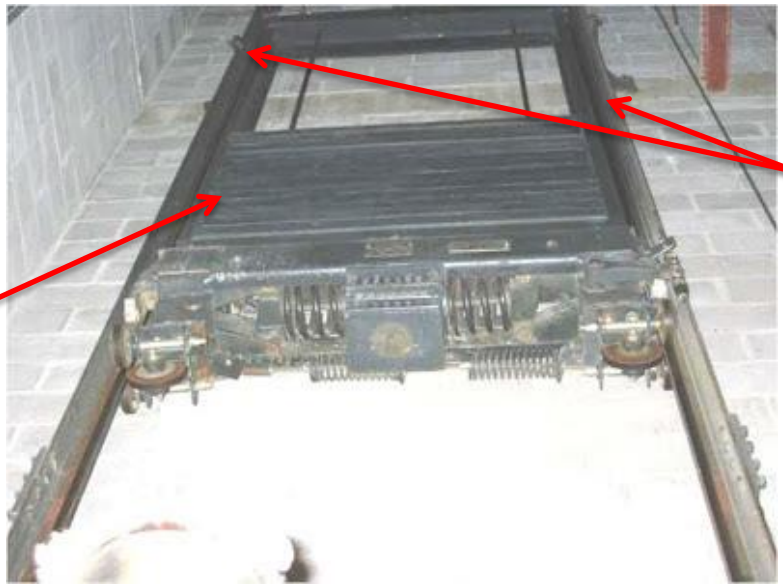


Figure 7.1.3.2d: Counterweights and guide rails.

Lift shafts and Pit

The shaft, or also called the hoistway, is the vertical void that acts as a passageway for the lift car and also the counterweights. The size of the shaft depends on the size, speed of car and the type of door gear. The lift shaft is extruded below to form a lift pit. The lift pit must be watertight and drainage must be provided to prevent from any short circuits.

4.2 ESCALATOR

4.2.1 CASE STUDY

Figure 7.1.3.2e: Lift pit

An escalator provides an immediate means of transportation. It is also referred as a moving stairway or an electric stairway. It is a modern successor that delivers passengers comfortably, rapidly, safely and continuously. It moves at a constant speed and usually has no delays at the boarding level. It is quick and reliable and most times because it requires no waiting time. It is also reversible to suit the main flow of traffic during peak times.

An escalator should be easily seen and located. The carrying capacity of an escalator depends on its speed – which varies from 0.45 meter per second to 0.7 meter per second. The width of the tread varies from 600 millimeters to 1200 millimeters.
There are two types of arrangements of escalators:

- Criss-cross.
- Parallel.

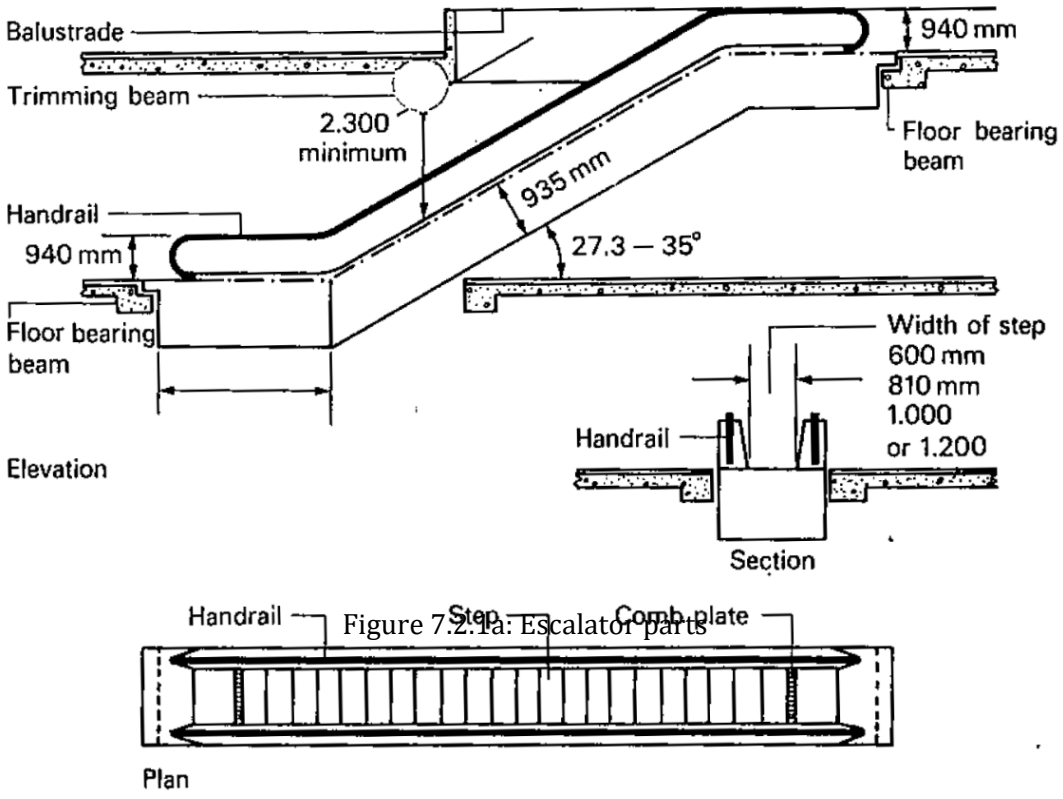


Figure 7.2.1a: Escalator parts

4.2.3 ARRANGEMENTS

CRISS CROSS ARRANGEMENT

The criss cross arrangement allows rapid, comfortable and very economical of space because the escalators are next to each other.

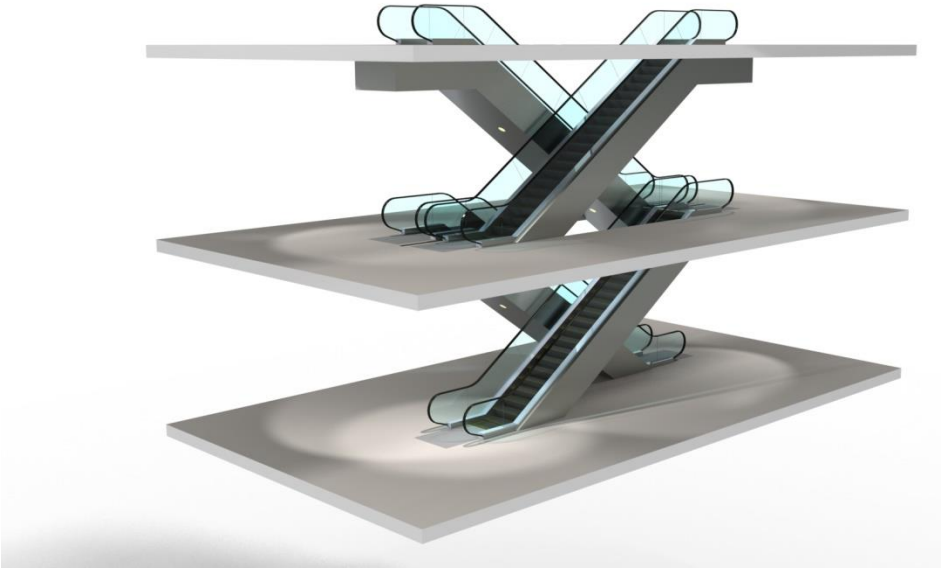
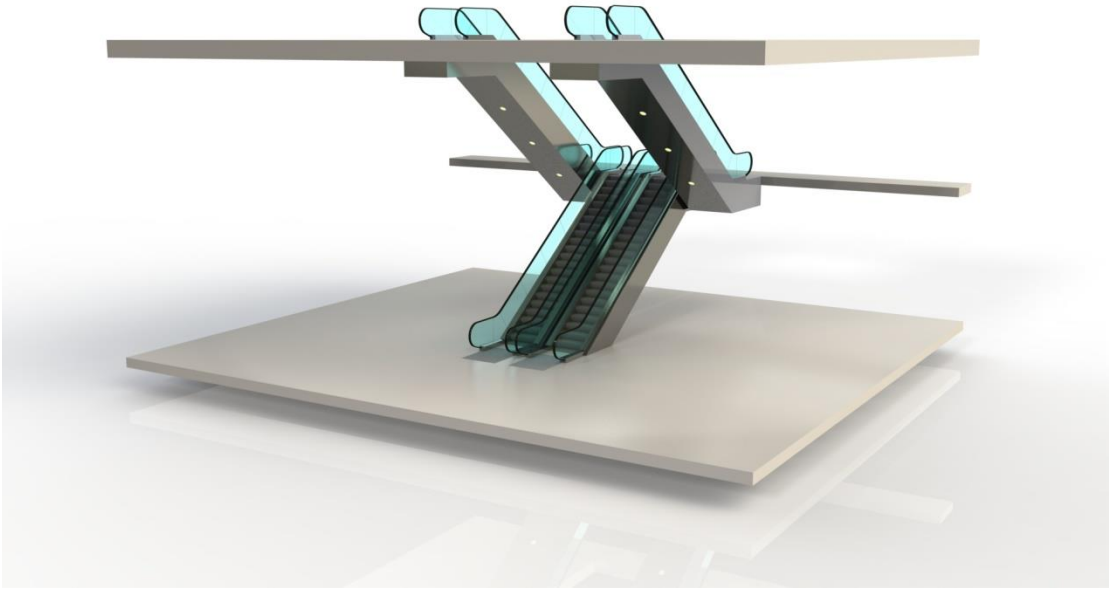


Figure 7.2.3a: Criss cross escalator.

