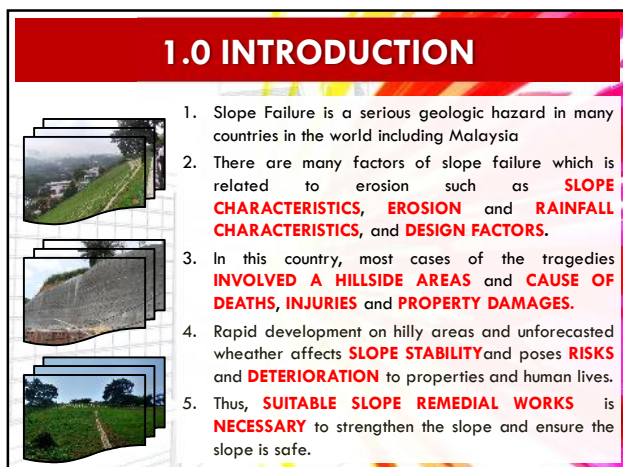


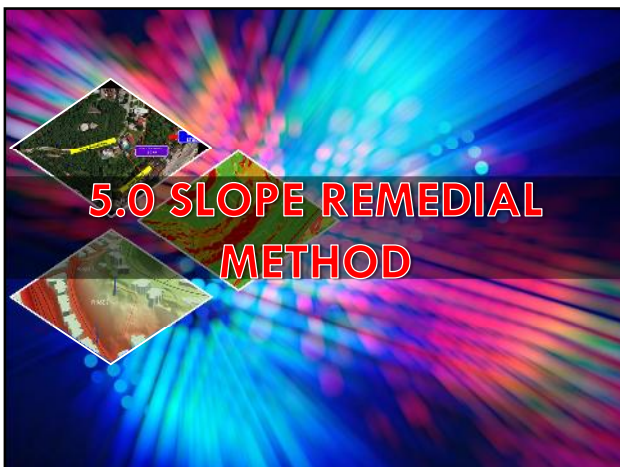


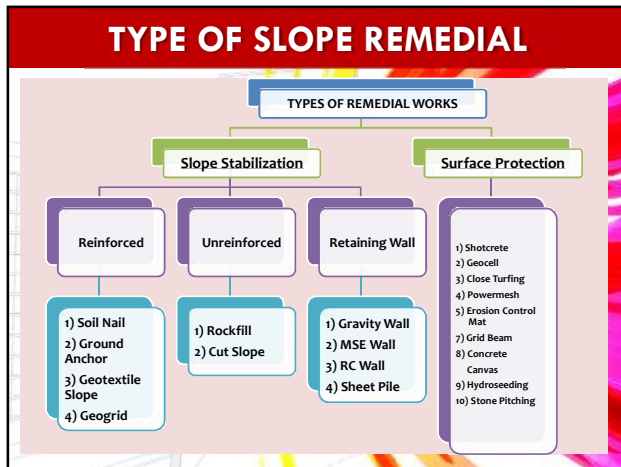














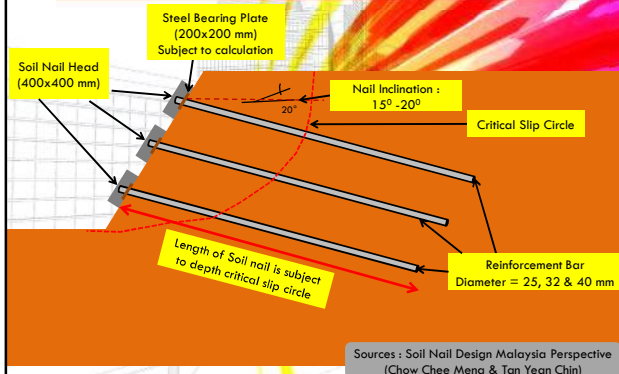
SOIL NAIL

1. Soil nail is commonly used in Malaysian slopes both **as stabilization measure** for **destressed slope** and **very steep cut slope**.
2. Popularity of soil nail is due **to technical suitability** as an effective slope stabilization method and **maintenance free**.
3. Basic concept of soil nailing is **installing closely spaced steel bars**, called **soil nail** into slope .
4. The soil nail functioning when develop their **reinforcing action** through **nail-ground interaction** as the ground deform.

