TAYLOR'S UNIVERSITY
Wisdom • Integrity • Excellence

SCHOOL OF ARCHITECTURE, BUILDING, AND DESIGN

# BUILDING CONSTRUCTION I

**PROJECT 1:** *Experiencing construction*: Experiencing, documentation and analysing construction process

Tutor: Ar. Chin

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# INTRODUCTION

In a group of eight, we have visited, studied, and recorded three sites currently under construction. The purpose of this activity was to identify different types of building elements and their construction processes, details, and materials. The purpose of this activity was to document, analyse, and explain the various specifications, dimensions, standards, procedures, and so on related to building construction. As such, this is a documentation and reflection of our studies and recordings on the three sites previously mentioned above.

# INTRODUCTION TO SITE

Site 1

Our first site was a low-rise, three-storey semi-detached residential unit located in Sri Hartamas 17.

| | |
|---|---|
| **Architect** | **C.T. Architect**<br>Lot T8 (3rd Floor), Centrepoint,<br>Lebuh Bandar Utama, Bandar Utama,<br>47800 Petaling Jaya, Selangor Darul Ehsan, Malaysia |
| **Owner** | **Clear Concept Sdn. Bhd.** |
| **Civil and Structural Engineer** | **TYL Perunding Sdn. Bhd**<br>5-3A, Jalan SS 26/4, Taman Mayang,<br>47301 Petaling Jaya,<br>Selangor Darul Ehsan |
| **Mechanical and Structural Engineer** | **KVA Konsult**<br>55-1-1, Jalan Medan Putra 1,<br>Medan Putra Business Centre,<br>Bandar Manjalara, Selangor<br>Kuala Lumpur |
| **Quantity Surveyor** | **VQS Praktis Sdn. Bhd.**<br>2A-2 & 2A-M, Jalan PJU 5/22,<br>The Strand Kota Damansara,<br>47810 Petaling Jaya,<br>Selangor Darul Ehsan |
| **Contractor** | **BE Construction Sdn. Bhd.**<br>No. 3045-3, Batu 4-1/2,<br>Jalan Klang Lama,<br>58000 Kuala Lumpur |

Site 2

Our second site was the Avantas Residences, serviced suites that comprised of twenty-eight stories, plus one basement level parking lot. These sat upon Lots 1428 and 1245 of Jalan Klang Lama. The building would comprise of:

- 1 basement parking lot
- 1 commercial level
- 6 parking podium
- 1 recreational amenities / facilities podium
- 1 20-storey tower of serviced suites (198 units)

| | |
|---|---|
| **Owner** | **CPI Development Sdn. Bhd.**<br>Lot 3-53, Scott Garden 289,<br>Jalan Klang Lama, 58000 Kuala Lumpur |
| **Architect** | **A&A Architects Sdn. Bhd.**<br>B-7-8, Block B, Megan Avenue 1, No. 189, Jalan Tun Razak,<br>50400 Kuala Lumpur |
| **Civil and Structural Engineer** | **Ciptamas Consult Sdn. Bhd.**<br>No. 52C, Jalan SS 21/35, Damansara Utama,<br>47400 Petaling Jaya, Selangor Darul Ehsan |
| **Mechanical and Electrical Engineer** | **East Orient Consult Sdn. Bhd.**<br>D3A-3-1 & D3A-3-2, Block D3A, Pusat Perdagangan Dana 1, Jalan PJU 1A/46,<br>PJU 1A, 47301 Petaling Jaya, Selangor Darul Ehsan |
| **Quantity Surveyor** | **JK Quantity Surveyor**<br>48C, Jalan SS 21/62, Damansara Utama,<br>47400 Petaling Jaya, Selangor Darul Ehsan |
| **Landscape Architect** | **Wein Designs Sdn. Bhd.**<br>D-01-3, Block D, Plaza Glomac, No. 6, Jalan SS 7/19, Kelana Jaya,<br>47301 Petaling Jaya, Selangor |
| **Interior Designer** | **Planet Graphics Sdn. Bhd.**<br>C805, Centre Wing, Metropolitan Square, Jalan PJU 8/1<br>Bandar Damansara Perdana, 47820 Petaling Jaya, Selangor |
| **Contractor** | **Pasukhas Construction Sdn. Bhd.**<br>Wisma Modal Khas, Lot 5815,<br>Jalan Mawar, Taman Bukit Serdang,<br>43300 Seri Kembangan,<br>Selangor Darul Ehsan |
| **Groundwork Contractor** | **G-Pile Sistem Sdn. Bhd.**<br>B-3-01, B-3A-01, Neo Damansara, Jalan PJU 8/1,<br>Bandar Damansara Perdana, 47820 Petaling Jaya, Selangor |

Site 3

Our third site was an eleven storey wholesale shopping centre undergoing its third phase on Block B. It is located the 2.44 acre lot PT 118177. The would comprise of:

- 6 shopping levels
- 4 parking levels

| | |
|---|---|
| **Owner** | **Precinct Blossom Sdn. Bhd.**<br>10-7-1, 7th Floor Queen's Avenue, Blok 10,<br>Jalan Shelly, 55100 Kuala Lumpur |
| **Town Planner** | **PIR Planner**<br>No. 45-2, Jalan USJ 21/10,<br>47630 UEP Subang Jaya, Selangor Darul Ehsan |
| **Architect** | **INTERGRA-CT Architects**<br>Suite A-07-06, Plaza Mont Kiara No. 2,<br>Jalan Kiara, Mont Kiara, 50480 Kuala Lumpur |
| **Civil and Structural Engineer** | **Sekutu Jurunding Sdn. Bhd.**<br>No. 528, Jalan SS 21/35, Damansara Utama,<br>47400 Petaling Jaya, Selangor Darul Ehsan |
| **Mechanical and Electrical Engineer** | **Perunding Mektrik Sdn. Bhd.**<br>No. 8, Jalan SS 2/103,<br>47300 Petaling Jaya, Selangor Darul Ehsan |
| **Quantity Surveyor** | **JK Quantity Surveyors**<br>47B, Jalan SS 21/60, Damansara Utama,<br>47400 Petaling Jaya, Selangor Darul Ehsan |
| **Landscape Architect** | **Elle Landscape and Nursery**<br>No. 19A, Jalan Kristal L7/L, Seksyen 7,<br>40000 Shah Alam, Selangor Darul Ehsan |
| **Substructure Contractor** | **Choice Approach Sdn. Bhd.**<br>No. 3-10-BB, Jalan Desa 2/2, Desa Aman Puri,<br>52100 Kepong, Selangor Darul Ehsan |

# SITE SAFETY






Signboards are a way to inform people to take necessary precautions and to be weary on a site in case of falling objects or uncovered manholes.

A piece of cardboard or wood is slotted under the base of the scaffold to prevent it from moving about

Ladders and scaffolds are examples of site safety. They also provide easier access.

# SITE SAFETY

When visiting or working on a site, it is important to be equipped and dressed appropriately. The standard equipment are:

- Safety helmet
- Boots/shoes
- Long pants

Fire extinguishers should be readily available in the event of a fire.

Sharp objects should be kept properly as it may cause injuries.

# MACHINERY

# PLANTS AND M


**Backhoe loader**
Used for small-scale construction work, for example: digging, loading, lifting, and carrying loads. A backhoe loader consists of a loader (tractor fitted with shovel or bucket) and a backhoe. Normally used for scooping or digging up sand, soil, or rocks.


**Excavator**
Consists of boom, arm, and bucket. An excavator is used for a larger-scale construction as compared to a loader. It can be used for digging trenches and pits, and loading. The bucket can be replaced with a hammer or drill, depending on the condition of the site.


**Telescoping boom truck-mounted mobile crane**
Flexible as it does not require assembling or dismantling. It is used for lifting and lowering heavy objects. It allows for mobility and is able to lift loads at a 360 degree radius.

# PLANTS AND MACHINERY

**Rebar-bending machine**
Used for bending or shaping reinforcement bars. The machine operates on electricity. It is faster, more efficient, and more accurate than bending the bars manually.


**Concrete-pouring bucket**
While attached to a telescopic boom truck-mounted mobile crane, the bucket can carry and unload concrete. However, this requires manual operation of the workers.

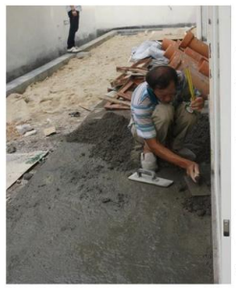
**Portable concrete mixer**
Combines cement, aggregate, and water to form concrete. It is an alternative for mixing concrete manually, which requires more labour and time.

# EXTERNAL WORK

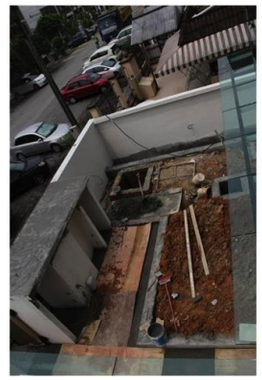
External work is a category of construction that involves any feature that helps finishes or adds to the final outcome of the exterior portion
of any construction project

Road
The road within the site is made to allow easy access for the constructuion process to take place. Will be paved over with proper materials after the construction process takes place

Fence
Around one of our sites, the construction process for the fence has already started.
The end is a post for security guards and a possible boom gate.



Apron
An apron is a raised piece slab of concrete that circles around the building. it's main purpose is to provide a walkway as well as a to prevent foundation corrosion cause by excessive water.



Sewarage and Drainage
the sewerage system defers from drainage in terms
of usage. Sewerage is more 'heavy duty'
in which its meant to carry storm and sanitary fluids as well as solids. The drainage system is yet to be installed in our site as the pipes are still left there. drainage is mainly used for diveting water and waste to a sewerage system



BAR BENDING STATION
just out front, the workers can send bars to order to the top floor via crane or any one el.



Walls.
brick wall boundary.
provides a sense of enclosure as well as security. Walls above eye level restricts vision granting the impression of a concealed room. gates will be installed soon

screeding
a screed is a flat piece of material. screeding is using that flat material to level out wet concrete. it is also sometimes used to apply a top finishing like plaster.

# EXTERNAL WORK


Construction Boards
poorly maintained, these boards are supposed to explain important information to th public., employees and workers. out of the information provided, are general project details and safety measures to take whe traversing site.


hoarding

Is required to be set up on the perimeter of the consruction site. it protects the construction site and prevents theft of materials as well as unathorized access. This can prevent accidents from happening to children and other civilians.

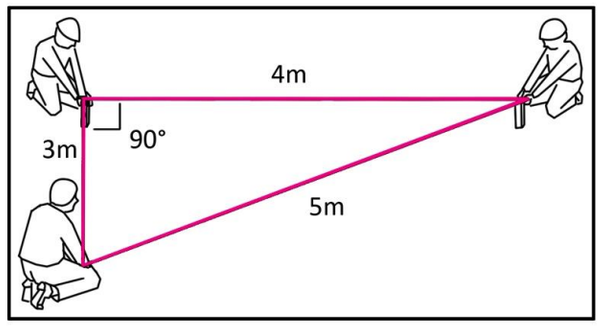

safety signs
somewhat appropriate. The sign is well maintained and is displayed big enough to see, even for ppl who are far away. could use more color for further emphasis on warning.

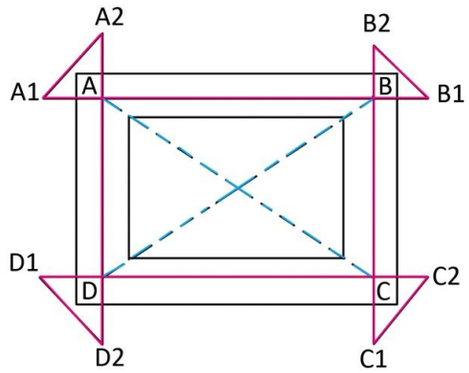

poorly portrayed. the safety sign, being one of the most important of signs isnt displayed large enough nor does it enough color to emphasis on the warning.

# SETTING OUT

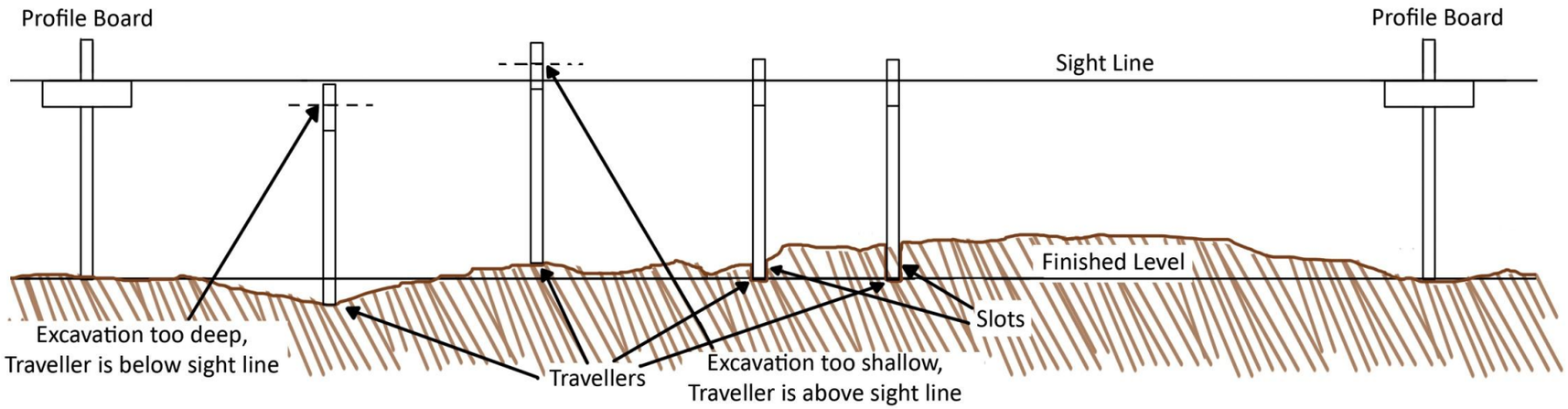
Setting out is the work process of setting various points on the land to acccurately plot out the vital elements of a building before the construction process. This is the process where various environmental elements such as trees, roots, or boulders are removed. There are various techniques and methods to perform while doing setting out work. Note that setting out is a form of surveying and should be performed very accurately and swiftly as mistakes or delays can lead to unnecessary costs.