PARALLEL ARRANGEMENT

Parallel arrangement gives out a remarkable appearance in design matters but it is unpleasant for the users because they are forced to walk around to the other end of the escalator to continue their journey whether up or down.



4.2.4 COMPONENTS

Figure 7.2.3b: Parallel escalator.

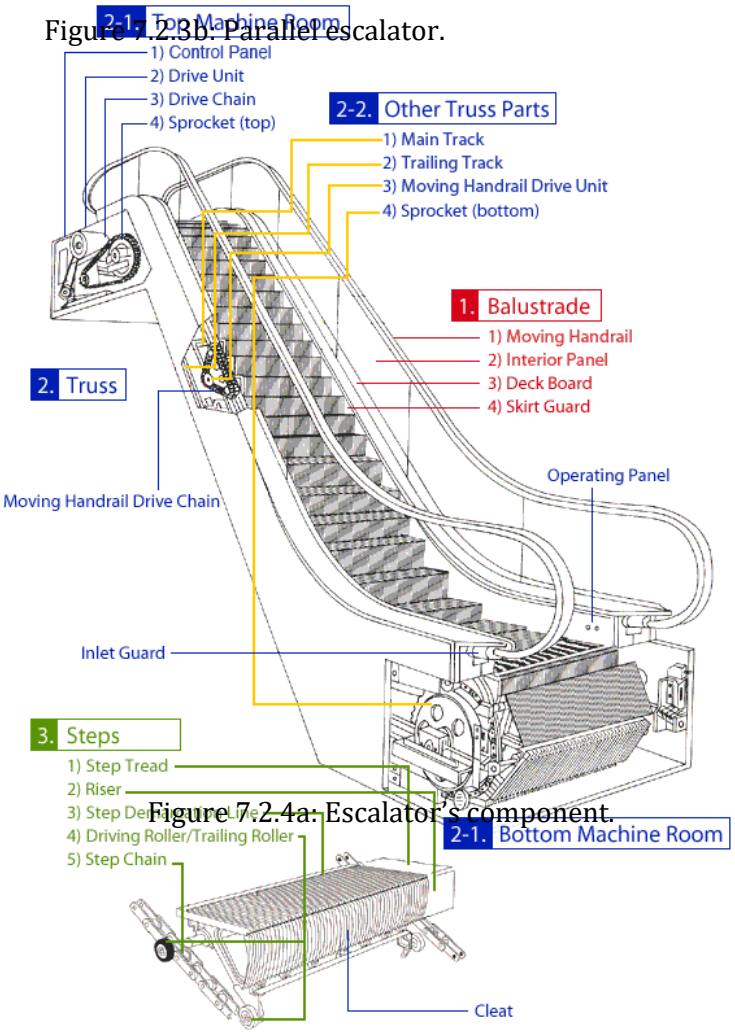


Figure 7.2.4a: Escalator's component.

4.3 CONCLUSION

As the conclusion, the mechanical transportation system of San Andreas Mall, Subang Jaya is applicable for the function of the building as a shopping centre. It is designed and projected accordingly to UBBL to provide an optimum experience for its customers.

5.0 ACTIVE & PASSIVE FIRE PROTECTION

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ELLEN GOWIKO	0318496

5.0 ACTIVE & PASSIVE FIRE PROTECTION

5.1 LITERATURE REVIEW

Fire protection is the procedures and safety measures where is conducted to prevent fire from becoming destructive by reducing the impact of uncontrolled fire which could ensure safety of the people in the building. Fire protection system is involving the implementation of safety planning practices and includes education of fire, safety planning, investigation, building construction, safe operation, investigation, training and testing of mitigating systems.

There are three basic essentials of fire protection:

1. Study of Fire

   To learn the causes and extinguishing techniques fire, detection and extinguishing equipment and the uses of it, also the rules and regulations related to the building construction.

2. Active Fire Protection

   Active fire protection is includes manual and automatic detection of fire, firefighting and first aid, also the use of fire and smoke alarms.

3. Passive Fire Protection

   In passive fire protection, the fire regulations in force must be implemented in factories, living areas, public and transportation. Design and infrastructures of building, use of fire resistance material in construction, provision of isolating fire, fire walls and doors, smoke doors, training of firefighting, signage, also markings and evacuation of building in case of fire will be discussed. Education of fire and regular drill practices are also major compliance to the passive fire protection issue.

5.1.1 AIM

The aim of the fire protection systems is categorized into active and passive fire protection system which is to avoid the spread of fire from one particular area to another area in the building. This would allow people to escape safety from fire as it would control and reduce on damaging the buildings as well as reducing the risk on collapse of emergency system.

5.1.2 EDUCATION

It is a must for operator to understand the emergency precautions of the building. However, it is important for the inhabitant that occupies the building also should have a clear understanding of the safety security system code on the drawing plan whenever there is a fire. Therefore, fire escape plans should be provided. Function of the passive and active fire protection system in a fire as well as the blind spot of these systems should be covered in education system.

5.2 ACTIVE FIRE PROTECTION

Active fire protection systems are widely used in process industries. It is a group of systems that interacts with the surrounding and operates together, through some amount of action or motion in order to work efficiently in the event of a fire. Active fire protection systems can either be manually operated, (ie) a fire extinguisher, or automatic -through sensors, (ie) fire sprinklers. The system works through detection of fire or any other emergencies in a building, which then sends signals that would automatically activate it's components to control the situation. Active systems are more beneficial in buildings of larger scale, when natural ventilation, such as openings and windows are not able to combat the fire. The main purpose of an active fire protection systems are as follows ;

a) Extinguish the fire
b) Control the fire
c) Provide exposure protection to prevent fire from spreading

5.2.1 FIRE ALARM SYSTEMS

COMPONENTS

5.2.1.1 SMOKE DETECTORS

Smoke detectors are a series of interconnected systems, individually configured to detect the presence of fire. The main component of the system, which is the smoke alarm, identifies signs of an emergency such as smoke or an increase in temperature, which then issues a signal to the fire alarm control panel. This then activates an acoustic signal that would warn occupants to vacate the building. Smoke detectors are also usually positioned throughout the building.

UBBL 1984, Section 238 : Fire Alarm Sytems

Every building shall be provided with means of detecting and extinguisher fire and alarms together with illuminated exit signs in accordance with the requirements as specified in the tenth schedule to these by-laws.

TYPES OF SMOKE DETECTORS

In our case study, the San Andreas Mall uses two types of smoke detectors;

- **Photoelectric Smoke Detectors**

Photoelectric smoke detectors are operated through the reaction with light. It contains a light source in a light-sensitive electric sensor, which detects the presence of fire when light source hits the sensor. In the case of a fire, smoke scatters the light - which will clash with the sensor, hence triggering the alarm. This type of detector generally responds faster to fire, as it is more sensitive to the warning signs.

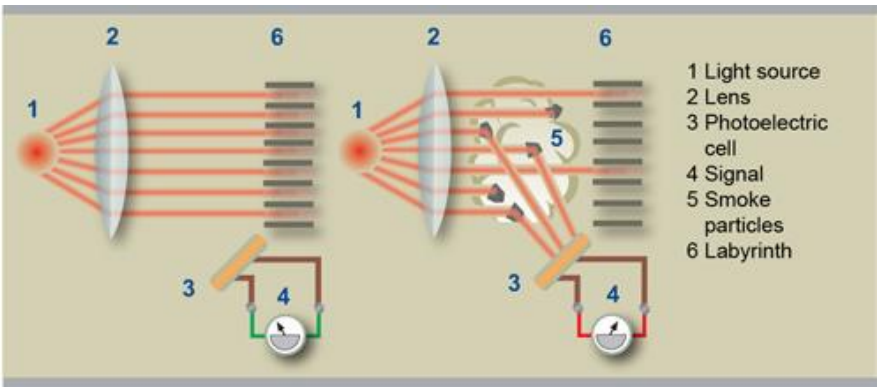


Figure 1 : Light source is scattered when smoke is present, which hits the smoke detector
(source : http://w3.usa.siemens.com/buildingtechnologies/us/en/fire-products-and-systems/fire-protection-products/fire-detection/smoke-detection-knowledge-center/modern-smoke-detection/pages/modern-smoke-detection.aspx)

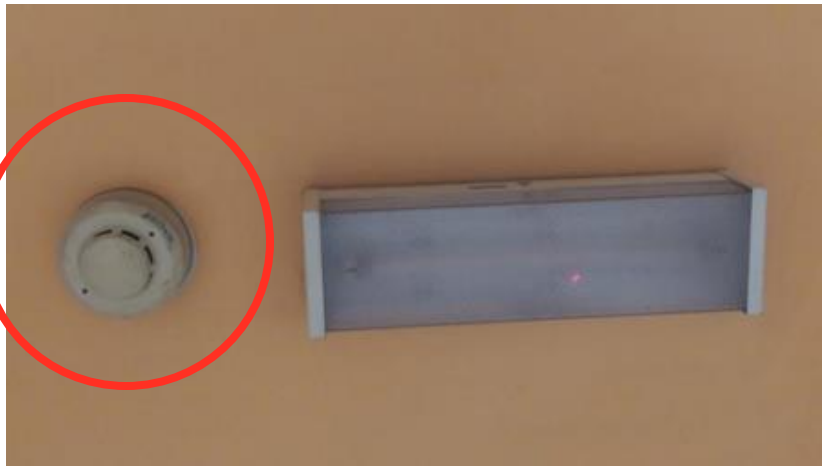


Figure 2 : Photoelectric smoke detector found in San Andreas Mall

5.2.1.2 FIRE CONTROL ROOM

The fire control room or the fire command station is the main location where signals from the fire detection system and control systems are displayed, and from which all systems can be manually controlled. This is where the main fire control panel is located. The fire control panel receives information from sensors that detect the presence of fire, provides automatic control of equipment, and transmits necessary information to prepare the building in events of a fire.