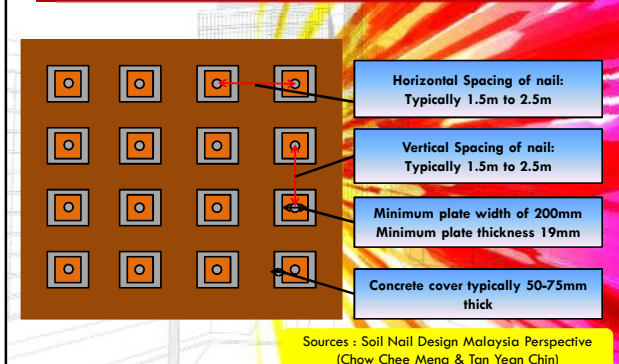
EXAMPLE OF SOIL NAIL

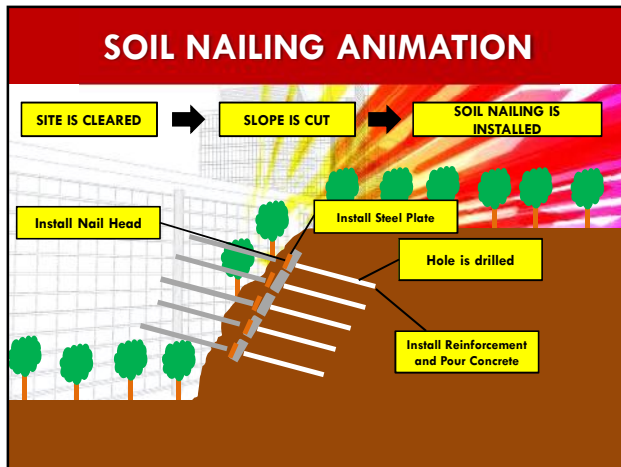


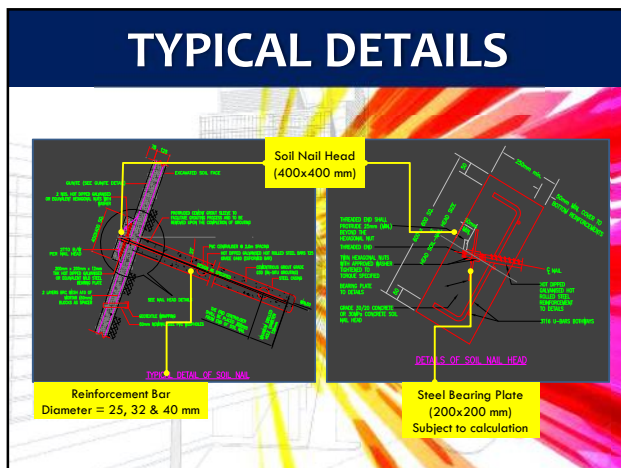
TERMINOLOGY OF SOIL NAIL



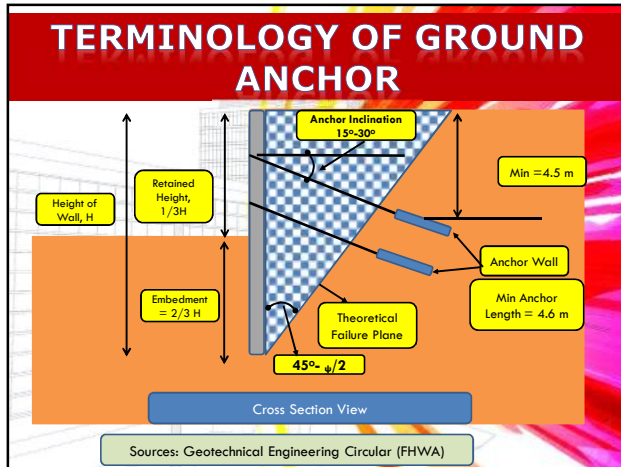
TERMINOLOGY OF SOIL NAIL

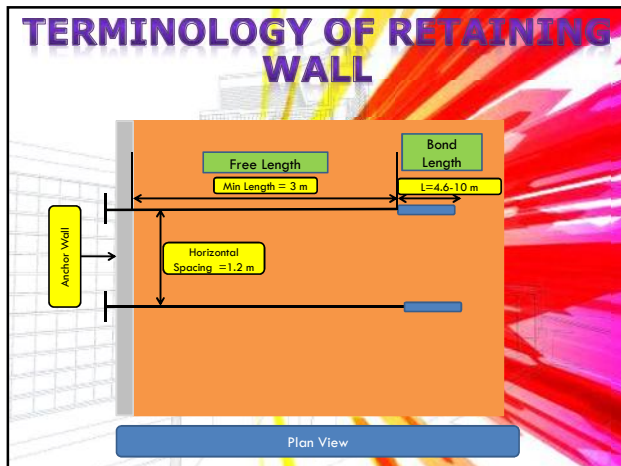


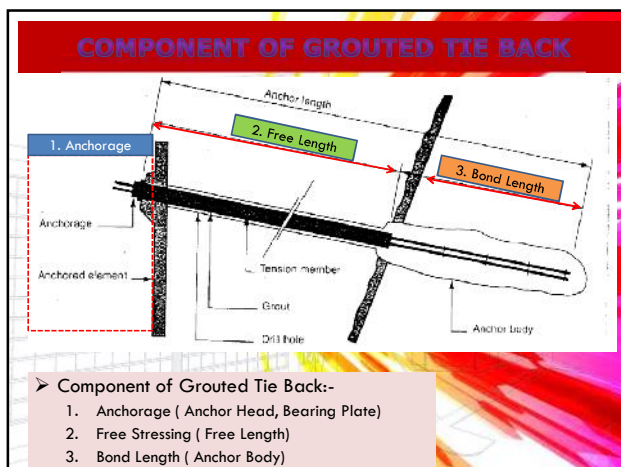


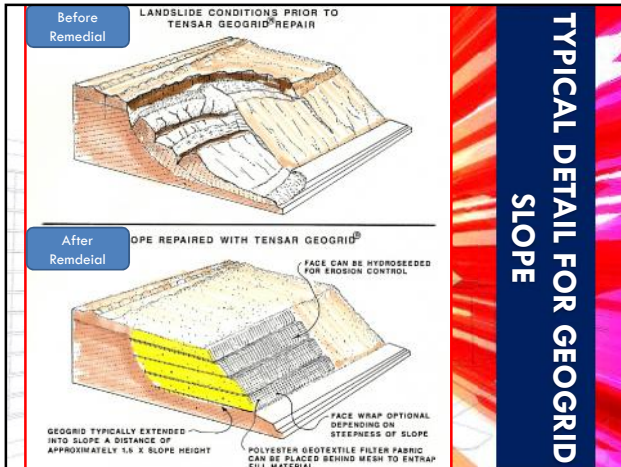


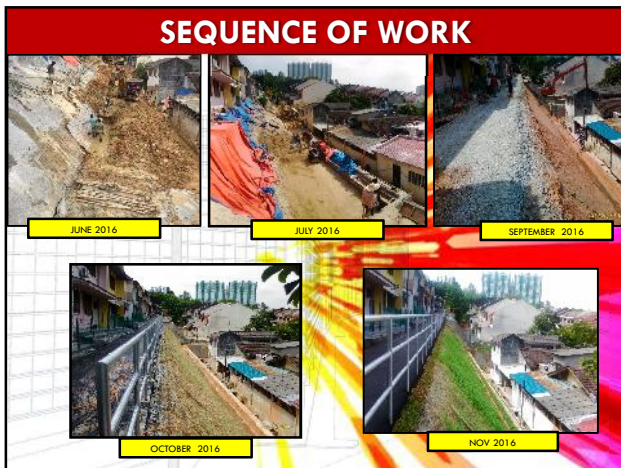




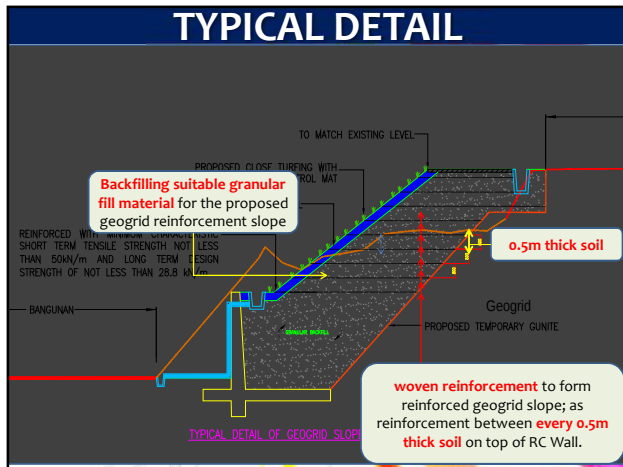




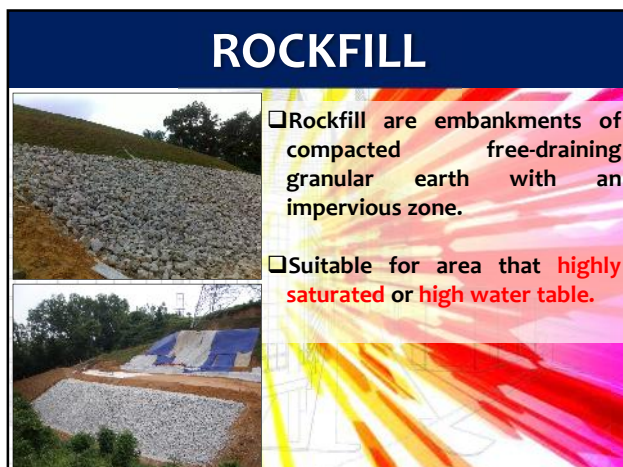












ROCK FILL

Project STRIDE, Kajang (Reinforced Geotextile Slope & Rockfill)

TNB Pylon Di Kem Tentera Sungai Besi, Mukim Petaling, Kuala Lumpur

TYPICAL DETAIL

The diagram illustrates a cross-section of a slope failure repair. At the top, a road surface is shown with a 10040mm width. Below the road, a geotextile separator