**THE 3- 4- 5 METHOD**




The 3- 4- 5 method utilizes Pythagoras's Theorem which is a^2 + b^2 = c^2. We choose 3,4,and 5 because 4^2=16, 3^2=9, and 5^5=25. These are all easily calculated and provides an acurate 90° angle to work with. Forexample, a group of 2- 3 people will help set point A, B, C & D. They will measure points A, B & D in ratios of 3, 4 &5 metres as shown in the diagram. When planting measurements, point A1, A2, B1, B2, C1, C2, D1 & D2 are used instead. These are called Offset Pegs. The reason this is done is because when excavation starts, points A, B, C & D are removed. The distance between A1, A2 & A is calculated according to excavation requirements. Lines AB and DC are used to check the distance and angle of A, B, C & D.




There are a few issues that might come about when performing the setting out work. normally on flat land, or flattened out land, the setting out process is rather straight forward. However, when uneven land is present, the traveller, a third profile board that runs inbetween the two to check if the land is flat, varies rom being too high or too low. This, as shown in the above diagram, can be detected when the traveller is set at various points between the two profile boards. It is considered good practice to dig up slots in which the travellers can sit in at 4 to 5 metre intervals. This allows the workers to excavate and connect the slots after the proper measurements have been made and the travellers can once again be used to check the flatness of the land.

Image edited, found via carsmoda.blogspot.com

# EARTH WORK

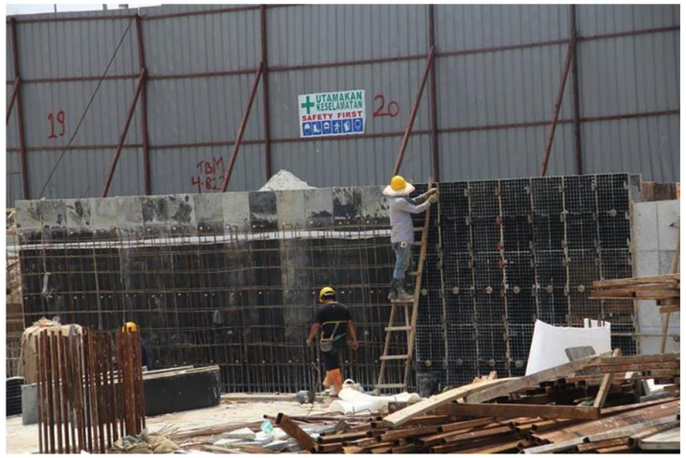
Earthwork is a process of excavation where earth from the surface is excavated and transported to another location. This process is usually performed in the relatively early stages of construction. The earthwork that is carried out are usually machine assisted as keeping a time eficient schedule is key to any successful project. The site must be cleared fast to allow other construction processes to start. Keeping water and moisture out of the working area is neccessary  in carrying out a smooth earthwork operation.

**Types of excavations at the sites**

Rock Excavation
Removal of any solid formations that require drilling or blasting.
Any boulder larger than 0.5 metres will be classified as rock.t

Muck Excavation
Removal of soil or unwanted material
that contains too much water to be of
any use. Will cause structural instabilities

Water Pump
A water pump used to pump water out of the excavation sites.
On rainy seasons, this device can mean the difference between a hard day's work andproject setbacks.

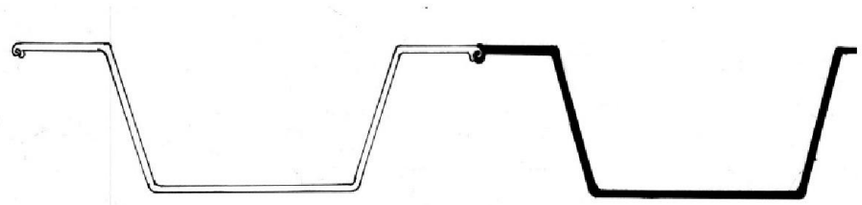



**Retaining Walls**
Retaining walls are used to prevent dirt fand soil from collapsing.
t is usually used on unnatural or mad-made
curves and slopes. Simply put,
They are used to connect soils with more than one group.
This method of constructing the retaining walls is refered to  as Bored Pile Retaining Walls. The method of
construction
is to arrange a series of bored piles and remove any access dirt.
Sometimes, depending on cases, te retaining wall may include reinforcing beams and shotcrete reinforcement area.

The four types of excavations:
-Topsoil excavation
-Earth excavation
-Rock excavation
-Muck excavation

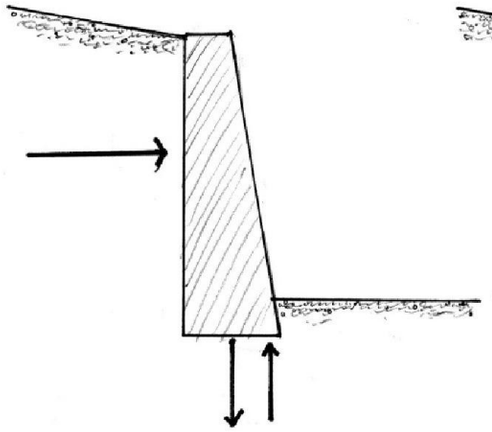
FOUNDATION

## Sheet Piling and Retaining Walls:



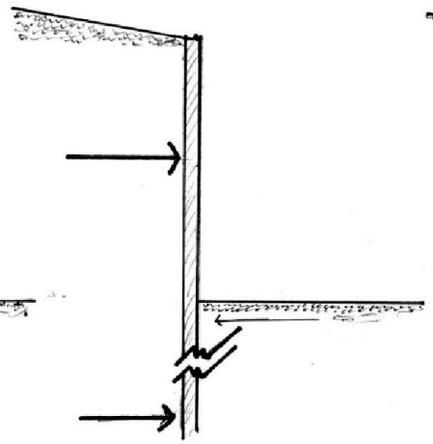
Sheet piles acts as a temporary supportive wall that is embedded into a slope or excavation to support the loose soil from caving inwards. They are most often made from steel and shaped like the picture on the left. However there are other different variables of shapes and materials depending on the terrain and availability.

**Gravity wall**



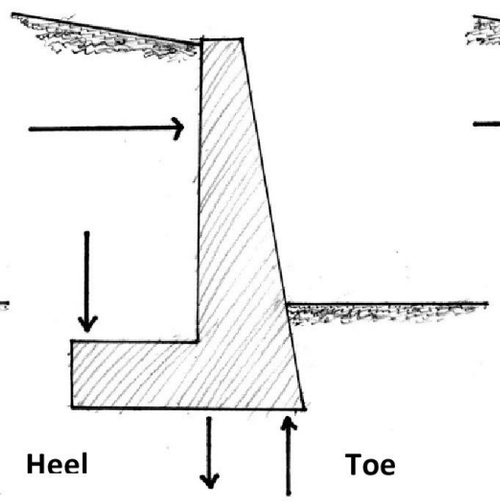
Gravity walls rely on its massive amounts of weight pulling it downwards while retaining its ability to hold back the earth/soil.

**Piling Wall**



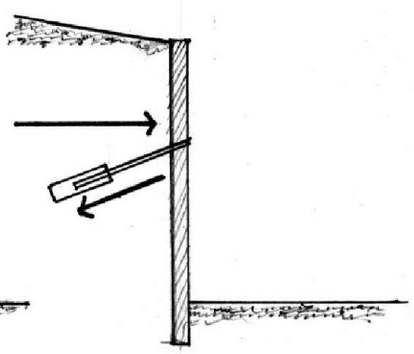
Piling walls are essentially permanent long piles that are embedded deep into the ground.

**Cantilever Wall**




Cantilever walls use the pressure applied by the falling soil to keep the soil in place.

**Anchored Wall**



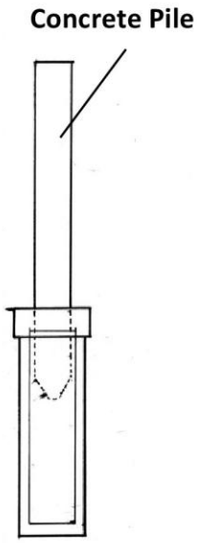
Anchored walls require boring of piles then adding additional cables to strengthen the overall structure.

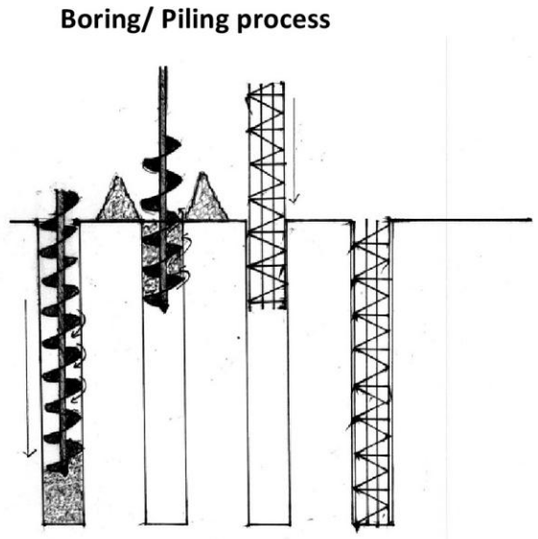
FOUNDATION

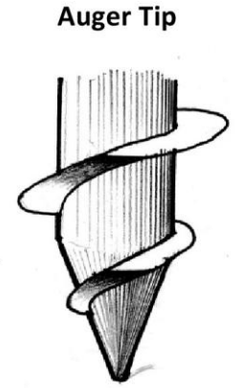
# Types of Foundation:

**Pile Foundation (Deep foundation)**

Pile foundations are essentially reinforced concrete piles (pillars/columns) that are embedded into the ground. The method relies on the depth and the strength of the pile. Piles can be driven, augured, or jetted into place. The installation method will vary with soil conditions. Before embedding reinforced concrete piles, a process called boring must take place in order for the pile to be inserted. After the boring process, a tubular metal structure is added to reinforce the piles further.

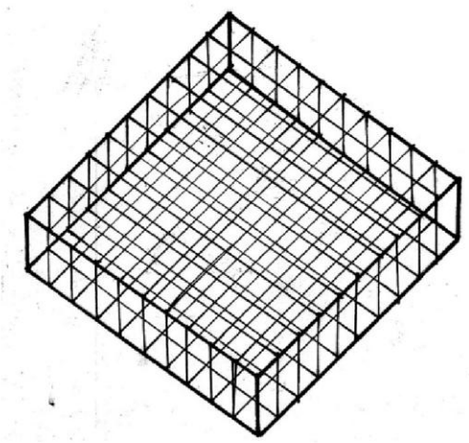


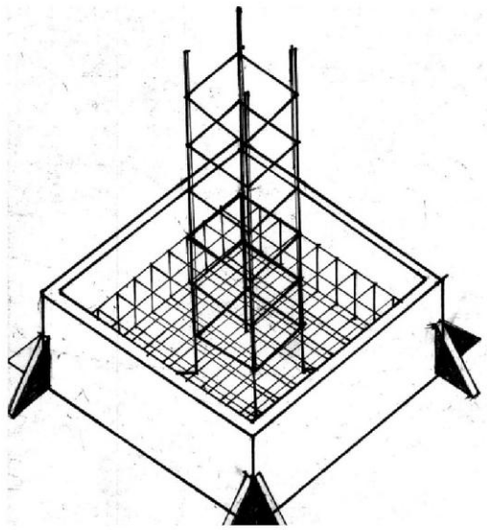




**Pad Foundation (Shallow Foundation)**

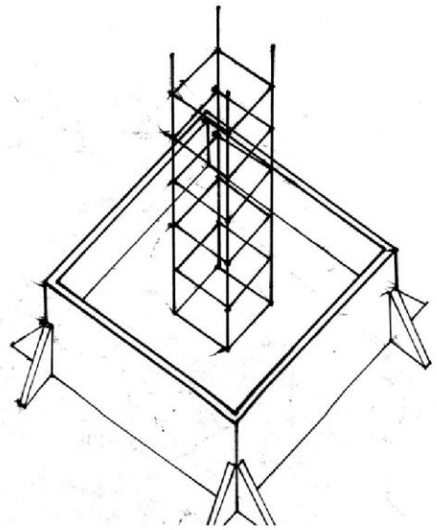
A ready-made frame is created to create a fix size/ area of space in which the concrete is able to set.



Once the frame for both the foundation and the pillar is erected, a moulding casket will be made to surround the frame for the concrete to be poured into.



Self-compacting concrete is distributed evenly and settled using vibrators to shake off excess air out of the concrete.