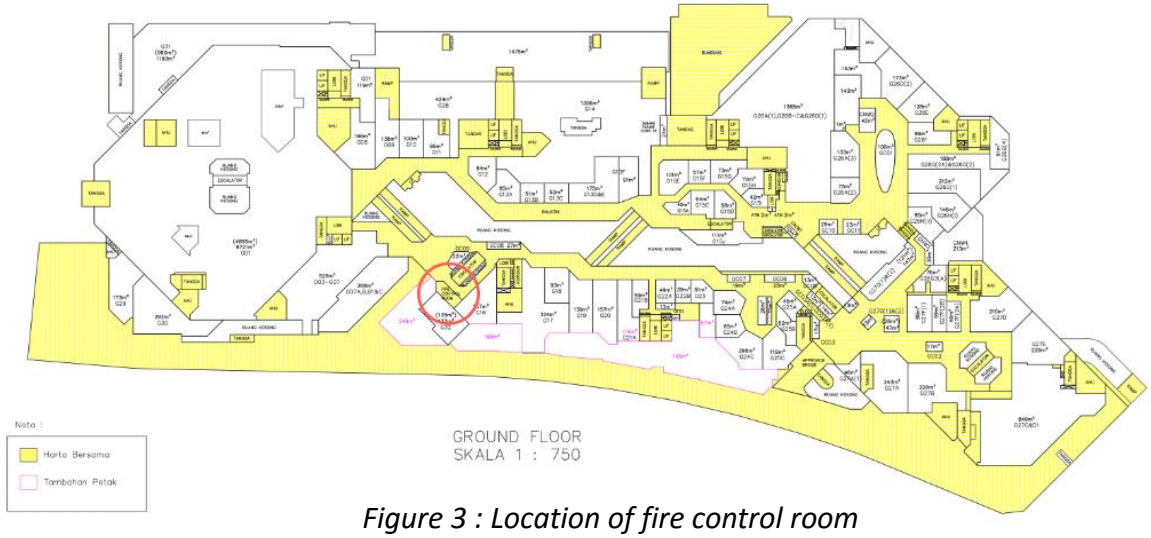


Figure 3 : Location of fire control room

Some of the requirements of a fire control room are as follows ;

a) Components of fire protection systems such as combustion engines and sprinkler valves, etc should be placed in separate rooms that are accessible via the fire control room
b) The enclosing contruction of the fire control room should be made of concrete, masonry, or any high impact resistant materials that are able to withstand falling debris, in the case of an emergency
c) Door openings in the internal wall of the fire control room should be equipped with a self closing smoke sealed fire door
d) The fire control room should have a floor area of not less than 10 m2 and the length of any internal side must be not less than 2.5 m
e) The fire control room should be naturally ventilated from a window/doorway in an external wall of the building, which opens directly into the room from an open space.

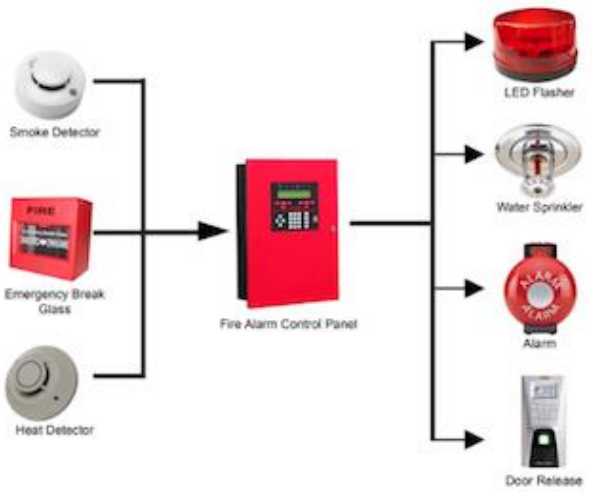


Figure 4 : transmission of fire signals through fire control panel

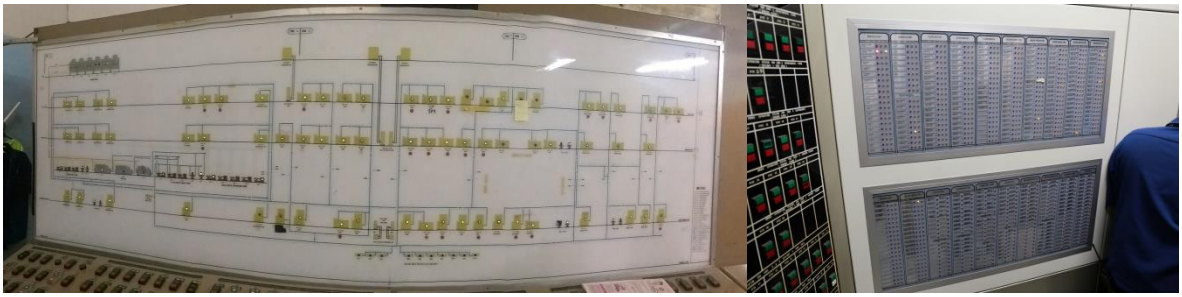


Figure 5 : control panels in the fire control room

UBBL 1984, Section 238 : Command and Control Centre Every large premises or building exceeding 30.5 meters in height shall be provided with a command and control center located on the designated floor and shall contain a panel to monitor the public address, fire bridge communication, sprinkler, water flow detectors, fire detection and alarm systems and with a direct telephone connection to the appropriate fire station by passing the switchboard.

UBBL 1984 Section 155: Fire mode of operation The fire mode of operation shall be initiated by a signal from the fire alarm panel which may be activated automatically by one of the alarm devices in the building or manually

5.2.1.3 MANUAL CALL POINT

A manual call point is a device that allows occupants to signal the presence of a fire in a building. It is connected to the control panel, which is connected to the alarm system. An indicator is present on the monitoring unit, to identify where the call is coming from to analyze the situation. It is also usually positioned in areas that is easily accessible by the occupants.

Figure 6 : Manual call point

Figure 7 : Monitoring unit at the control room, that indicates where the call point is operating from

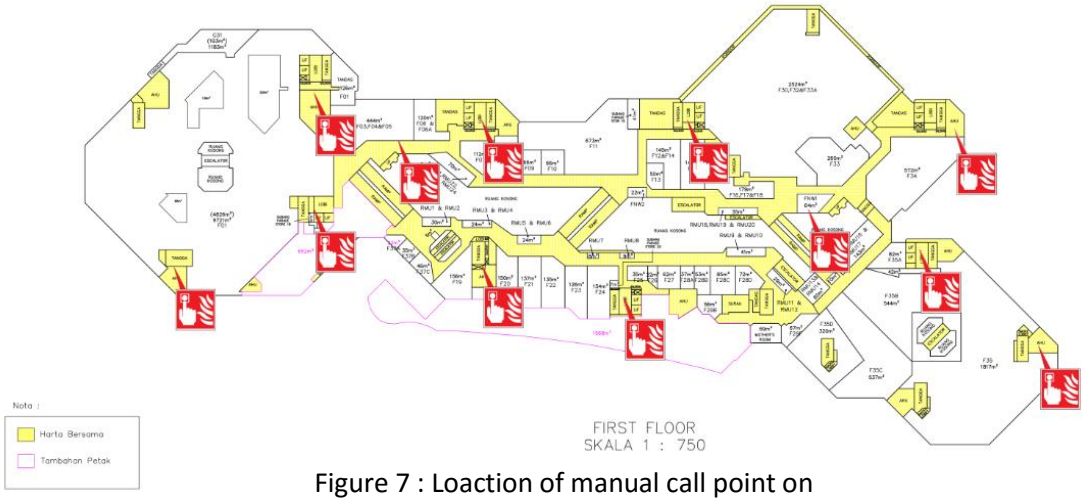


Figure 7 : Loaction of manual call point on

Some of the requirements of manual call points are as follows ;

a) To be placed at all storey exits and all exits to open air, regardless of whether or not they are designated fire exits
b) The distance between one call point to another should not be more than 45 metres apart
c) The above distance should be reduced to 25 and 16 metres respectively, if there are occupants with limited mobility or there is a likelihood of rapid fire development
d) Manual Call Points should be positioned 1.4 metres + or - 200mm above the floor

5.2.1.4 FIREMAN INTERCOM SYSTEM

The fireman intercom system provides a two-way communication between the remote telephone handset located in buildings, and the master telephone located at the fire command centre. The remote handsets are located at the fire exit staircases of each floor. In the events of a fire, a call lamp with signals will flash at the control panel to indicate where the call is coming from. The signal is then silenced once the call is accepted.