is indicated. The slope itself is composed of well-compacted rock fill, shown in a light blue pattern. A geotextile separator is placed between the rock fill and the underlying soil. A drainage layer, labeled 'SURFACE DRAINAGE TO ENGINEER'S DETAIL', is shown above the rock fill. A 'CUT/trim soil to form benching on the slope failure area for rock fill placement' is indicated. A 'WELL COMPACTED ROCK FILL' layer is shown below the geotextile separator. A 'GEOTEXTILE SEPARATOR' is also shown below the rock fill. A 'DRAINAGE LAYER' is indicated at the bottom. A 'TOE DRAIN TO ENGINEER'S DETAIL' is shown at the base of the slope. A 'PROPOSED SLOPE' is indicated with a 1.5:1.0 ratio. A 'BENCHING' is shown at the toe of the slope. A 'WELL COMPACTED ROCK FILL' layer is shown below the geotextile separator. A 'GEOTEXTILE SEPARATOR' is also shown below the rock fill. A 'DRAINAGE LAYER' is indicated at the bottom. A 'TOE DRAIN TO ENGINEER'S DETAIL' is shown at the base of the slope. A 'PROPOSED SLOPE' is indicated with a 1.5:1.0 ratio. A 'BENCHING' is shown at the toe of the slope.

Rock used for filling shall be clean rough granitic quarry stone. Allowance for min. stone dimension of 75mm shall be allotted to fill-in the gap/void

Cut/trim soil to form benching on the slope failure area for rock fill placement

approved non-woven geotextile composite separator

Labels in diagram include: ROAD, CURB/RAIL, SURFACE DRAINAGE TO ENGINEER'S DETAIL, WELL COMPACTED ROCK FILL WITH CLOSE TYPING, GEOTEXTILE SEPARATOR, 1.5:1.0, PROPOSED SLOPE, TOE DRAIN TO ENGINEER'S DETAIL, BENCHING, WELL COMPACTED ROCK FILL, GEOTEXTILE SEPARATOR, DRAINAGE LAYER, and BENCHING.