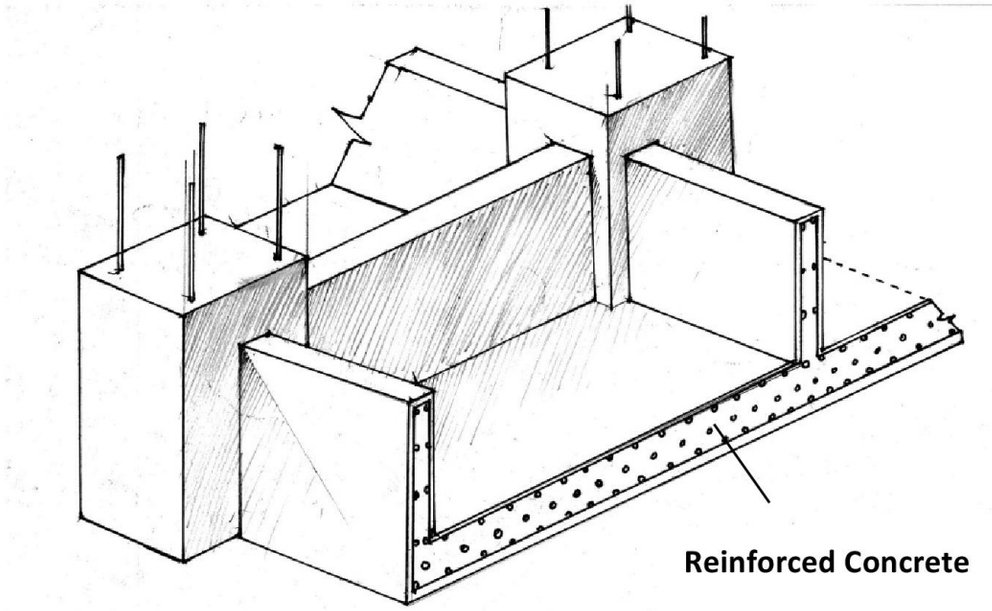


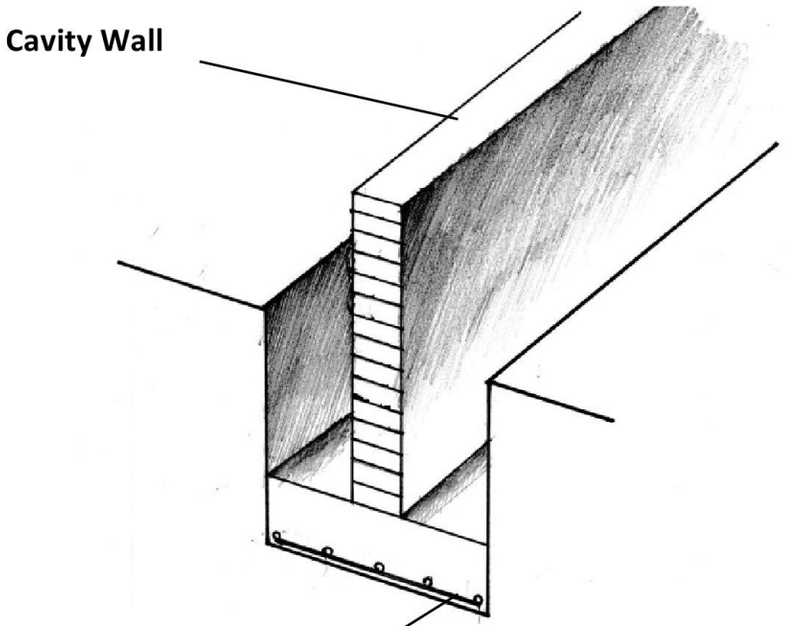
FOUNDATION

# Types of Foundation:

**Raft Foundation (Shallow Foundation)**

The Raft Foundation takes advantage of its large surface area in which the pillars' and columns' weight are evenly distributed. It is mostly used where the ground conditions are very poor and bearing power of the soil are low. The process is very similar all around, metal frames of the base and pillars are connected together to form the reinforced inner structure. The moulding casket is made and concrete is poured evenly and settled to dry forming a very strong base that will be able to support the surrounding pillars.




**Strip Foundation (Shallow Foundation)**

The Strip Foundation is usually applied in where the soil is of good bearing capacity. This type of foundation relies on the support of the ground load. It is built by digging trenches using an excavator, length, width and depth varies depending on structure and terrain. Steel reinforced rebar are placed in the trenches, leaving the very bottom of the trenches filled with rebar layering. Concrete is then moulded into the trenches forming a solid reinforced base that will support the walls and pillars.

# FOUNDATION

## Site: GM Klang

The site bears an uneven ground level which eventually had to be dug up to form a levelled platform for the construction to begin. The ground is mixed soil which contains around 40 percent clay. The site's climate varies over the course of the day but rains very often almost up to five times a day. The clay is dug up and replaced with ground dirt due to it being unstable when wet. The clay shrinks on drying and expands on wetting, which may adversely affect structures. The clay is transported to another site, where it will later be reused. The site uses two different types of Retaining walls and three types of foundation.

### Retaining Walls and Sheet Piling:

The site uses an anchored retaining wall made out of concrete to stabilise the outer layer of soil permanently. The site also uses steel interlocking sheet piling to temporarily hold the soil in place.

### Raft Foundation:


The foundation is first made by layering reinforced bars that are tested by being able to withstand the weight of the workers, if they crack or snap, they are immediately replaced.

### Pile Foundation:

Once the ground is even, trenches are dug to position the piles. Reinforced concrete piles are then buried into the dug soil using a boring/ piling rig.

### Pad Foundation:

Similar to the raft foundation, reinforced bars are made as the 'inner layer'. They are then moulded into place with concrete, creating a solid base for the foundation pillar to be built.

FOUNDATION

## What could have been done better and what can be improved?

One of the major issues which set the deadline back is the usage of the sheet piles. They are not connected properly or even connected, which causes the unstable land to slide inwards when it rains.

Because the temporary structures are not being use its full potential, they are nc using desperate attempts at holding the land in, like implanting piles of wood to hold the land in place.

Due to the amount of rain that circulates towards the structures, it may soften up the soil surrounding it causing it to sink in or move. This causes the structure to be off centre which may cause problems in the near future. The contractors and engineers should have taken the weather into consideration.

# SUPERSTRUCTURE

Superstructure is the part that is entirely above the foundation of a building. It is the parts of the building that are above ground level and it usually serves the purpose of the building's intended use.

# BEAM & COLUMN

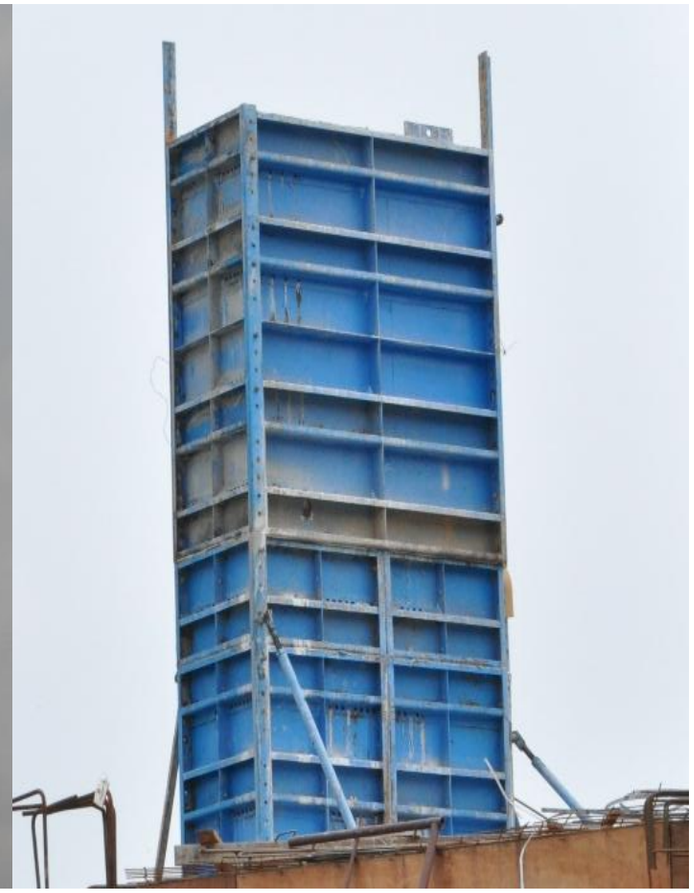
## Beams

A beam is a long thick straight-sided piece of wood, metal, concrete and others to be used as a horizontal structural member in a building. It is a structural element that can withstand loads and is bend-resistant.

## Columns

A column is usually a rounded shaft with a capital and base, which serves as a support and are traditionally made with stone instead of reinforced concrete. A column can also be non-structural, in other words, used for decorative purposes.

# BEAM & COLUMN



Instead of using wood to make the formwork for columns, a metal formwork is used to hold the concrete until curing is completed to save costs in the long run. This is because wooden formwork can only be used up to two to three uses per formwork.

Post-tension concrete is used on walls as it improves building stability and wind resistance. They are used in both precast and in place concrete construction. Other than that, rebar and wire mesh is also embedded in the post-tensioned concrete.

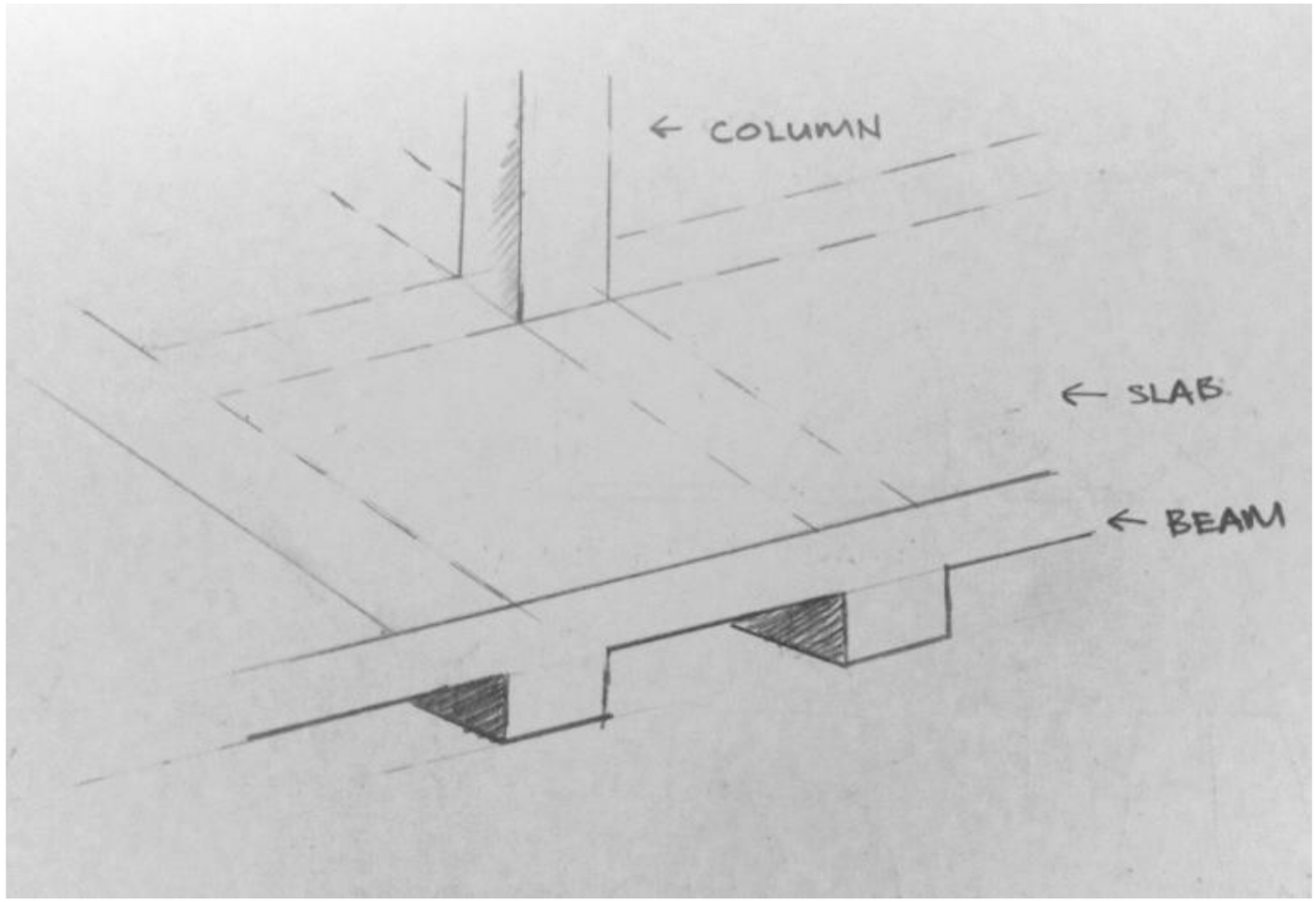
# BEAM & COLUMN

Also, steel reinforcements are placed inside the columns and beams to increase their load-bearing capacities.

As for beams, wooden formwork is still used. Formworks are normally made of plywood as it is one of the cheapest and most convenient material for formwork which are reusable.
The formworks are normally left until the concrete are dried up before taking them off and reusing them.

# SLAB

A slab is a flat rectangular architectural element that is usually formed of a single piece or mass.




The relationship between Beams, Columns and Slabs

SLAB

## Slump Test

A slump test is a method used to determine the consistency of concrete. The consistency, or stiffness, shows how much water has been used in the mix.