Figure 8 : Fireman intercom system remote handsets

Figure 9 : Emergency and EWIS at the fire control room

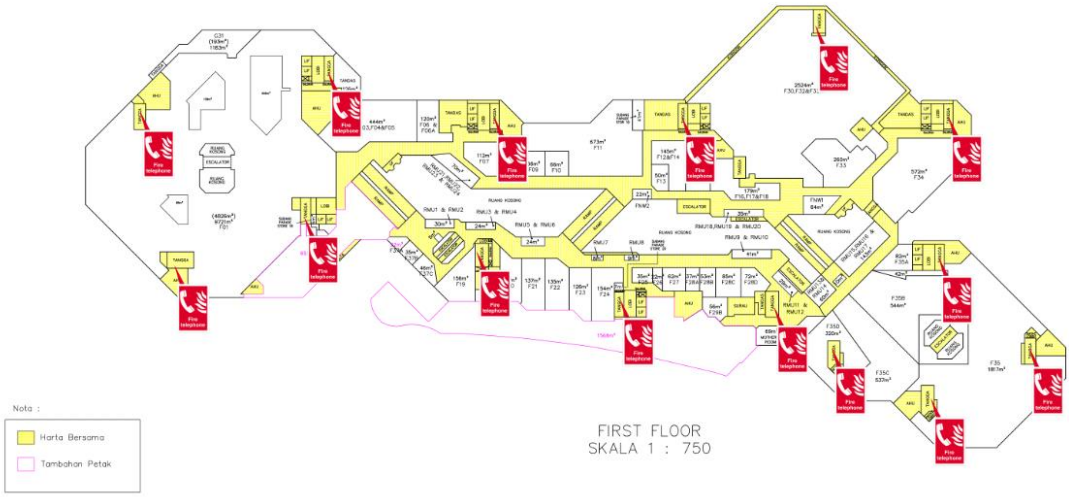


Figure 10 : Location of fireman intercom system

5.2.1.5 FIRE ALARM SYSTEMS

A fire alarm system is a notification appliance, consisting of components and circuits that work together to detect signals sent to the control panel and transmitting them in a form of an output to warn people when smoke, fire, carbon monoxide or other emergencies are present. Alarms are triggered from smoke detectors or heat detectors.

TYPES OF FIRE ALARM SYSTEMS

a. Fire Alarm Bell

Fire alarm bells are devices that deliver high sound pressure output to signal people in the events of a fire. It transmits a unique distinctive sound that would not confuse the occupants with other signals. The alarm bell can be triggered both automatically and manually via the smoke detector or a manual call point. When smoke is detected, or when a call point is triggered, the alarm bell will release a sound to alert occupants to evacuate the premises.

b. Fire Emergency Light

Figure 11 : Fire alarm bell

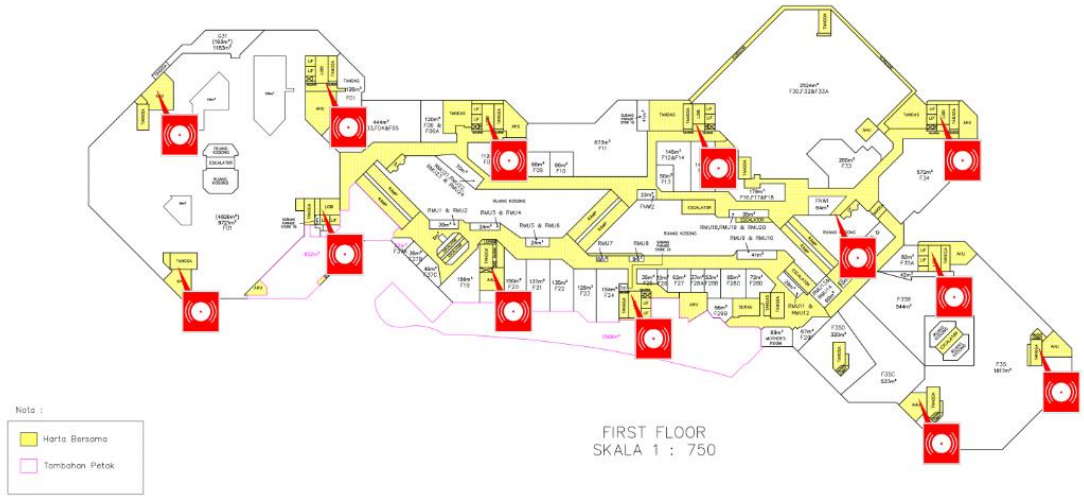


Figure 12: Location of fire alarm bell

UBBL 1984, Section 155: 1. The fire mode of operation shall be initiated by a signal from the fire alarm panel which may be activated automatically by one of the alarm devices in the building or manually.

UBBL 1984, Section 255: 1. Every building shall be provided with means of detecting and extinguishing fire and with fire alarms together with illuminated exit signs in accordance with the

5.2.2 SPRINKLER SYSTEM

A fire sprinkler system is a system that utilize water by using it directly onto fire and heat, which cause the combustion to cool down and prevents it from spreading. The fire sprinkler system is most useful during the intial stages of a fire growth, when it is still easy to control.

COMPONENTS

5.2.2.1 SPRINKLER

Each sprinkler is equipped with a heat sensitive element to detect a fixed temperature of 68 degree c. When the temperature reaches 68 degree c, the sprinkler is automatically activated.

TYPES OF SPRINKLERS

c. Pendent Sprinkler

A pendent sprinkle is a common type that is used throughout Subang Parade. It is recessed from the ceiling, with its head pointed downwards, and creates a circular sprinkle pattern. A pendent sprinkler can be installed directly on the sprinkler branch line or from a drop nipple.

Figure 13 : Pendent sprinkler

d. Upright Sprinkler

An upright sprinkler is a type that its head is installed on the top of the sprinkler piping. An upright sprinkler is installed close to the ceiling so the operating element of the sprinkler will operate quickly in a fire.

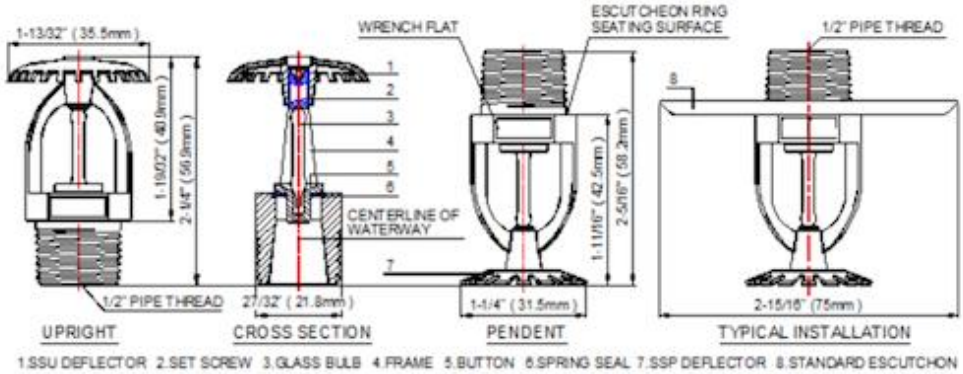


Figure 14 : Sprinkle head specifications

UBBL 1984, Section 25: 2. All sprinkler system shall be electricity connected to the nearest fire station to provide immediate and automatic relay of the alarm when activated

5.2.2.2 SPRINKLER PUMPS

The sprinkler pump is the source of water for the fire sprinklers. It obtains its water supply from either the public underground water supply, or a static water source such as tanks or reservoirs. It provides water supply at a high pressure to the sprinkler riser and hose, when there is a drop in pressure at the sprinkler system due to exposure to heat.

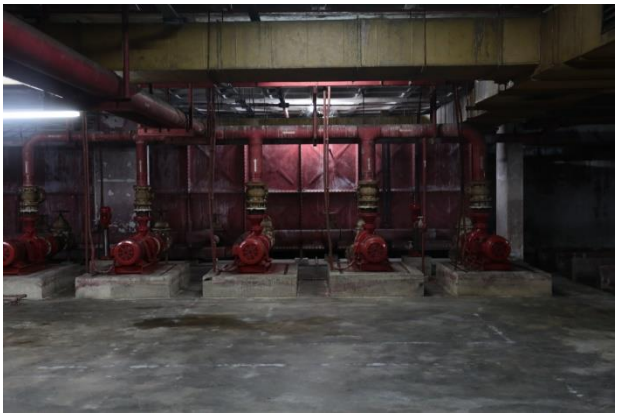


Figure 15 : Sprinkler pumps located at lower ground floor

UBBL 1984, Section 247: Main water storage tanks within the building, other than for the hose reel system, shall be located at ground, first or second basement levels, with fire brigade pumping inlet connection accessible to fire appliances.

5.2.2.3 OPERATION SYSTEM

An automatic fire sprinkler system is supplied with water coming from a reliable source. When a sprinkler is exposed to a certain temperature that exceeds the temperature rating of the heat sensitive element (68 degree c) , for a certain amount of time, the pressure of the sprinkler drops, and releases water flow from the sprinkler. When this occurs, the water from the water supply will pass through the alarm valve and the alarm bell system. The drop in pressure will also activate the alarm pressure switch, to indicate the presence of fire. The water supply may be stopped, by closing the stop valve.