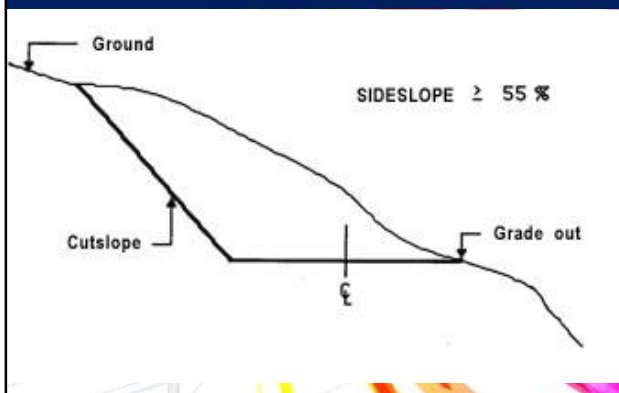
CUT SLOPE



- ❑ Cut slope is a man-made slope created by **excavation of in-situ material**
- ❑ Applicable both for **soil & rock slopes**
- ❑ All untreated slopes shall be designed with **minimum of 2m berm width** and **maximum 6m berm height** with a Factor of Safety greater than 1.3
- ❑ Stabilisation measures can be considered when the design is inadequate.
- ❑ Due to maintenance reasons and to minimise risk to the users, the **maximum number of berms** for cut slopes shall be **restricted to 6 berms**