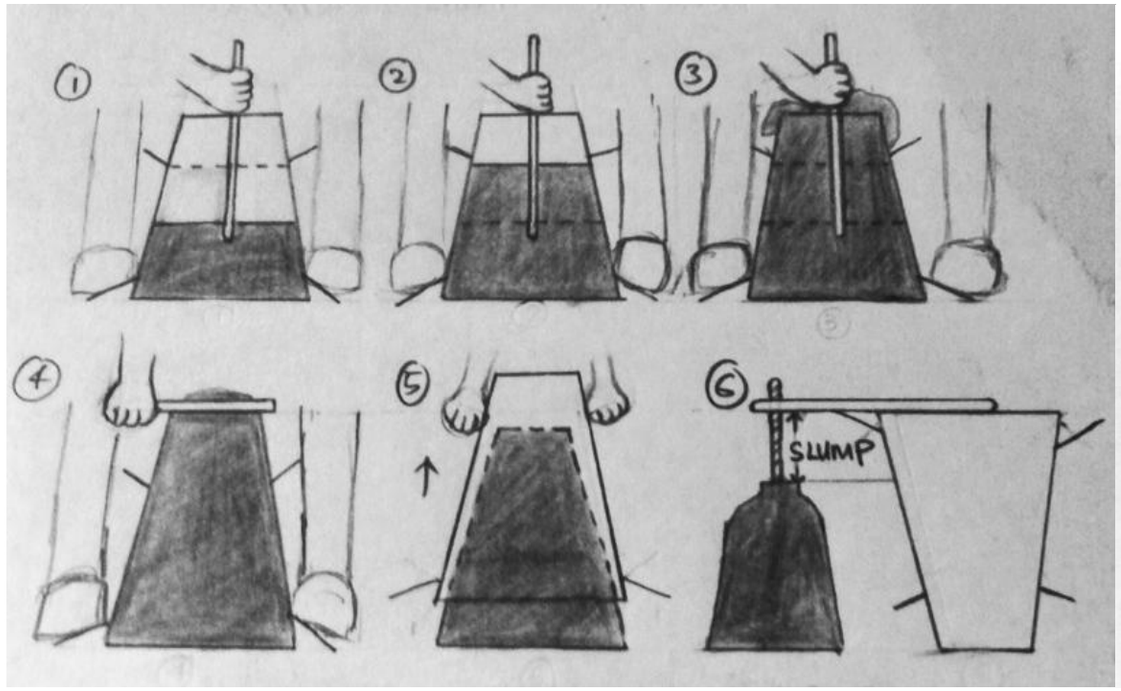
**Ingredients:**

- Aggregate, cement, water (primary ingredients for concrete)
- Admixtures
- Fibres
- Polymers

**Materials:**

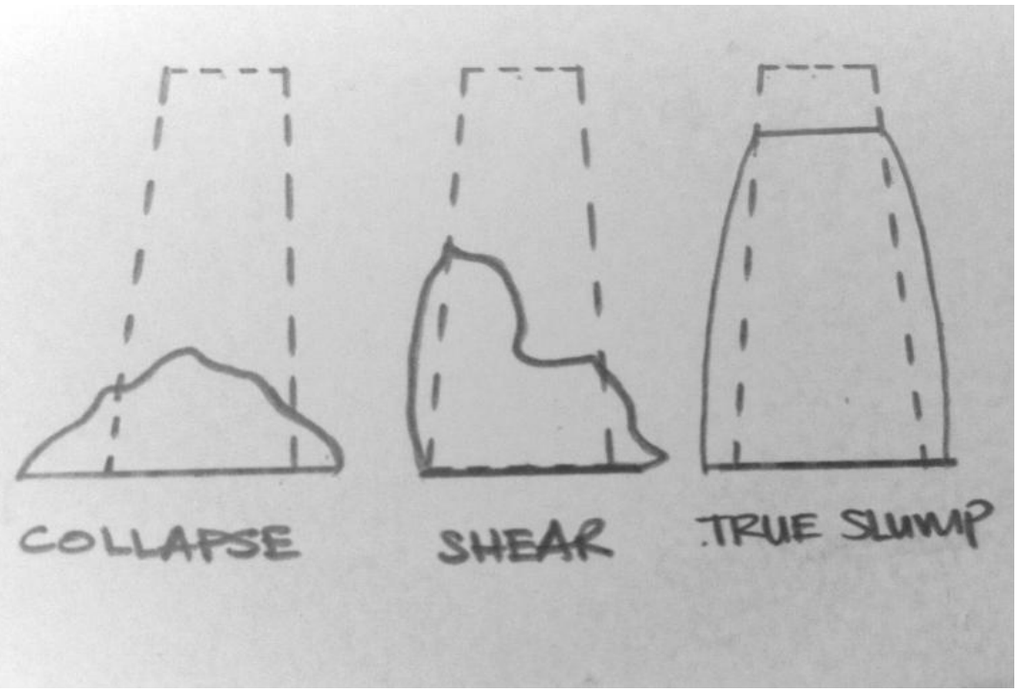
- Temping rod (standard 16mm/⅝ inches, normally steel)
- Scale for measurement
- Slump container (300mm/12inches; base diameter – 200mm/8inches; top diameter – 100mm/4inches)

# SLAB




**Procedure:**

- Place the base on a smooth surface.
- Fill the container with concrete in three layers (⅓ per time).
- Each layer is temped 25 times with the rod.
- After the container is filled with concrete, excess concrete on the top of the container is cut off until it is on the same level as the top of the container.
- The container is raised vertically, allowing the concrete to fall or slump.
- The slump is measured by placing the container next to the slump and the rod is placed over the container.
- The decrease in height is noted with scale, which is normally to the nearest 5mm (¼ inches).




**Types of slump:**

- Collapse slump

The concrete collapses, implying that the mix is too wet.

- Shear slump

The top portion of the concrete shears off and slips sideways.
If one-half of the cone slides down an inclined plane, the slump is said to be a shear slump.

- True slump

In a true slump the concrete simply subsides, keeping more or less to shape.

# STAIRCASE

## Introduction

A stairway, staircase, stairwell, flight of stairs, or simply stairs is a construction designed to bridge a large vertical distance by dividing it into smaller vertical distances, called steps.
Staircases have traditionally been built of wood, stone or marble, and iron or steel. The use of steel and reinforced concrete has made possible the daring curves and fantastic sweeps that can be important features in contemporary design.

Stairway towers are used as a solution for temporary access multiple story's on construction site.

## Benefits of Concrete staircase

- Reduced Noise
- Speed of Installation
- Variety of Finish
- Upper Floors Accessibility
- Cost Effective
- Variety of Sizes/Types
- High Fire Resistance
- Comply with Building Control Regulations
- Can Accommodate Progressive Collapse Requirements


*Fig 1*

Fig 1, Fig 2, Fig 3:
Reinforced concrete staircase with timber riser and tread finishing.


*Fig 2*


*Fig 3*

STAIRCASE

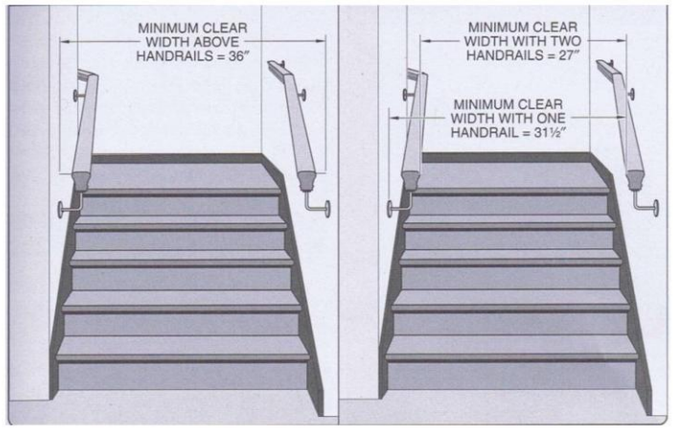
# Staircase Safety and Codes according to International Residential Code (IRC)

## Safety Considerations

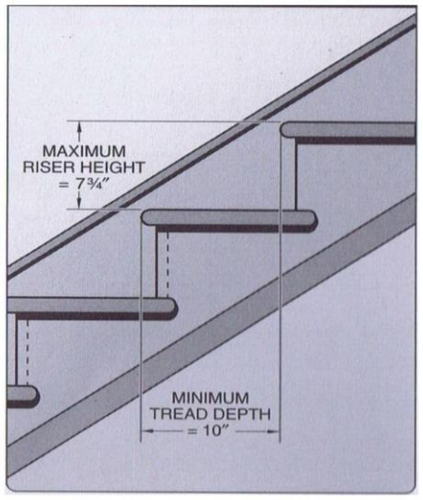
Staircase should be built in a manner that directs the user's attention to the staircase.

General safety practices :

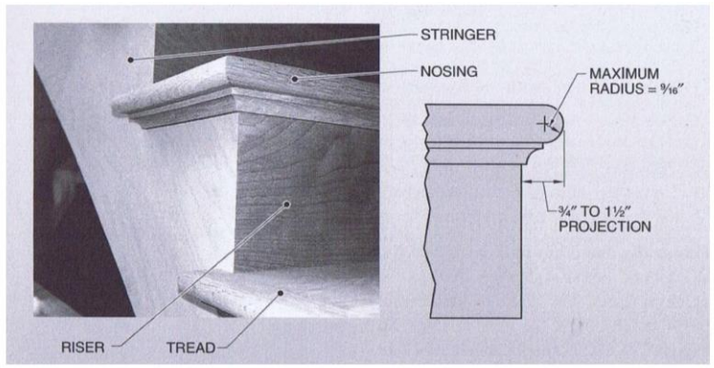
- All risers and trends should be equal in a flight
- The preferred angle of a stairway is between 30° and 35°
- Stairways should be free from winders and whenever possible.
- The stairway should be well lit and have light switches at the top and bottom of the flight.
- Landings should be level and soundly constructed.
- the width of the landings should be equal to the width of the stairway.
- Trends should be slip proof, firmly secured, and without protruding bolts, screws or nails.
- All stairways should be well equipped with permanent and substantial handrails.
- All handrails should have a shape that is easy to grasp and a surface that is smooth and splinter free.