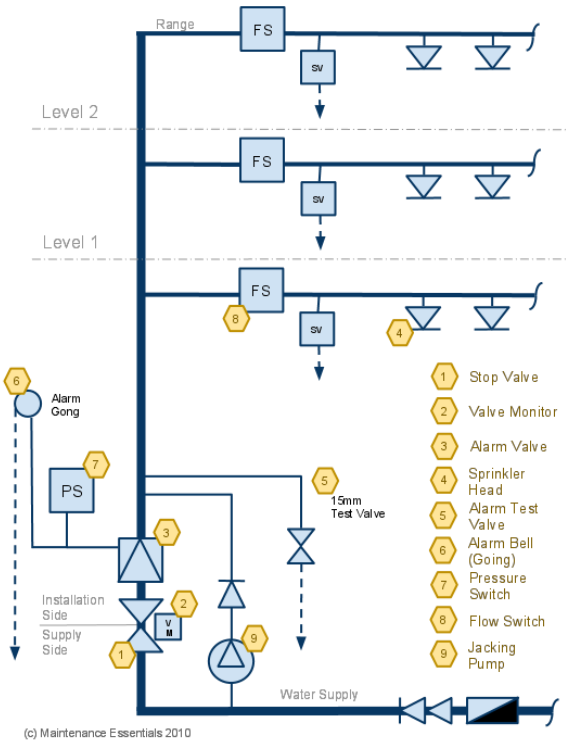


Figure 16: Fire sprinkler operation system

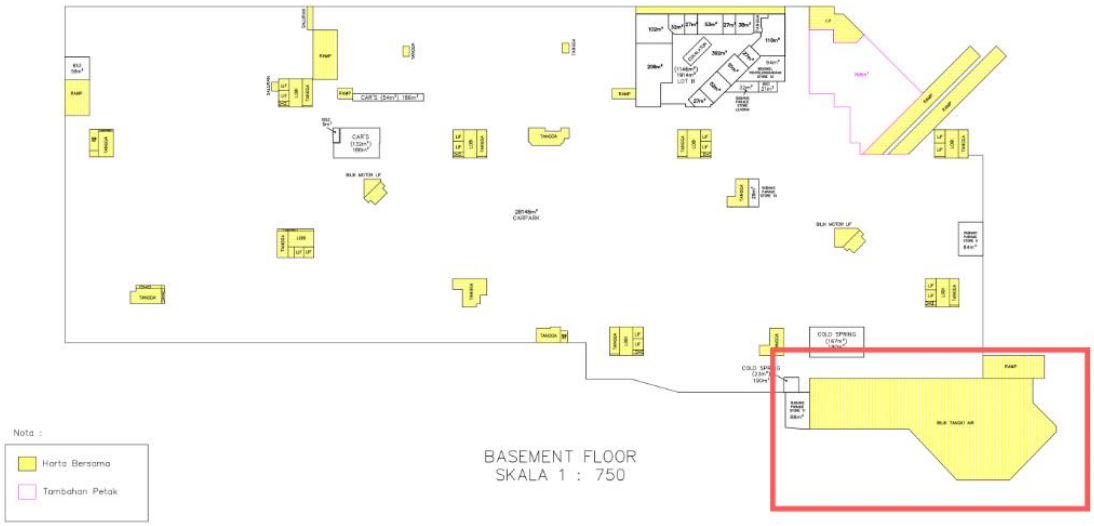


Figure 17: Location of sprinkle pumps at basement

5.2.3 HOSE REEL SYSTEM

Fire hose reels are located strategically throughout the building, in order to provide accessible and controlled water supply for fire extinguishing. It is manually operated, by opening a valve to allow water flow into the hose. The system pressure loss will trigger the pump, ensuring the right amount of water flow and pressure to release a jet of water that shoots up to 10 meters away from the nozzle.

COMPONENTS

5.2.3.1 HOSE REEL DRUM

The hose reel drum is fixed on specific locations on every floor of San Andreas Mall, connected to a fire pump set.

Figure 18: Hose reel drums

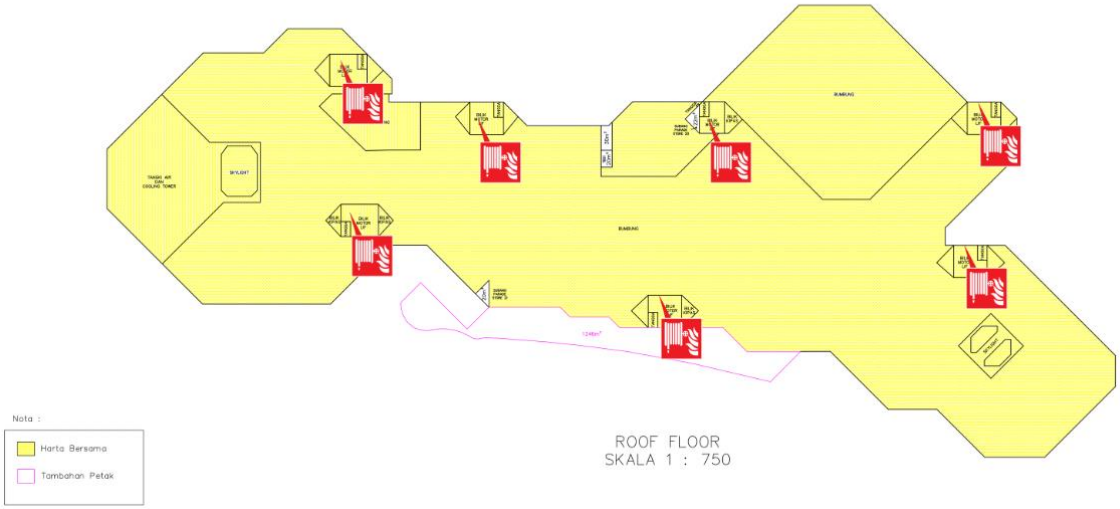


Figure 19: Location of hose reel

Some of the hose reel design requirements are as follow ;

- The discharge capacity of the hose reel is at 30 litres per min
- The hose reel jet and nozzle should be adjustable
- Water pressure from the nozzle should be at least 20 ft
- The pump set should be installed at a protected area

5.2.3.2 HOSE REEL TANK

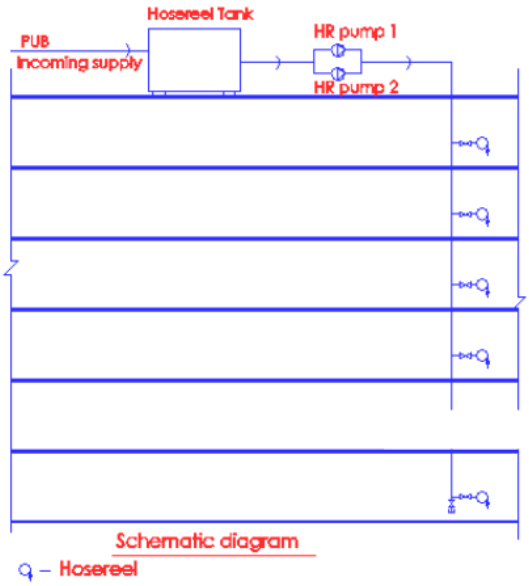


Figure 20: Location of hose reel tank

UBBL: 248. (1) Wet riser, dry riser, sprinkler and other fire installation pipes and fittings shall be painted red. 248. (2) All cabinets and areas of recessed in walls for location of fire installations and extinguishers shall be clearly identified to the satisfaction of the Fire Authority or otherwise clearly identified.

5.2.4 WET RISER SYSTEM

The purpose of a wet riser system is to ensure readily available water supply for fire fighting purposes, in the event of a fire so that fire fighters do not need to create their own distribution system. It is equipped with landing valves at specified points of each floor to ensure enough water supply.

COMPONENTS

5.2.4.1 WET RISER

A wet riser is an equipment that is constantly charged with water, in comparison to dry risers, which are not charged through fire service pumping appliances. Wet risers are charged with water from a pressurized supply, often supplied from a storage tank, with landing valves at specified locations on each floor. It should be located within the fire fighting shafts/protected escape stairs.

Figure 20: Wet riser

UBBL 1984, Law 23: Installation and testing of wet rising system

1) Wet rising system shall be provided in every building which topmost floor is more 30.5m above the fire appliance access level

2) A hose connection shall be provided in each fire fighting access lobby

3) Each wet riser outlet shall comprise standard 63.5mm coupling fitted with a hose of not

5.2.4.2 SYSTEM OPERATION

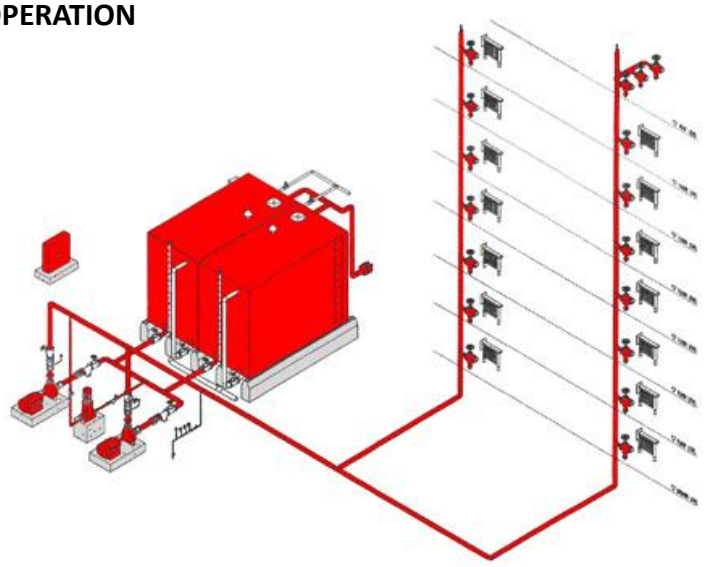


Figure 21: Wet riser operating system

Wet riser system comprises of vertical pipes with landing valves at each floor except ground level. The tanks are outfitted with automatic warning systems to imply low water level. Wet risers are designed to supply 1500 litres per minute for 45 minutes minimum. Water pressure reduction valves are also included due to the height of the building.