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CUT SLOPE TYPICAL DETAIL

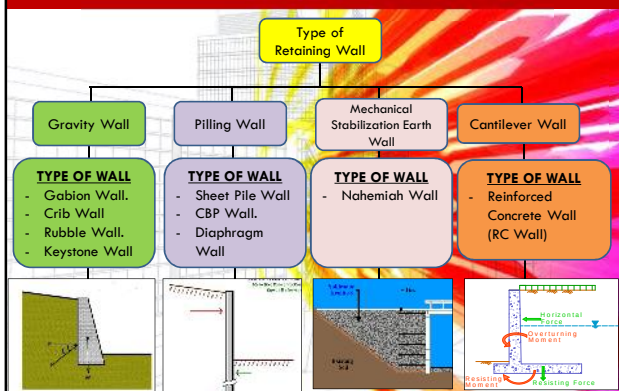


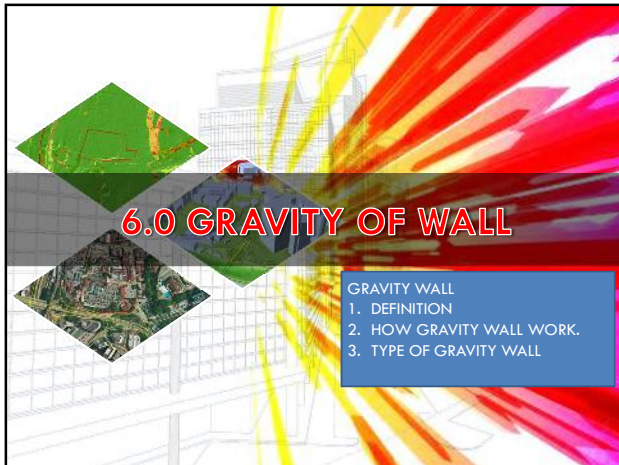
5.0 SLOPE REMEDIAL METHOD

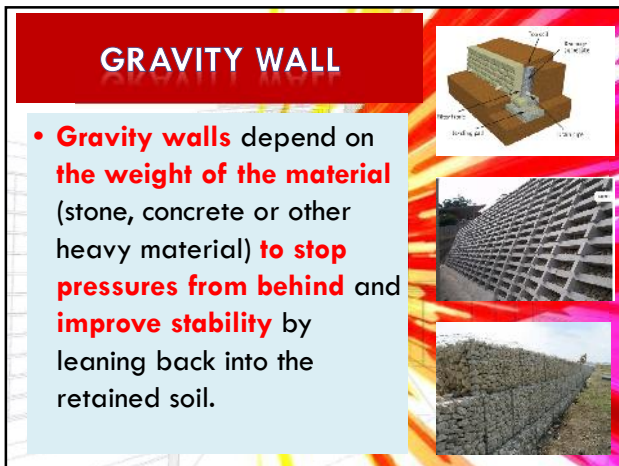
RETAINING WALL

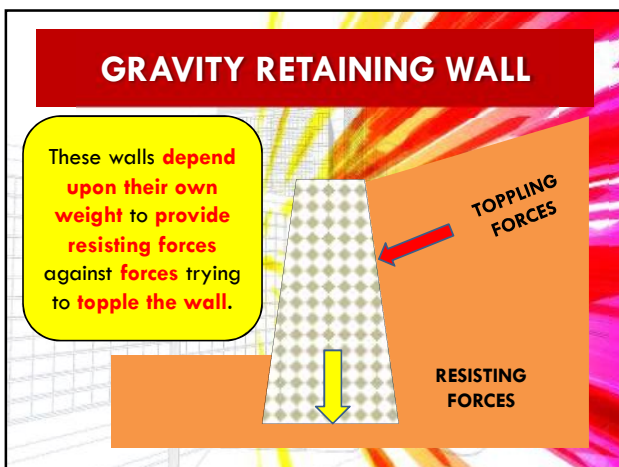


TYPE OF RETAINING WALL









GABION WALL

- A gabion wall is a **retaining wall** made of **stacked stone-filled gabions** tied together with wire.
- Gabion walls are **usually battered (angled back towards the slope)**, or stepped back with the slope, rather than stacked vertically.



EXAMPLE OF GABION WALL



CRIB WALL

- Crib walls are **gravity retaining walls**, constructed from **interlocking, precast, concrete components**.
- They are filled with **free draining material** and **earth backfill** to eliminate the **hazards of hydrostatic pressure** building up behind the wall.



EXAMPLE OF CRIB WALL



Keystone wall

- Keystone created the **mortar less segmental retaining wall** market with its patented **interlocking modular** design.
- This wall are able to **resist lateral pressure** with **their unit weight** and **deep embedment shape**.



EXAMPLE OF KEYSTONE WALL



RUBBLE WALL

- The wall use of **undressed, rough stone**, generally in the construction of walls.
- Its is suitable for **smaller retaining wall** especially where the **finished appearance is important**.
- A simple Stem Wall is suitable for **small retained height** up to **1.5 m**



EXAMPLE OF RUBBLE WALL



ADVANTAGE AND DISADVANTAGE GRAVITY WALL

ADVANTAGE

1. Cheap and simple to build.
2. When constructed from natural materials can look attractive

DISADVANTAGE

1. Limited to about 5m height (wall becomes too big for higher walls).
2. Space needed behind wall for construction and backfilling
3. Not suitable for soft soils due bearing failure.





6.0 PILING WALL

PILING WALL

1. DEFINITION
2. TYPE OF PILING WALL
 - SHEET PILE WALL
 - CONTIGUOUS BORED PILES WALL.
 - DIAPHRAGM WALL

SHEET PILE WALL

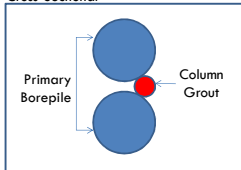



- Commonly as TEMPORARY RETAINING WALL
- SPT-N LESS THAN 30 : Achieved Required Penetration
- Suitable for SHALLOW EXCAVATION
- Water tightness : Seepage EXPECTED to pass through

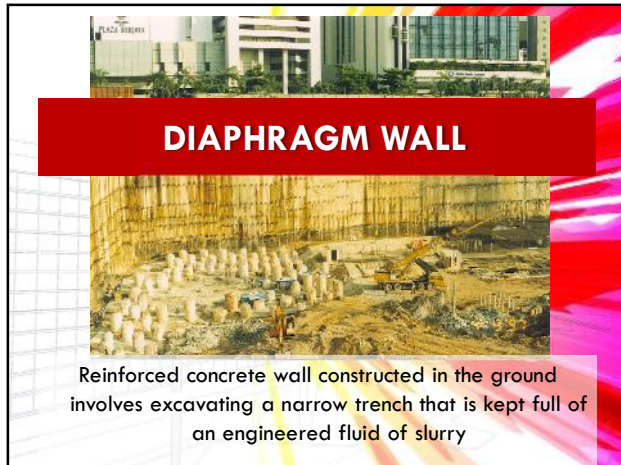
CONTIGUOUS BORED PILES (CBP) WALL



Cross-Sectional



- Ease coring into rock
- Lack water-tightness
- Minimum noise and vibration disturbance