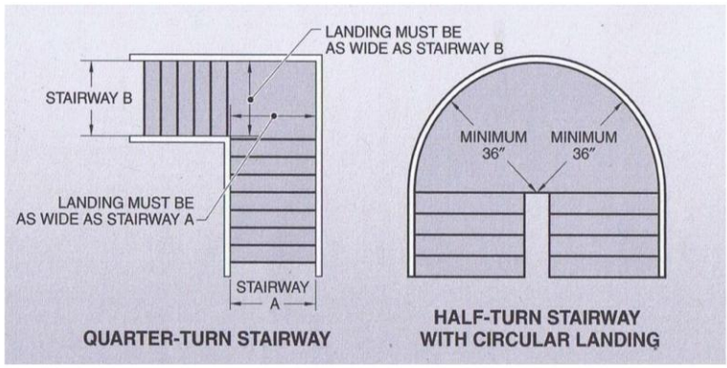

Residential Stairway Widths



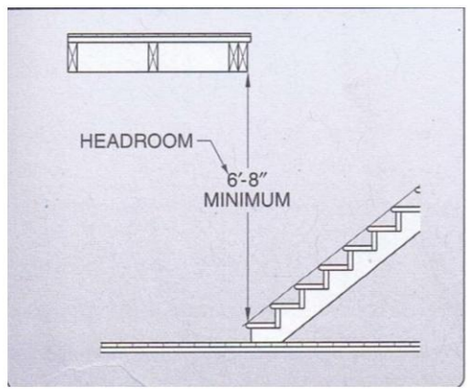

Riser and Tread Dimensions



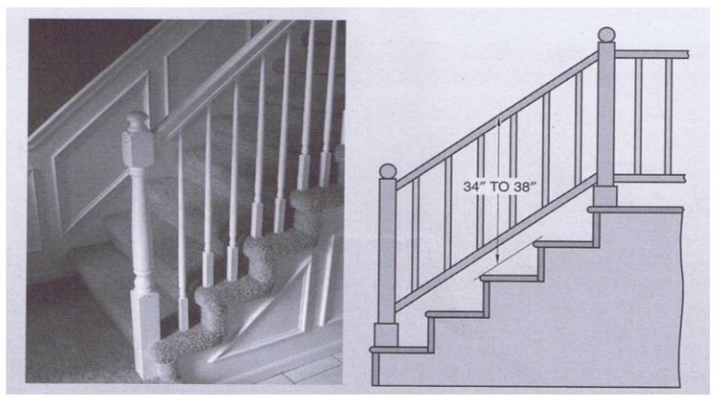

Nosing Requirements



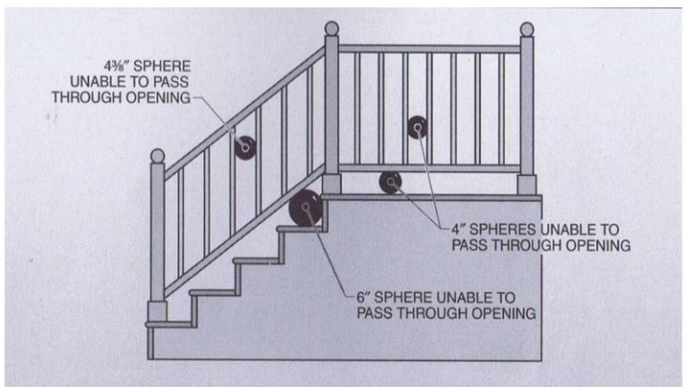

Landing Requirements




Minimum Headroom



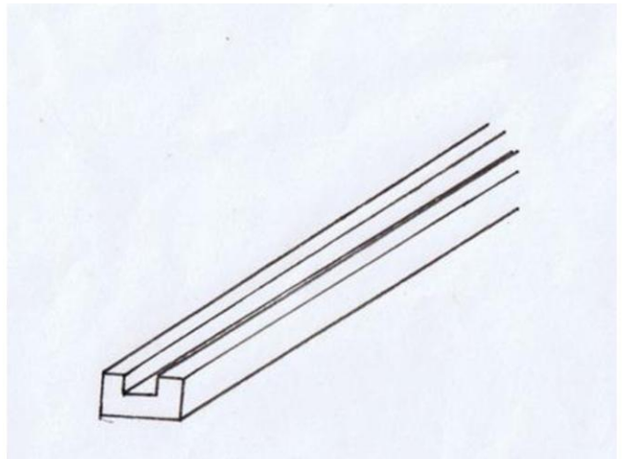

Residential Handrail Height



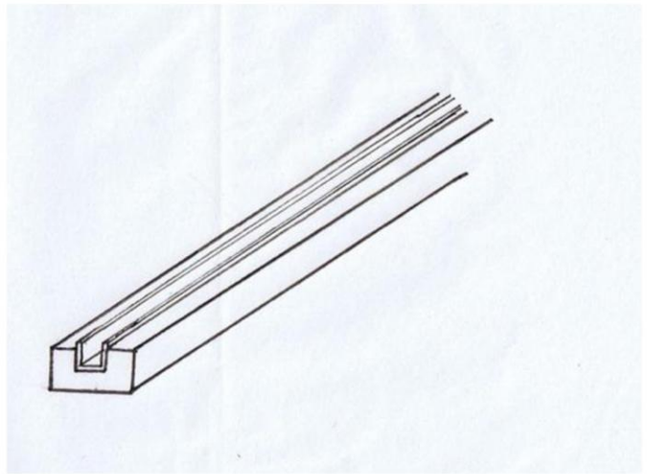

Baluster Openings Requirements

STAIRCASE

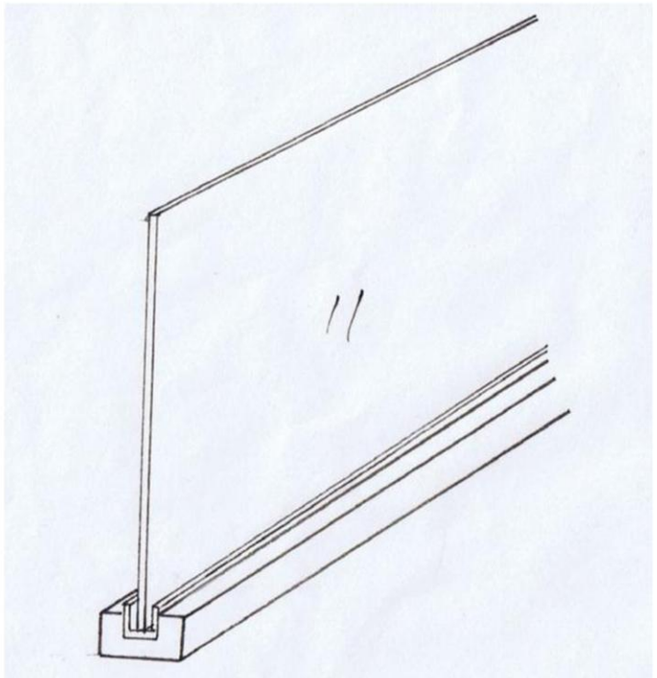
## Installation of Balustrades



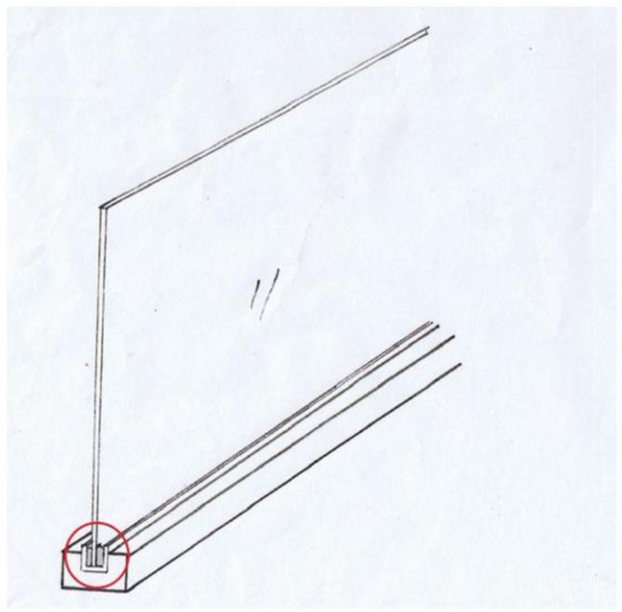
1. Concrete is casted and wait to be hardened



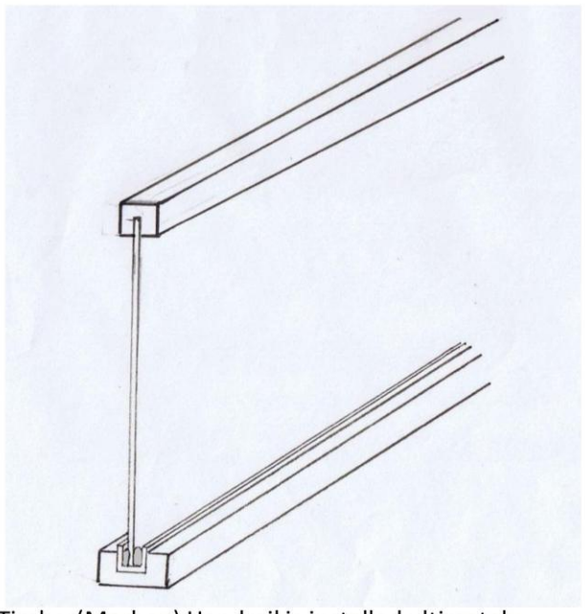
2. An aluminium channel is added.



3. Tempered Glass panel is placed vertically as the Baluster.



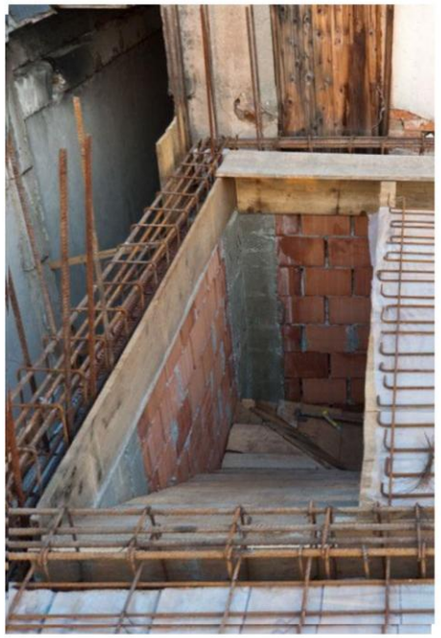
4. Plastering to secure the baluster.



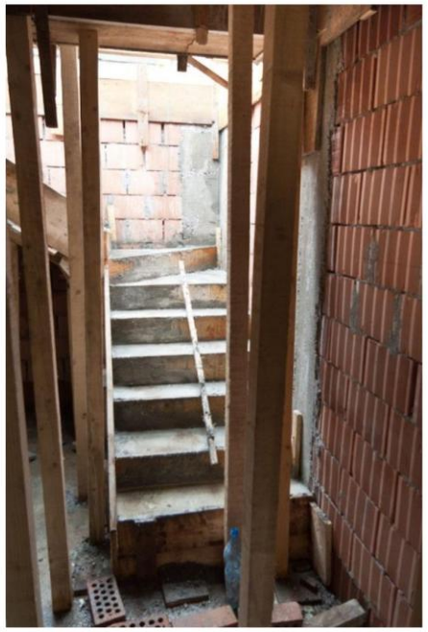
5. Timber(Merbau) Handrail is installed ultimately.

Finished baluster and handrail.

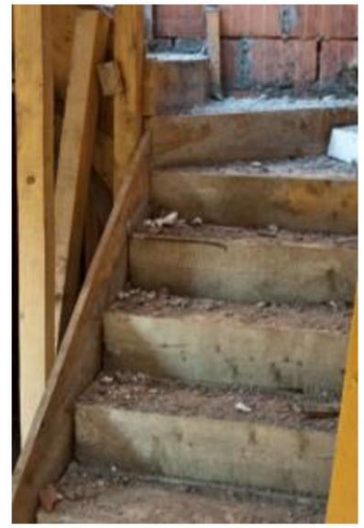
# Installation of Concrete Staircase



Use long screws and nails to lock together the wooden formwork and make sure there are no gaps between the boards.



Lock the wooden formwork together tightly by using different boards and posts. This is to prevent the risers to move from their position as pouring the concrete in the form will create a great pressure.



The stairs need at least 4 weeks to dry out completely, water the concrete daily to prevent crack.

Remove the wooden concrete stair framework

Wait for the concrete to dry.

WALL

# WALL

## Introduction

wall, structural element used to divide or enclose, and, in building construction, to form the periphery of a room or a building. In
traditional masonry construction, walls supported the weight of floors and roofs, but modern steel and reinforced concrete frames, as well as heavy timber and other skeletal structures, require exterior walls only for shelter and sometimes dispense with them on the ground floor to permit easier access.
Wall can be classified into load-bearing and non-load bearing wall.

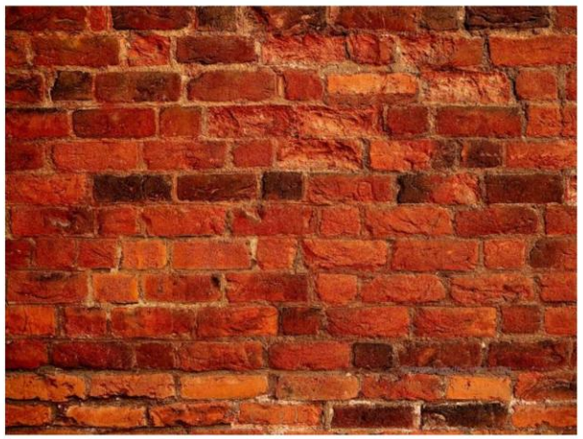
Types of wall:

1. Concrete wall
2. Masonry Wall
3. Dry wall
4. Glass wall
5. Curtain Wall

## Reinforced Concrete Wall


The lateral and gravity load-resisting system consists of reinforced concrete walls and
reinforced concrete slabs. Shear walls are the main vertical structural elements with a
dual role of resisting both the gravity and lateral loads. Wall thickness varies from 140 mm
to 500 mm, depending on the number of stories, building age, and thermal insulation
requirements

## Brick Masonry Wall



Brick masonry is widely used in many forms of construction, landscaping and hardscaping industries. Ever since the days of the Mesopotamian's, brick masonry has been used to build houses and other forms of shelter, as well as pathways, decks, steps and walls. Amongst all the different types of building materials available, brick masonry is the most popular.

WALL

# Brick Walls

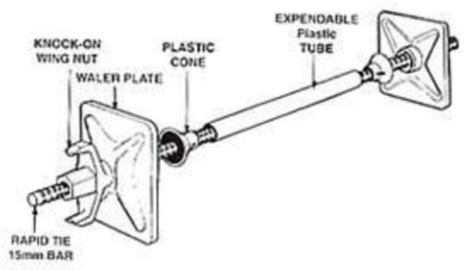
Solid clay brick is aligned with running bond brickwork.

Plastering the wall

Finishing  wall with OPC.


Insert corner beam and splash dash.
Function of splash dash is to enhanced griping power  of Ordinary  Portland Cement (OPC).

# Formwork Tie for concrete wall




Formwork Tie

Hole in concrete is used to place formwork tie to prevent bulging in concrete wall.

Aluminium System Formwork

WALL

## Method used to create a perfect surface

Surface is rough and uneven before rendering.

Worker applying **Thin Render** on the wall.

Smooth and even surface after drying.

**Corner beam** is used to ensure the turning of the corner of the wall is 90°,thus also aim to create a sharp corner perpendicular to the ground.

**Aluminium bar** is placed on a wall after plastering to check the flatness of the wall.

# OPENINGS

Doors and windows are an essential part of a building. Their design, style and placement can determine the overall character of the building. Both doors and windows are used for egress, ventilation, nature lighting and also weather protection.

## Functions

| Doors | Windows |
|---|---|
| ➢ Provide access into a buildings interior from the exterior and passage between interior spaces | ➢ Admitting light |
| ➢ Weather proofing | ➢ Controlling ventilation |
| ➢ Sound control | ➢ Influencing thermal comfort |
| ➢ Security | ➢ Security |

## Types of doors in site

- Hinged doors
- French doors
- Stackers doors

## Types of windows in site

- Awning windows
- Casement windows
- Sliding windows
- Fixed windows

# OPENINGS

## Hinged doors

Hinged doors are the most common type of doors we used. They are normally used as a passage between two interior spaces, such as living room and kitchen.

## French doors

French doors are popular for their ability to 'open up' a space and create a big entry or exit. Normally used as the main door.

## Stackers doors

Stacker doors allow massive openings in homes, letting you effectively open up an entire wall onto either a different part of the house, or onto a yard area.

## Awning windows

Awning windows are usually operated with a roto-gear or push-out lever so that the window can be adjusted to keep out rain but let in fresh air. This window type provides up to 50% ventilation area, as the hardware does not allow them to be fully opened.