5.2.5 FIRE EXTINGUISHER

The fire extinguisher is an equipment used to control fire in cases of an emergency. It is a portable equipment that releases a jet of water, foam, gas, or other material to extinguish a fire. Every floor of the San Andreas Mall is equipped with a fire extinguisher, near the fire escape doors and hose reels. Fire extinguishers should also be easily accessible for occupants.

> *UBBL 1984, Section 227: Portable Fire Extinguisher shall be provided in accordance with relevant codes of practice and shall be sited in prominent position on exit routes to be visible from all direction and similar extinguishers in a building shall be of the same method of operation.*

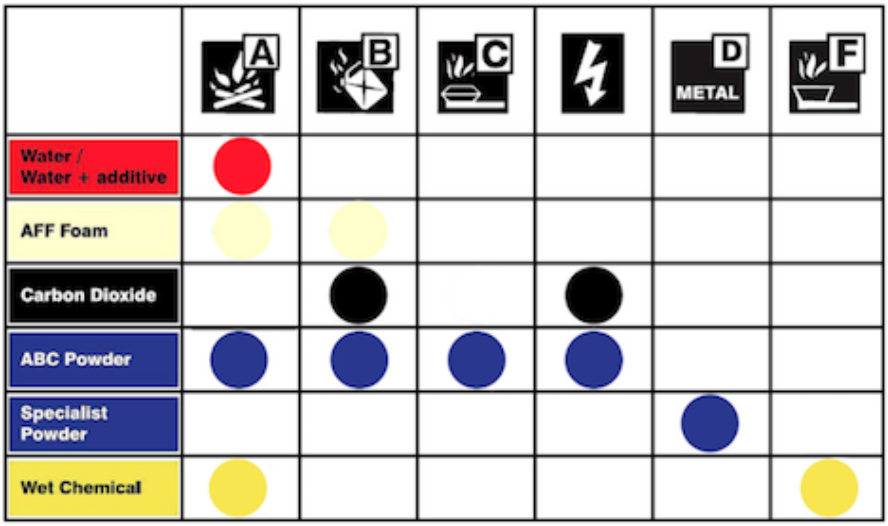


Figure 22 : Fire extinguisher chart

COMPONENTS

5.2.5.1 ABC POWDER FIRE EXTINGUISHER

The ABC Powder extinguisher is one of the most common powder extinguishers used. It is a multipurpose fire extinguisher that can be used on class A, burning solids, class B, liquid fires, and class C, gases and is filled with mono-ammonium phosphate powder.

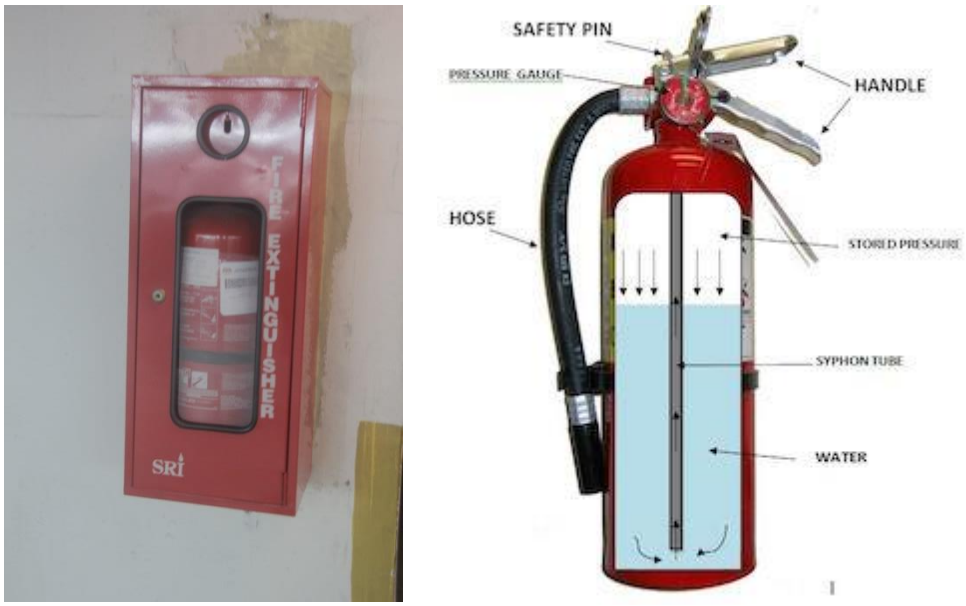


Figure 23: ABC Powder extinguisher

5.2.5.2 CARBON DIOXIDE FIRE EXTINGUISHER

Carbon dioxide extinguishers are packed with non-flammable carbon dioxide gas that is under extreme pressure. It is identifiable by its horn and lack of pressure gauge. It can only be used on class B, flammable liquid, and class C, electrical equipment, as the normal ABC powder can damage electrical equipment.

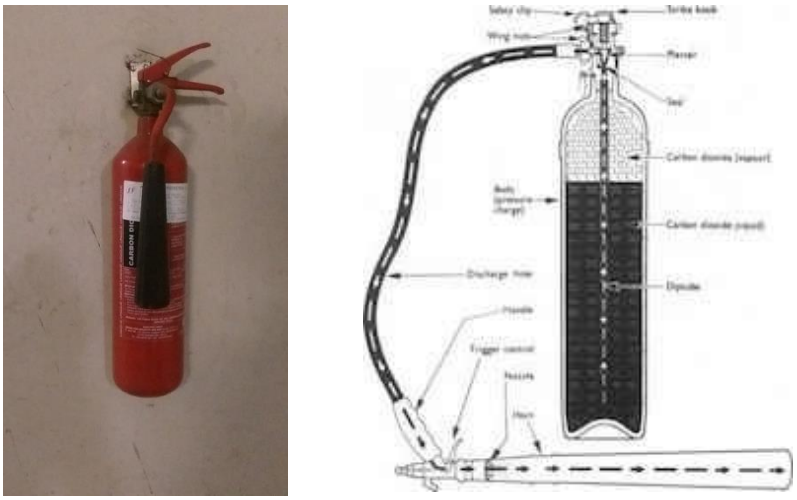


Figure 24: Carbon dioxide fire extinguisher

5.2.5.3 SYSTEM OPERATION

The operating system for a fire extinguisher can be easily remembered through the PASS system :

- **P**: Pull the pin. The first step is to pull out the pin that is located on the top of the fire extinguisher. Pulling the pin releases the fire extinguisher's locking mechanism that allows you to operate the fire extinguisher.
- **A**: Aim. After pulling the pin, aim the fire extinguisher at the base of the fire. It is important to aim at the base of the fire, not at the flames, since the fuel of the fire is located at its base.

Figure 23: ABC Powder extinguisher

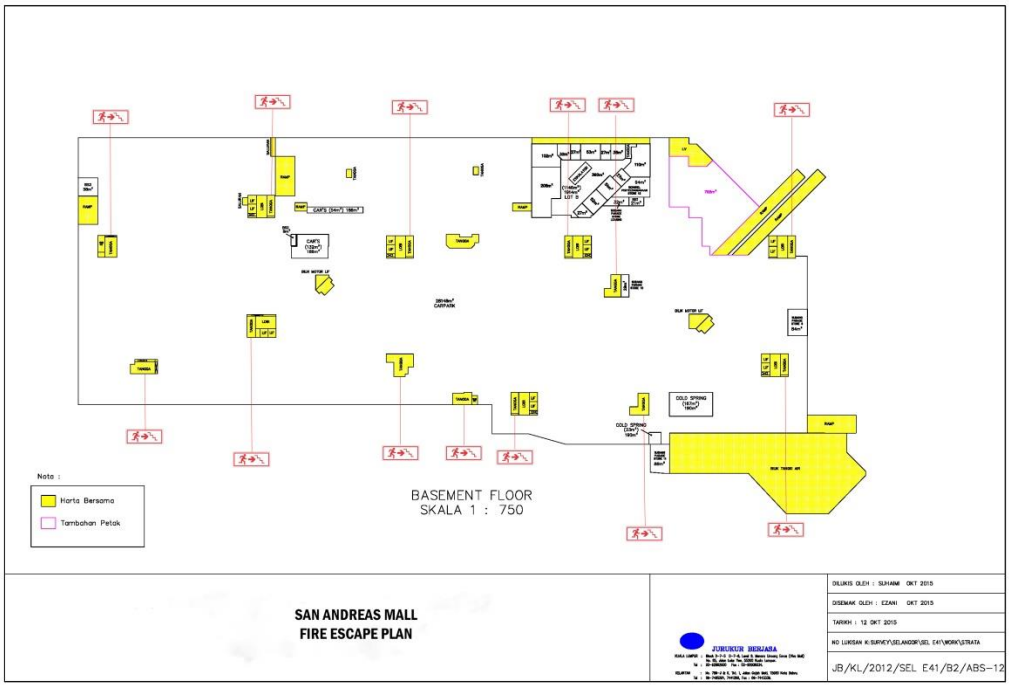
- **S**: Squeeze the lever. Slowly squeeze the lever to release the extinguishing agent in a controlled manner. To stop the discharge, let go of the lever. Remember that the extinguisher only holds a limited amount of extinguishing agent, usually lasting around 10 seconds, so use it wisely.
- **S**: Sweep. Move the fire extinguisher back and forth across the base of the fire until it has been completely extinguished. Stand a safe distance away, and as the fire begins to recede, more forward.