Example of Mechanical stabilization earth wall

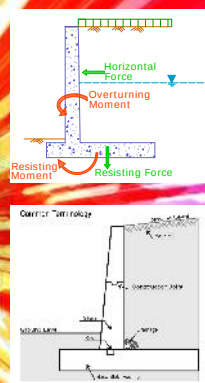


6.0 CANTILEVER WALL



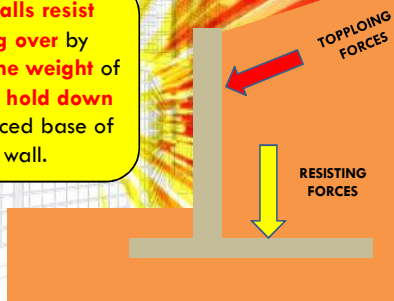
CANTILEVER WALL

- **RC Cantilevered walls** are made of reinforced concrete that consist of **Thin Stem** and **Base Slab**
- These walls cantilever loads to a large, structural footing and **convert horizontal pressures** from behind the wall to **vertical pressures on the ground below**.

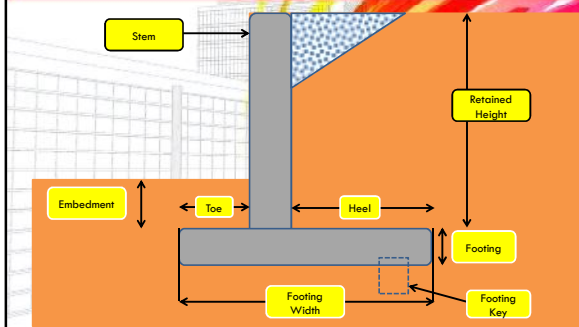


Reinforced concrete retaining wall

These walls resist **toppling over** by **allowing the weight of the soil to hold down** the reinforced base of the wall.



TERMINOLOGY OF RETAINING WALL

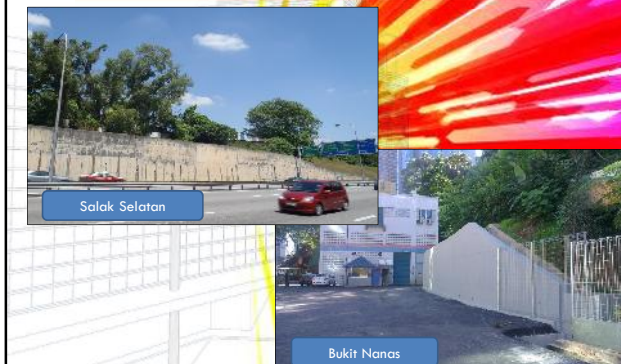


Example of cantilever wall



Jalan Syed Putra, Kuala Lumpur

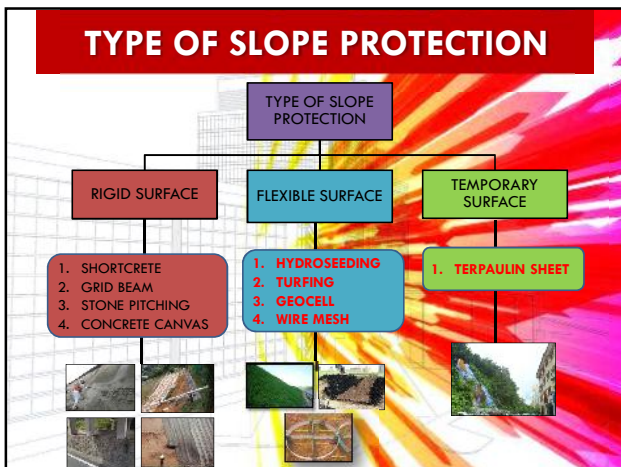
Example of cantilever wall



5.0 SLOPE SURFACE PROTECTION

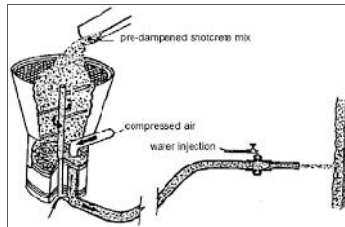


TYPE OF SLOPE PROTECTION





DEFINITION OF SHOTCRETE



Shotcrete is a today an all-inclusive term that describes **spraying concrete or mortar** with **either a dry or wet mix process through a hose** and nozzle onto a surface