## Casement windows

Casement windows are operated with a roto-gear and crank. It provides almost 100% ventilation area, because they can be fully opened and the out-swinging sash can direct plenty of air into the building.

## Sliding windows

Sliding windows  are operated by sliding on both top and bottom  tracks. It provides 50%-66% ventilation area, because it can be fully opened .

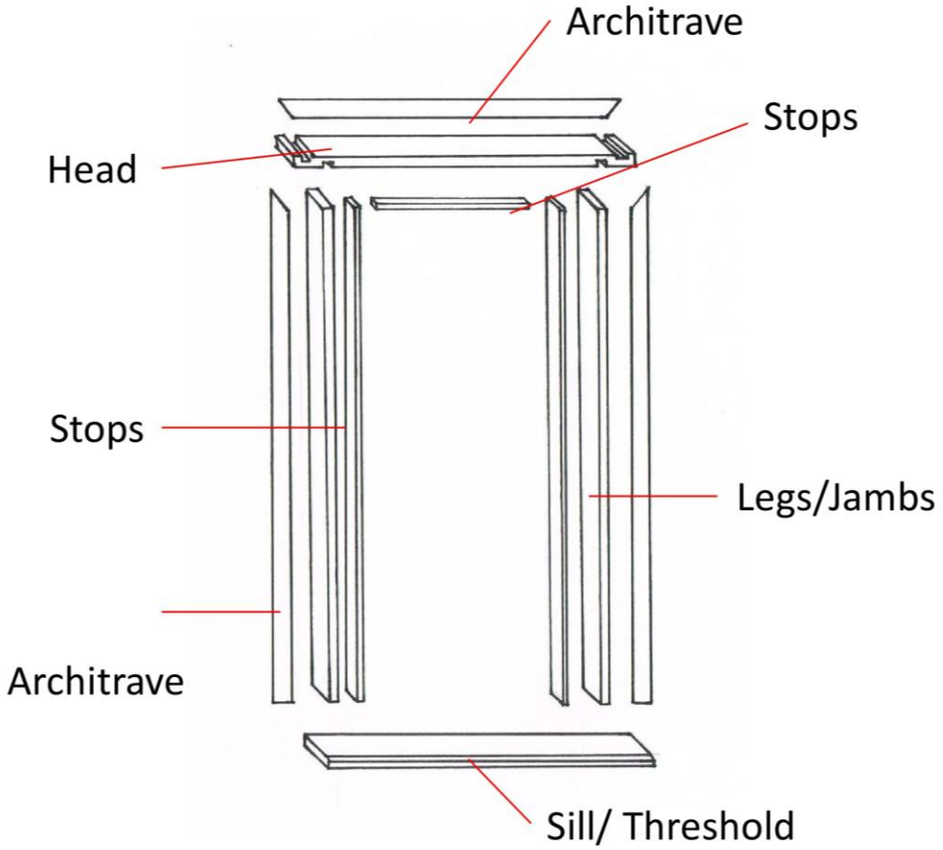
## Fixed windows

Fixed windows cannot be opened. It is fixed on the wall and no ventilation area is provided.

DOORS

## Door frame

It is set within a finished opening or wrapped around a rough opening. Figure below shows the different parts of the door frame.




**Architrave** ⟶ A style of mouldings framing the top of a door which are functioned to cover the gap of the door and wall and decorate the door.

**Stops** ⟶ A thin slat built inside a door frame used to hold the door open or closed. It prevent the door from swinging through when closed.

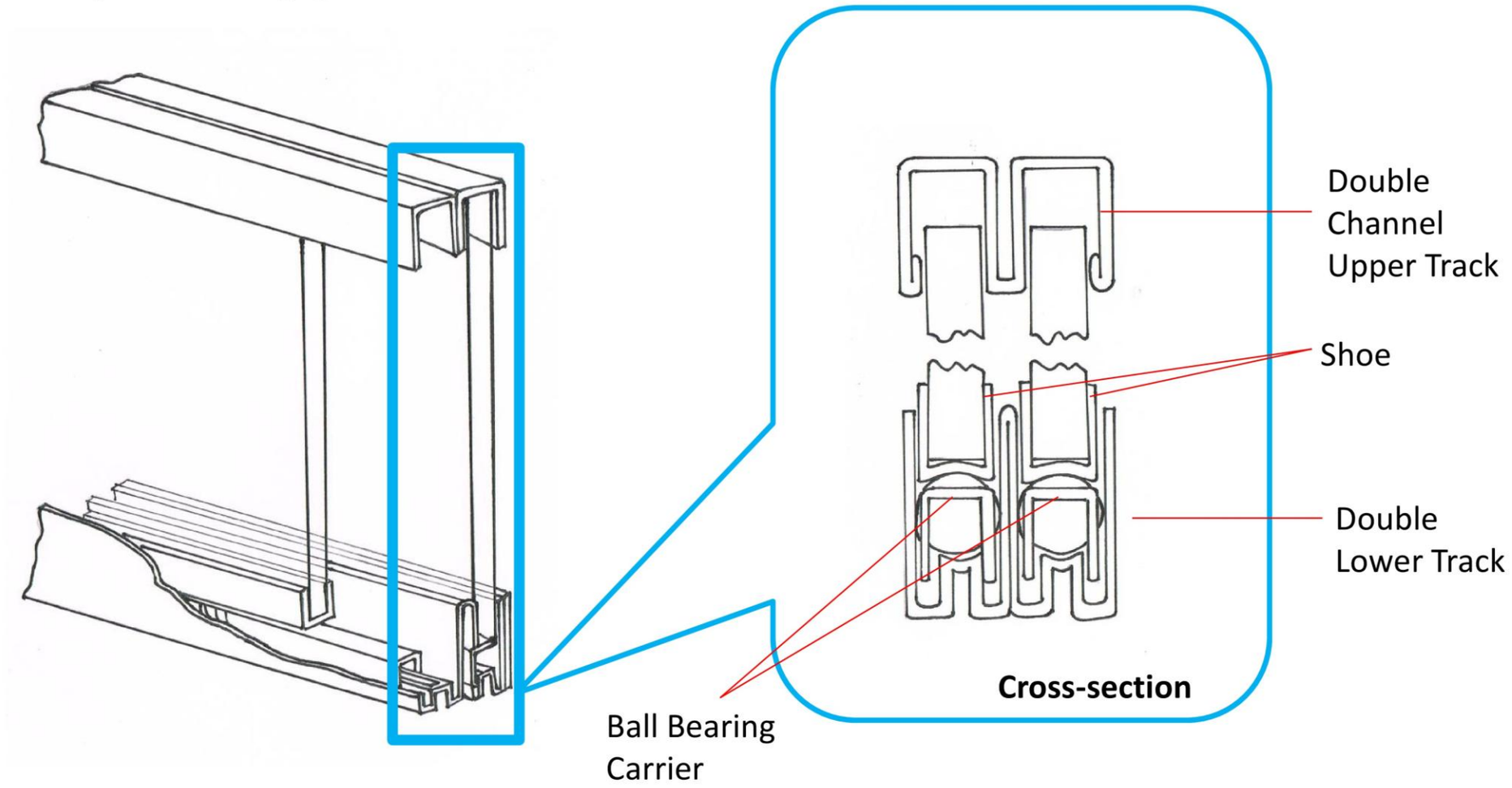
**Legs/Jambs** ⟶ The vertical portion of the frame onto which a door is secured. It bears the weight of the door through its hinges which is vitally important to the overall operational durability and security of the door.

**Sill/ Threshold** ⟶ Similar to architrave, it is used to cover the gap between the floor surface and the underside of the door.

**Head** ⟶ A support built in above a door and is about twice as thick as the surrounding framing. It is supported by king studs, another integral component of door and window framing.

DOORS

## Anatomy of sliding glass door track




| PROS | CONS |
|---|---|
| **Practical**<br>- Require less space | **A costly affair**<br>- More expensive than traditional door. |
| **Great decorating accessory**<br>- Have a clear view of the other part of the door/ | **Not suitable in weather conditions like frost , storms and extreme heat.**<br>- Not weather-proof. |
| **Ample light**<br>- Receive natural light due to transparency. | **Maintenance takes a lot of money and time.**<br>- Door parts might not be available at all times for replacement. |
| **Environment friendly**<br>- Do not use wood as materials. | |

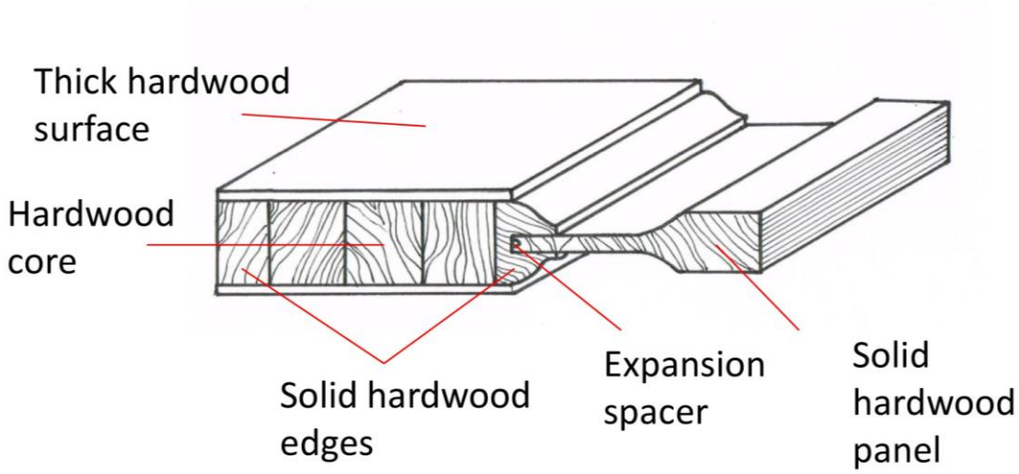
DOORS

## Materials

The materials used to make the door is hardwood. At the site we've visited, there are two types of door frames. One is yato and another is aluminum. Aluminum frame is used in the bathroom doors and the others are yato frame. This is because  aluminum is water-proof which is more suitable for bathroom which are frequently wet.

Bedroom

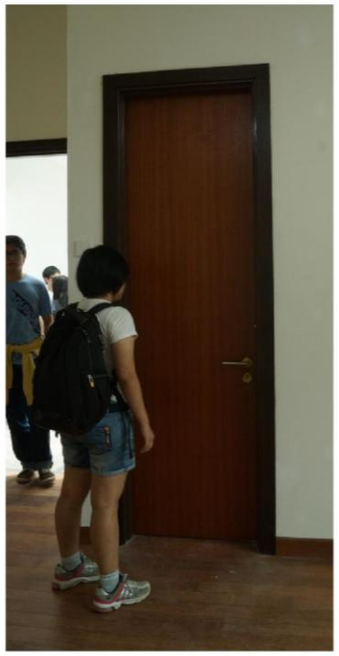
Bathroom




## Size of doors

Standard size of doors

| Type | Size of opening (mm) | Door size (mm) | Door thickness (mm) | Use |
|---|---|---|---|---|
| 1 | 900 x 2100 | 826 x 2040 | 40 or 44 | External doors |
| 2 | 800 x 2100 | 726 x 2040 | 40 or 44 | Internal doors |
| 3 | 700 x 2100 | 626 x 2040 | 40 or 44 | Cloakroom, toilet |
| 4 | 600 x 2100 | 600 x 2100 | 40 or 44 | Cupboards, etc |

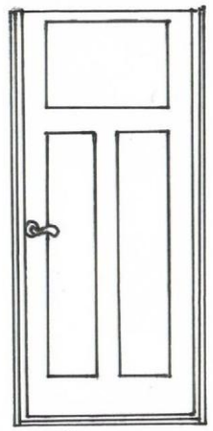


The doors at the site are not made in standard size.  It is custom-made in the height of 8 feet, which is equal to 2438.4mm.

DOORS

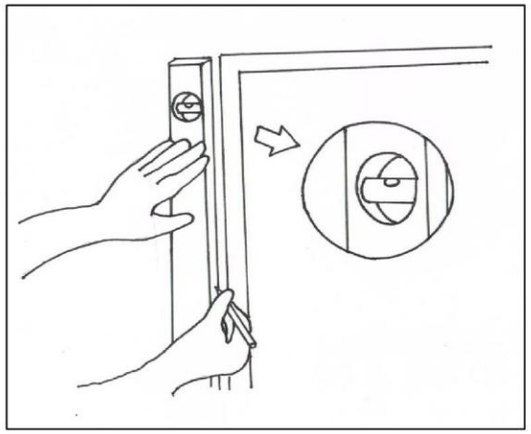
# Installation of doors

1



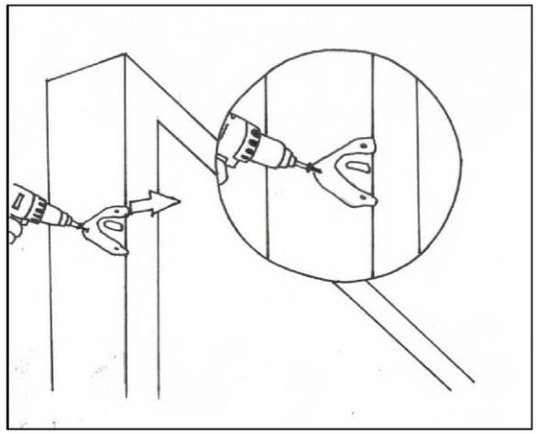
Purchase a door according to the size of your openings. Doors and door openings are generally standard sizes, generally 24-36". The framed-in rough opening for the door is always around 2" wider than the purchased door . This allows for adjustment when installing the door to achieve plumb "level".