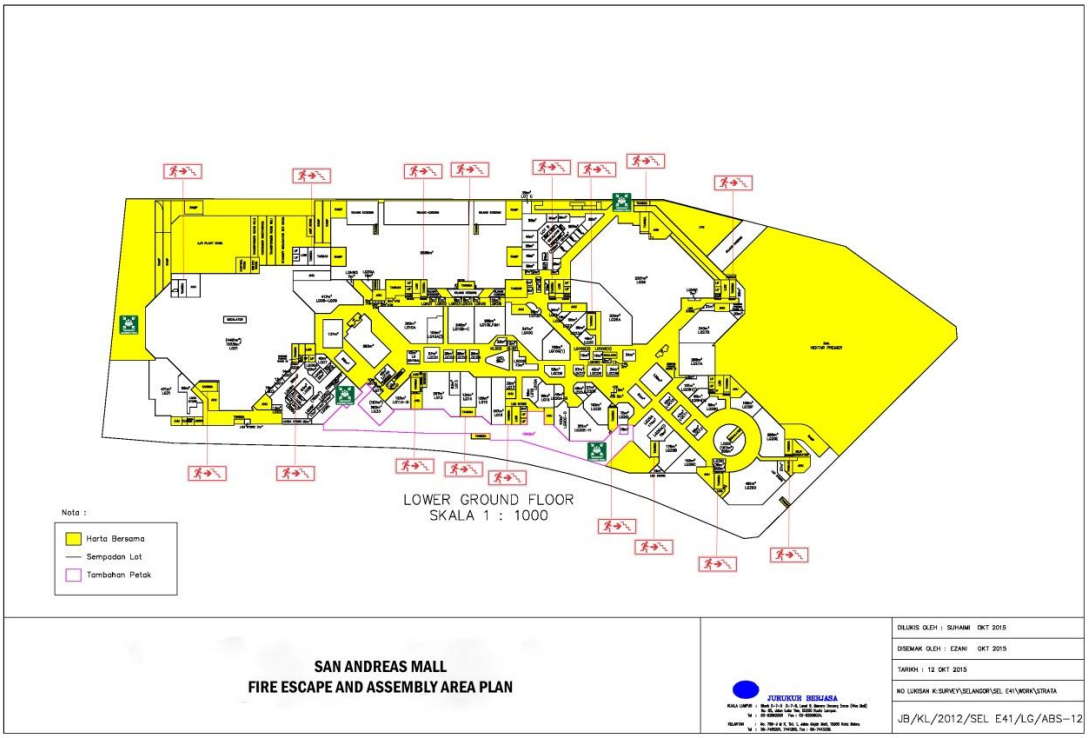
5.3 PASSIVE FIRE PROTECTION (PFP)

Passive fire protection is the primary measure integrated within the constructional fabric of a building to provide inherent fire safety and protection by responding against flame, heat and smoke to maintain the fundamental requirements of building compartmentation, structural stability, fire separation and safe means of escape. Passive fire protection measures achieve their intended purpose by raising the fire resistance of the structure, protecting the structure against the effects of fire, reducing fire spread through secondary ignition, limiting the movement of flame and smoke, and minimizing the danger of fire-induced collapse or structure distortion. PFP design, incorporating passive fire protection materials, systems and assemblies, serves by fire containment to protect life, safeguard the building structure, protect assets, maintain building serviceability after fire, minimize rebuild costs, and facilitate quick business recovery and continuity.

5,3,1 PASSIVE FIRE PROTECTION SYSTEM

In a large building, fire escape plans are the most part that should not be neglected because when dwellers are having an emerge situation, they will refer to the plan and know where to exit from the building to the assembly point by not using any elevators. However, the routes and exits is displayed right in front of all lifts' lobby areas to allow occupants safety and capable to escape from fire or smoke as a fire fighting access lobby or a fire protection area.




LOWER GROUND FLOOR
SKALA 1 : 1000
Nota :
Harta Bersama
Sempadan Lot
Tambahan Petak
SAN ANDREAS MALL
FIRE ESCAPE AND ASSEMBLY AREA PLAN
JURUKUR BERJASA
DILUKIS OLEH : SUHAIMI OKT 2015
DISEMAK OLEH : EZANI OKT 2015
TARIKH : 12 OKT 2015
NO LUKISAN K:\SURVEY\SELANGOR\SEL E41\WORK\STRATA
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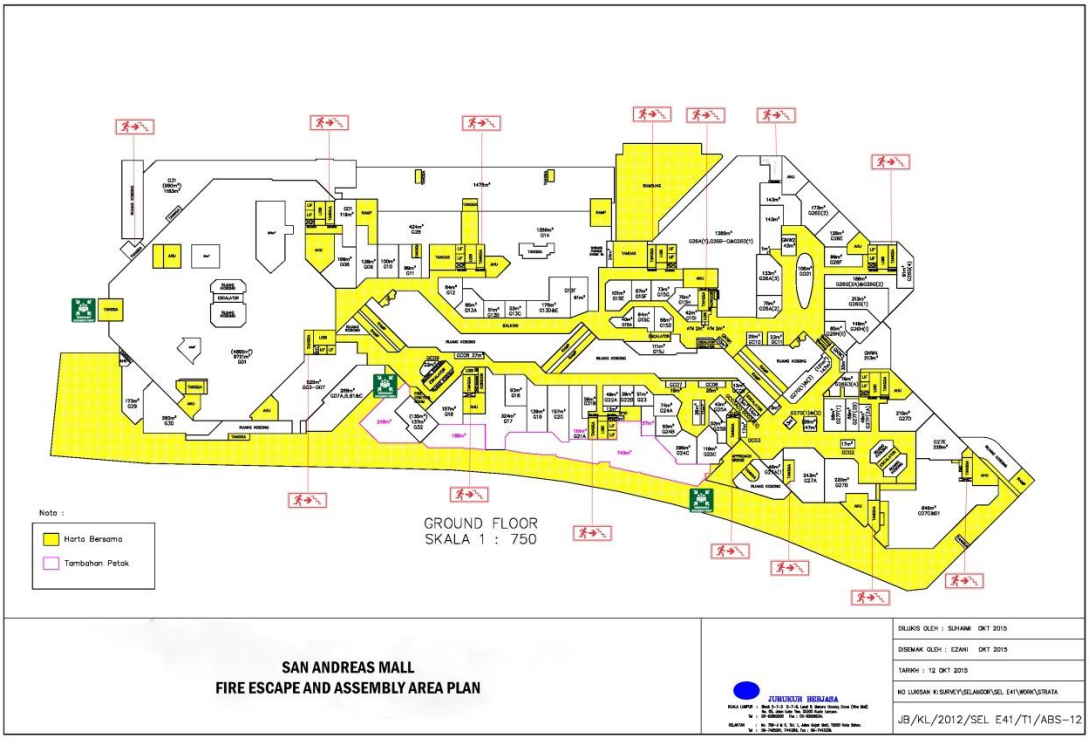
GROUND FLOOR
SKALA 1 : 750
Nota :
Harta Bersama
Tambahan Petak
SAN ANDREAS MALL
FIRE ESCAPE AND ASSEMBLY AREA PLAN
JURUKUR BERJASA
DILUKIS OLEH : SUHAIMI OKT 2015
DISEMAK OLEH : EZANI OKT 2015
TARIKH : 12 OKT 2015
NO LUKISAN K:\SURVEY\SELANGOR\SEL E41\WORK\STRATA
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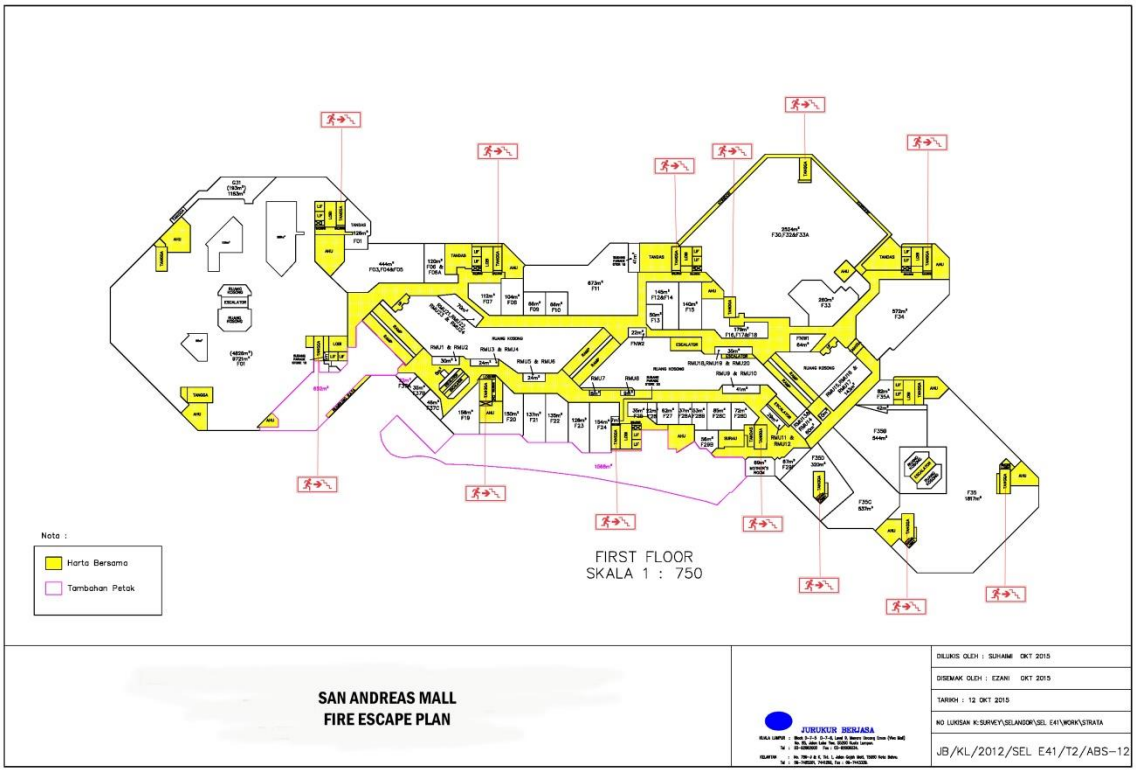


According to UBBL 1984: Enclosing Means of Escape in Certain Building

1. Every staircase provided under these By-Laws in a building where the highest floor is more than 120mm above the ground level, or in any place of assembly, or in any school when such staircase is to use as an alternative means of escape shall be enclosed throughout its length with fire resisting materials.
2. Any necessary openings, except openings in external walls which shall not for any purpose of this By-Law include wall to air wells, in the length of such staircase shall be provided with self-closing doors constructed of resisting materials.

5.3.2 FIRE EXIT DOOR

Exit route doors must be unlocked and free of any device or alarm that could restrict emergency use of the exit route if the device or alarm fails. It needs to be installed or built by using solid hardwood core with an asbestos insulating board with an hour of fire resistance. The door has to be installed with a metal push blade inside and a door closer outside. It also needs to be allocated at every escape door with the dimension of 1800mm x 2100mm x 38mm for each double leaf escape door.

According to UBBL 1976, Chapter 7, Part 7:

- 7.7.2.6 Markings on exit doors

All the exit doors and other types of doors is provided for egress purposes shall be painted in red or identified by a red luminous band that is not less than 18 inches broad across the full width of the door and positioned not less than 26 includes from the floor level. All such doors shall be readily distinguishable from the adjacent surfaces.

- 7.7.2.7 Exit doors to be openable from inside without use of key

All the exit doors need to be an openable from the inside without the use of key or any special knowledge or effort. Exit doors need to close automatically when it released and all door holding device including magnetic door holders, shall release the doors upon power failure or an acuation of the fire alarm.

According to UBBL 1976, Chapter 7, Part 4:

- 7.4.1.6 Exits to be accessible at all times

Exits shall be located and exit access shall be arranged that exits are readily accessible at all times. Exits are no immediately accessible from and open floor area, safe and continuous passageway or corridors leading directly to every exit in order to arrange and provide a convenient access for each occupant for at least 2 exits separate ways of travel should.

- 7.4.1.7 Exit access not to lead towards high hazard occupancies

Exit access should be arranged that it will not be necessary to travel towards any area of hazard occupancy in order to reach the nearest exits.

5.3.3 EMERGENCY EXIT SIGNAGE

Fire excape signs are provided to guide people to from whenever people are in the building, via a place of relative safety (the escape route) to the place of ultimate safety (the assembly area). Fire escape signs are green and white – safe condition. They must comprise a pictogram, an arrow, and possibly words. In Malaysia, the emergency exit signage of ‘KELUAR’ means ‘EXIT’, is to direct people a shortest route to a place of safety within a building which lead to the outside of building.

According to UBBL 1976, Chapter 7, Part 7:

- 7.7.2.1 : Emergency exit signs

The emergency exit signage where is required, exits and access to such exits shall be marked by readily visible signs.

- 7.7.2.2 Visibility of exit signs

It consisted no decoration, furnishing of other equipment which will impair visibility of an exit sign shall be permitted.

- 7.7.3.2 Natural draught smoke vent

A sign reading 'KELUAR' or some sort of similar designation with an arrow indicating the direction shall be placed in every location where the direction of traveling shall be placed in every location where the direction of traveling to reach the closest exit is not immediately apparent.

- 7.7.2.4 Size of lettering for exit signs

Every exit sign shall be having the word 'KELUAR' in plainly legible letters which not less than 6 inches high with the principle strokes of the letters not less than ¾ inches wide and yet the lettering shall be in red against black background.

- 7.7.2.5 Exit signs to be illuminated continuously during period of occupancy

All the exit signs shall be illuminated continuously during the periods of occupancy.

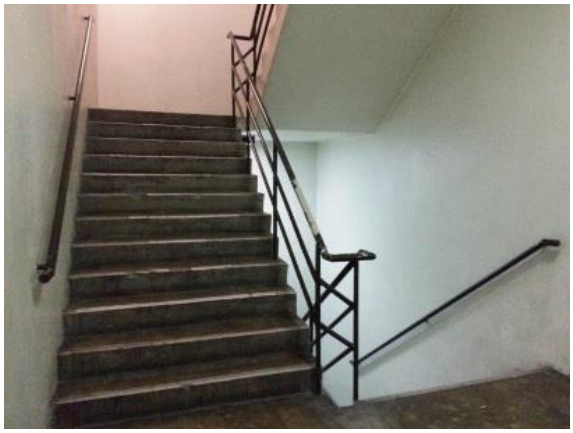
5.3.4 DOOR CLOSER

It is essential to apply door closer on top of all fire exit doors and yet function as in helping the fore door to close back immediately or automatically in preventing the spread of flame or smoke come inside from a space.

According to UBBL 1984, Section 162
All fire doors need to include frames that should be constructed in a specification that can be shown to fulfill the requirements for the relevant Fire Resistance Period (FRP) when it tested in accordance with the section 3 of BS 476: 1951.

5.3.5 FIRE ESCAPE STAIRCASE

For firefighting facilities, it consist fire escape staircases with the specific door boundaries at every level of the mall as well as in basement parking. Typically for fire escape staircase for this mall is U-shaped by providing a landing at each fight of the staircases as in material of cement concrete. It is necessary to provide landing on each fight of the staircases to ensure the dwellers do have enough circulation space to pass down from avoiding any injuries during emerge. There should be no obstruction in any staircase between the topmost landing thereof and the exit discharge on the ground floor. All the staircases should be properly lighted and ventilated according to the requirements of the Local Authority.



According to UBBL 1976, Chapter 6, Part 6: Dimension of Staircase

- 6.29.1: In any staircase, the rise of any staircase shall not be more than 7 inches and the tread shall not be less than 10 inches.
- 6.29.2: The width of staircases shall be clear widths.
- 6.29.3: The depths of landings shall not be more than the width of the staircases.

According to UBBL 1976, Chapter 7, Part 7:

- 6.34: Enclosure of staircase in a shop

In a shop, the flight of the stairs which has access direct from the street shall be enclosed with walls in combustible material.

According to UBBL 1976, Chapter 7, Part 7:

- 6.35.2: Use of timber staircase

All other staircases should have a fire-resistance rating of not less than 2 hours.

5.3.6 HANDRAILS

In terms of railings for staircase, it is important to provide a continuous railing instead of having suspended railings as well as without any obstruction matter in between. The flight for each staircases should be constructed with incombustible materials. The minimum height of the handrails should be 1000mm and diameter of 40mm. railing has to be 2 sided.

According to UBBL 1976, Chapter 6, Part 6: Handrails

- 6.30.1: All the staircases shall be provided with at least one handrail
- 6.30.2: In building other than residential buildings, a handrail should be provided each side of the staircase when the width of the staircase is 4 feet or more than that.
- 6.30.3: All handrails shall project not more than 3 ½ inches from the face of the finished wall surface.

5..4 CONCLUSION

San Andreas Mall is equipped with a good fire protection system that compiles the building laws and requirements stated in UBBL 1976. This is to assure the buildings, its occupants and contents are well protected from any possibility of fire occurs. Design with consideration that increase in the fire protection systems and provided a place of safety and security for the users of the buildings especially in the active fire system category, where it provides a lot of kind of fighting equipment, fire alarm detection and escape route in preparation in the event of fire. Safety is rest assured.

6.0 CONCLUSION

From the project we are able to identify and identify and understand relevant information related to mechanical ventilation, air-conditioning, and mechanical transportation system as well as fire protection systems. We were also understood how each building services functions including the connections and position of different parts. In addition, we manage to explain the principles and systems as well as space implications and regulations related to different building services. Thanks to San Andreas Mall for giving us the opportunity to analyse the service system & guiding us throughout the field trip.

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