2



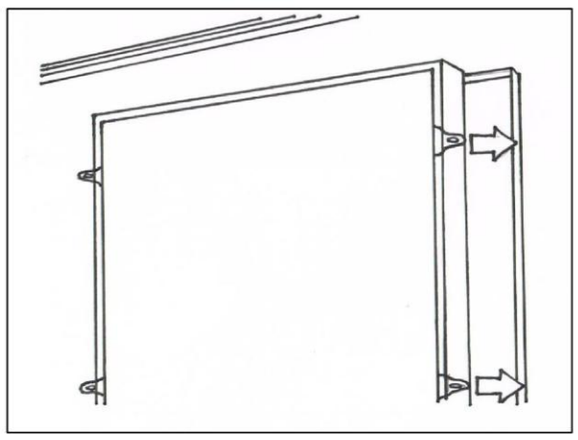
Draw a plumb line on the wall. Measure 1/2" in from the rough opening on the hinge side of the door. Using a 6' or 4' level draw a level line down the drywall. Using laser level will be more accurate and easier.

3



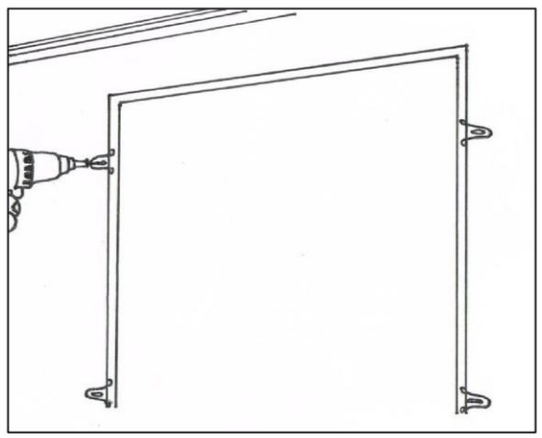
Attach 6 door installation brackets to the outside of the door jamb, the wood frame to which the door comes pre-attached. Place a bracket behind each of the three hinges. Attach the remaining three brackets on the other side of the jamb. The first bracket should be 8" from the top, the next bracket just above the latch stop, and the final bracket 8" from the bottom of the door.

4



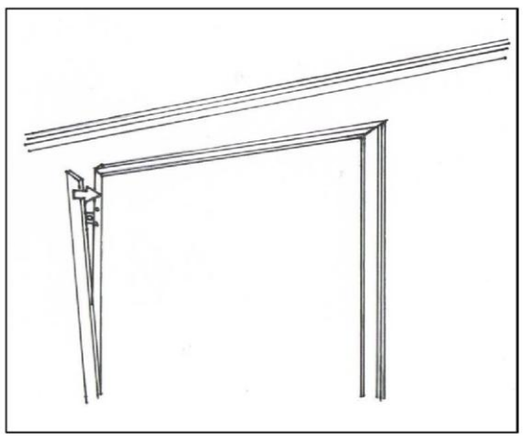
Place the door into the opening on top of blocks or shims. Place 1/2" blocks under the door if a carpet or hardwood is going to be installed or 1/4" blocks if installing laminate.

5



Attach the brackets. Using the plumb line on the wall, screw in all the brackets on the hinge side of the door and the wall is leveled. Check the reveal (gap between door and door jamb) when screwing in each of the final 3 brackets. The door will now be perfectly hung and the blocks under the door can now be removed.

6

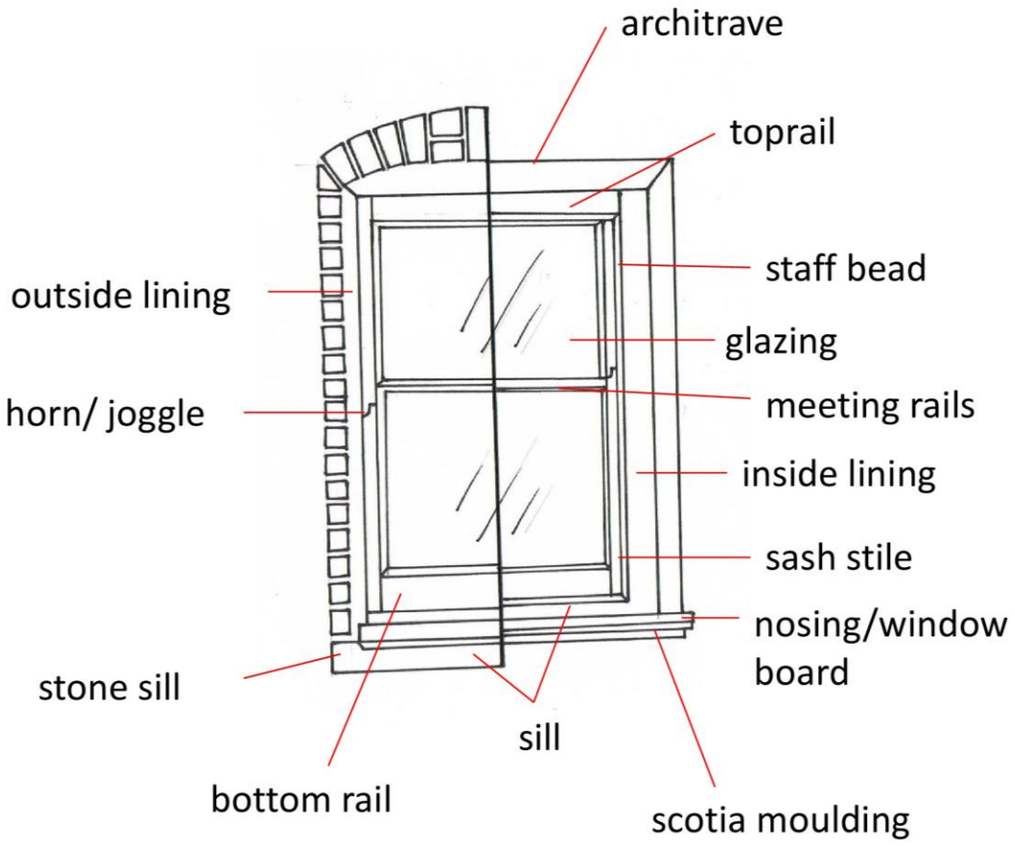


Install the casing around the installed door. The casing, also called the trim, is the strips of wood that hide the joints and some parts of the hinge. The trim will perfectly conceal the door installation brackets . Choose casing that compliments your style and cut it using mitered corners or other styles, depending on your preference.

WINDOWS

## Window frame

It is set within a finished opening or wrapped around a rough opening. It prevents rain water from outside from going in. Therefore, the materials must be waterproof.




architrave ⟶ A style of mouldings framing the top of a window.

toprail, bottom rail, meeting rails ⟶ Horizontal members of the sash, rails fit between vertical components of a window. Every windows have a top and bottom rail. Meeting rails is the rails located at the center of a double hung window.

glazing ⟶ The process of mounting glass into windows and also refers to the glass or plastic panes themselves.

sash stile ⟶ The frame of the window that actually holds the glass in place, a sash consists of rails at the top and bottom with stiles at the side.

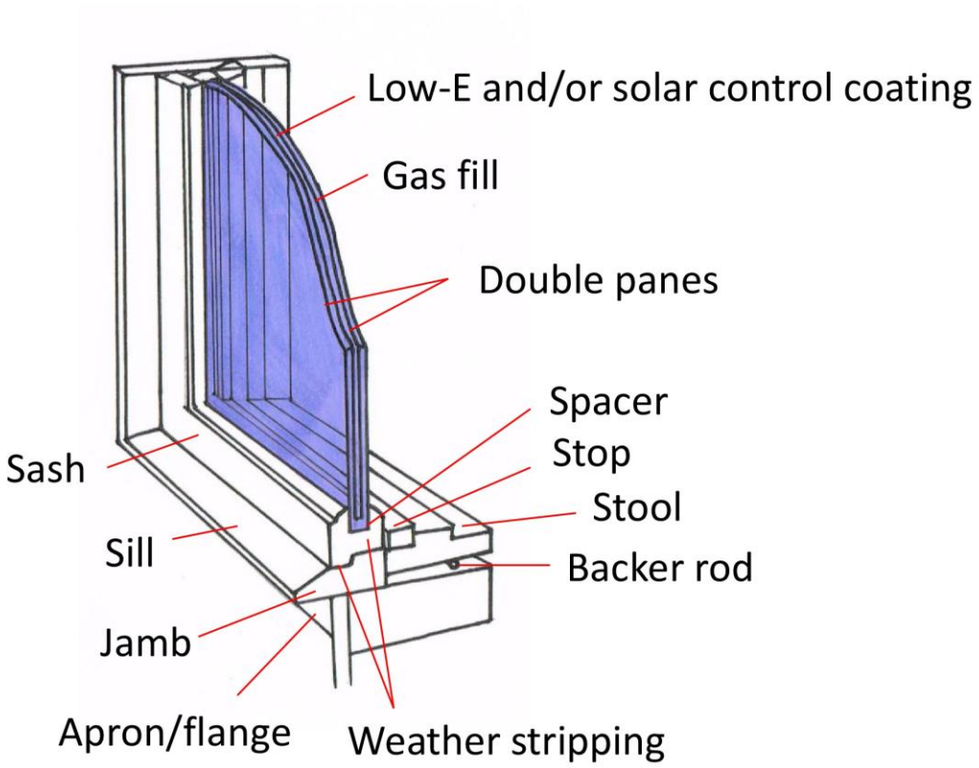
staff bead ⟶ A bead used to close the joint between a wooden frame and the adjacent masonry.

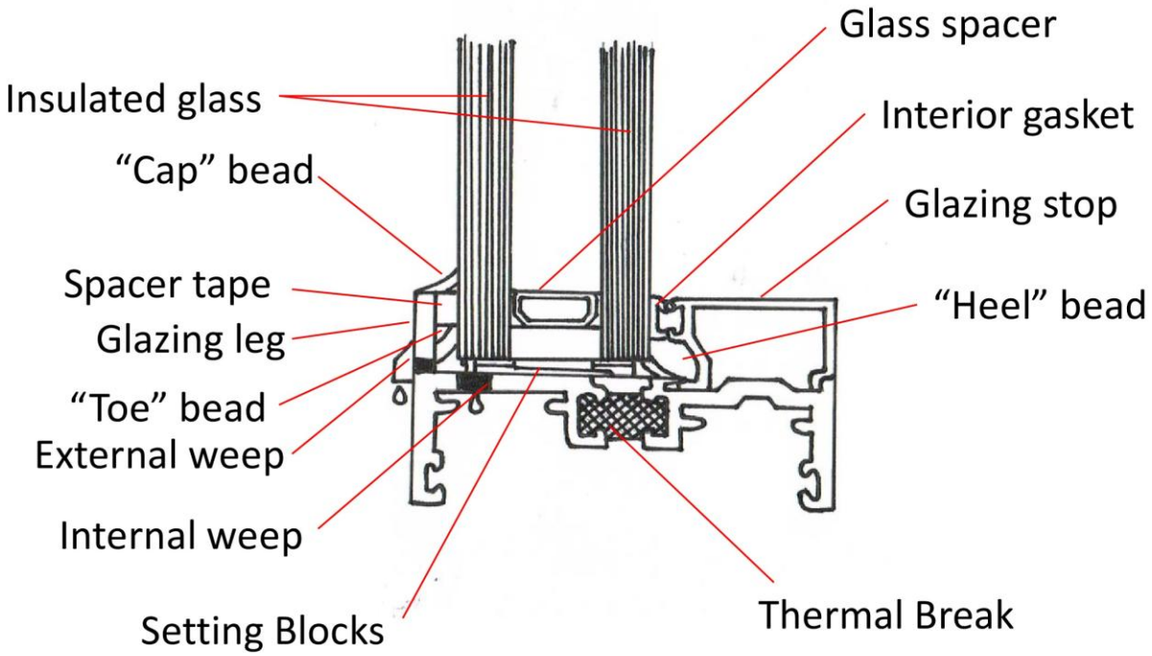
scotia moulding ⟶ A strip of material with various profiles used to cover transitions between surfaces or for decoration.

sill ⟶ The lowest part of a window frame. Window sills hold the side pieces in place and slope outward to drain water.

WINDOWS

# Anatomy of windows

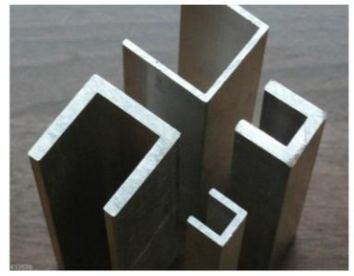


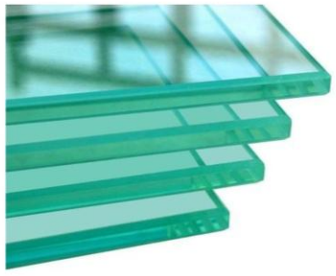
WINDOWS

## Materials

The frame of the window is made out of aluminum. The advantages in using aluminum frame is that the corrosion resistant qualities of aluminum provide a low maintenance frame and is weather resistant. It also reduces carbon footprint by saving energy.



The glass of the window is made out of tempered glass. Tempered glass is more tough as compared to the normal glass as a result of its resilient characteristic and proof dynamics. It can be explained to be safety glass as it burst into oval formed pebbles when broken.



## Size

There are three types of measurement for the windows at the site. The sliding and casement windows are both at the same high with the doors, where's as the awning windows are smaller and the fixed windows is larger which occupy half of the height of the building.

Awning windows

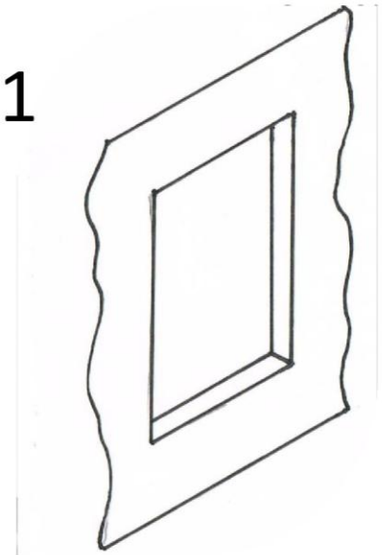
Fixed windows

Sliding / Casement

WINDOWS

Installation of windows

1



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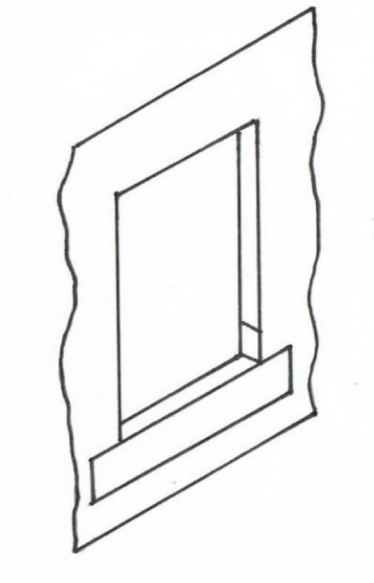

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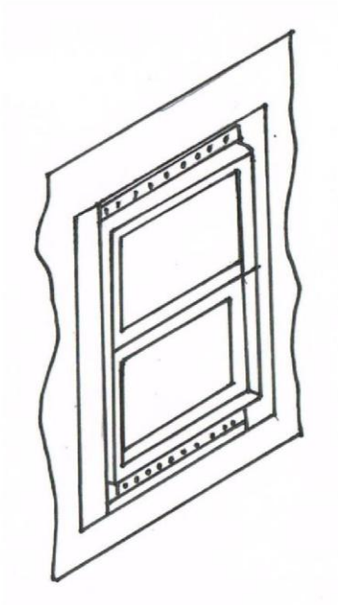

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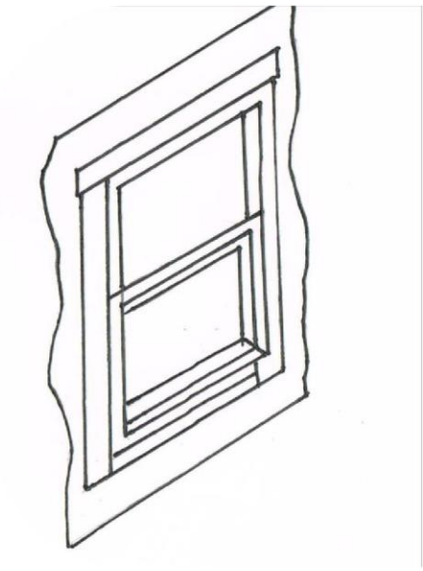

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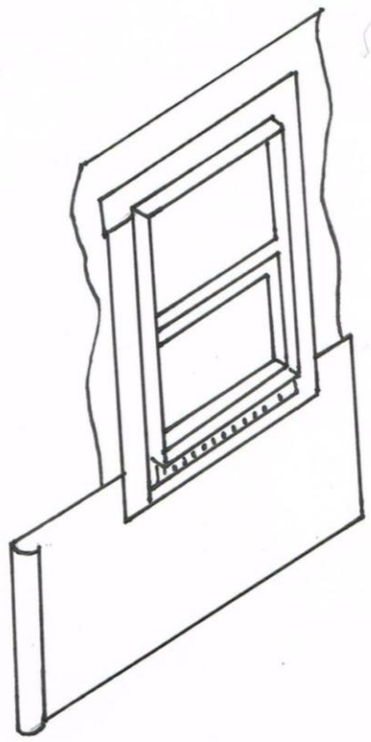

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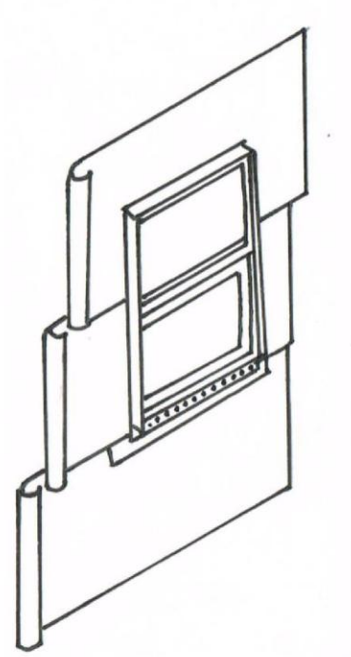


**Steps of installation:**

1. Create window opening according to the size you want your windows be.
2. Apply sill flashing to the bottom of the opening. Then apply sealant around the opening.
3. Install the window into the opening and apply jamb flashing.
4. Apply head flashing.
5. Slide first course of building paper under sill flashing. Apply sealant to jamb and head flashing.
6. Install subsequent courses of building paper.

ROOF

## Roofing

The roof is a slopped surface built with the intention of redirecting rain, as well as snow and hail, while also maintaining insulation within the structure. Typically, the slope (the vertical rise divided by its horizontal run) affects how efficiently the drainage occurs, with a higher pitch usually resulting in better redirection. Most angles of slope are usually between 10°-15° of slope.

The roof consist of two parts: The interior support layer, and the outer layer. The interior support layer is established during the framing process of the structure, and is categorised into either 'heavy-frames' or 'light-frames', both of which have individual properties that dictate the characteristics that the finished roof will have. The outer layer is the exterior of the roof, which will vary greatly depending on the material used to build the outer layer. Typically, the outer layer is comprised of layered tiles or shingles that form a cascade to help with the drainage of rain, while also forming a barrier against wind.

ROOF

## Types of Roofs

There are many types of roofs that fulfil different purposes. Most commonly seen are:

- Hip Roofs
- Gable Roofs
- A-Frame Roofs
- Flat Roofs
- Shed Roofs

As seen on the site at Sri Hartamas, the roof type used is a Flat roof:

The Flat roof consists of an under layer and a top coat, which are sealed together, with the outer coating normally consisting of synthesised rubber.

Due to its horizontal nature, the Flat roof is easy to maintain, as it is easy to access and inspect for damage due to its high degree of stability. It is also cheaper to re-coat the top layer when compared to sloped roofs, and much easier to install.

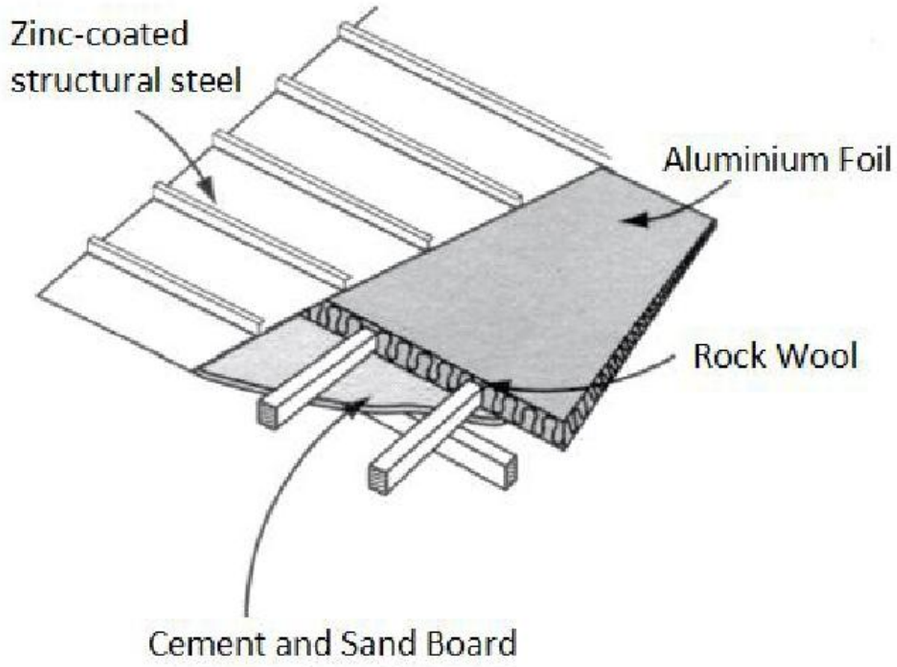
Also seen at the Sri Hartamas site is the Pergola (above), an open roof made with weather-resistant wood that's been stained. Designed more as a form of shading, Pergolas are an aesthetical architectural feature that usually gives cover to an isolated space.

ROOF

## Materials

Roofs are comprised from a large selection of materials, including (but not limited to) stone, clay, metal, timber, and assorted-vegetation.

In the Sri Hartamas site, several materials are used for the roofing, consisting heavily of different types of metals.




The decking is made of an alloy of structural steel that has been treated with zinc to allow for reflection of sunlight and heat.

The Flat roof's under layer consists of rock wool and aluminium foil, which act as sound insulation and temperature control.

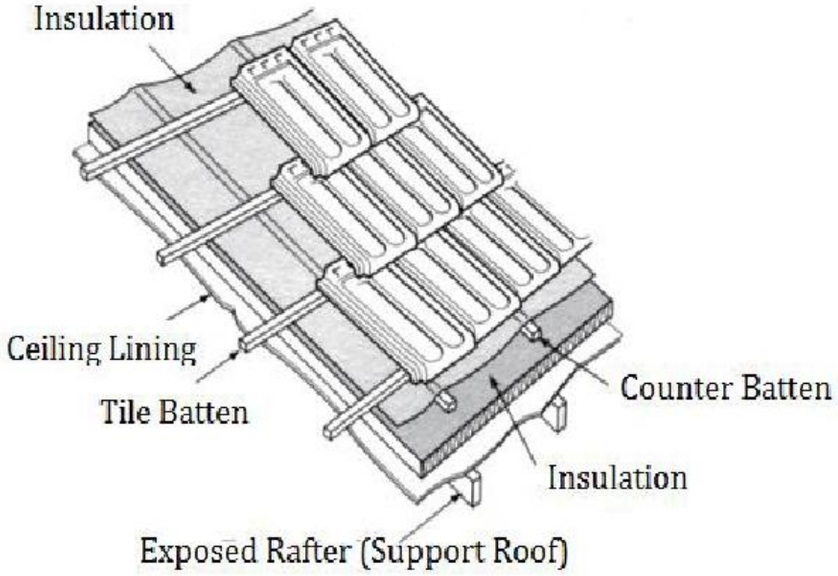
Aluminium is used for the frame structure, a common material for high performance roof installations, while cement and sand board is used as a the ceiling lining.

ROOF

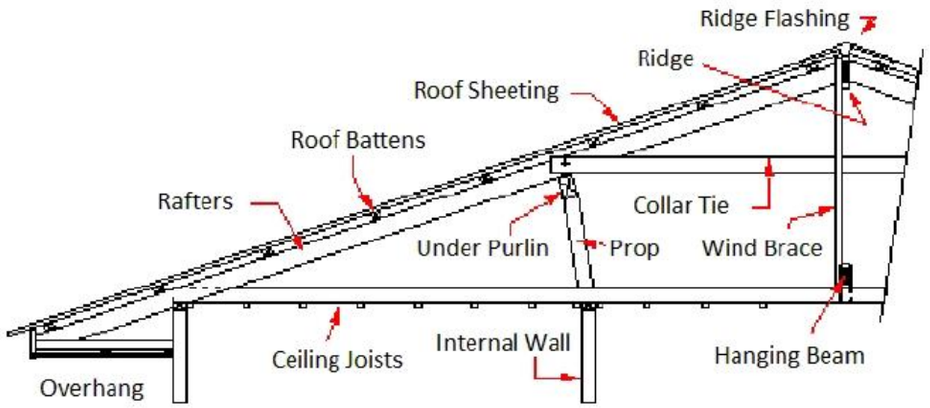
## Anatomy Of The Roof

The roof, while being primarily categorised into the outer layer and the inner support layer, has several other components that help support the roof as a whole.

As displayed in the diagram below, the outer layer consists of the roofing material, foil blankets and insulation layers, battens that hold the tiles and insulation in place, and then the inner support layer (rafters) before finally reaching the ceiling lining.




The interior support layer is a frame that consists of several beams that interlace with one another to fully support the weight of the outer roof.




The frame consists of rafters, props, beams, braces, and battens, all of which come together to support the overall weight of the outer roof. The supporting roof occasionally can act as a load bearer if the support is a 'heavy-frame'.

# CONCLUSION

After putting all of our combined efforts into this project, there is much that we have experienced and learnt about buildings and construction, from identifying the tiniest flaws to understanding structures. We have learnt the process of analysing and documenting everything that is carried out on a construction site. We understand elements and components of construction, as well as the technology used in construction here in Malaysia. We also know to relate these materials and technology to the construction industry.

We realise that every site has its own scale and methods of construction, and take different times to complete different stages. We also learnt to push ourselves to the limit and take the initiative to widen our horizons by studying and analysing larger-scale projects - which was initially not recommended by our lecturers.

Finally, we learnt the importance of communication - between ourselves as group members, us and our lecturers, and us and the people in charge of the sites.

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