DEFINITION OF GUNITE



Gunite is **trademarked name** that is incorrectly used to describe the **dry mix shotcrete process**







WHAT IS GRID BEAM?



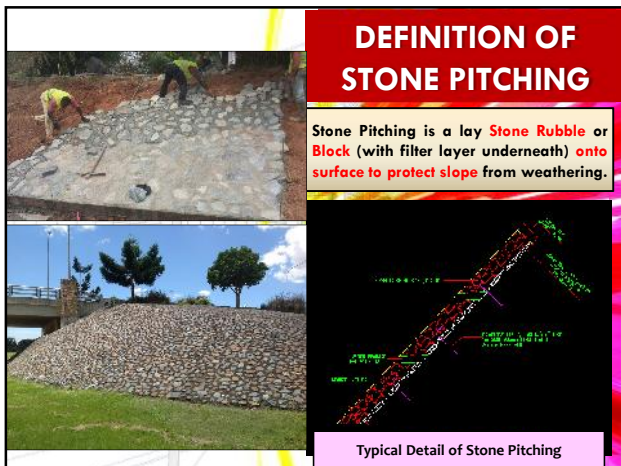
CONSTRUCTION SEQUENCES OF GRID BEAM

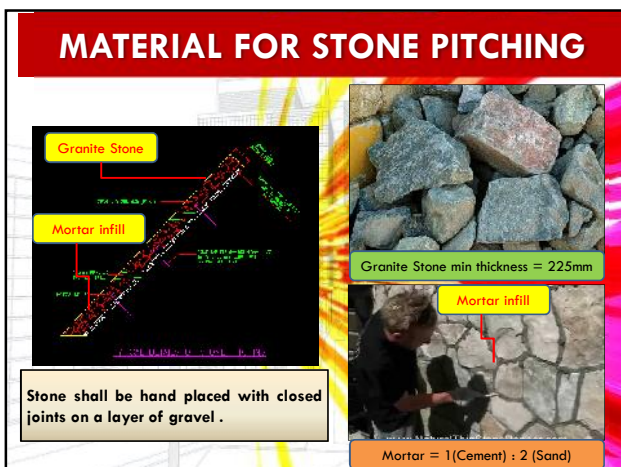


EXAMPLE OF SITE PHOTO











INTRODUCTION OF CONCRETE CANVAS

Concrete Canvas is flexible, concrete impregnated fabric that harden when hydrated to form a thin, durable, water proof and fire resistance.




This method is rapid install, easy to use and Eco Friendly

CC PROJECTS IN MALAYSIA SLOPE PROTECTION

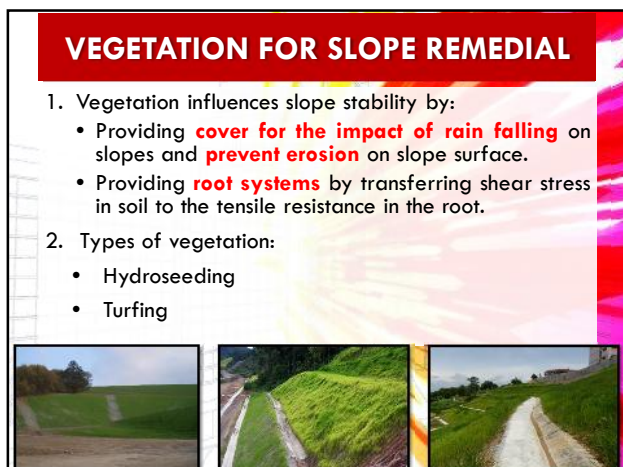
PILOT PROJECT
 CLIENT : JKR HQ
 LOCATION : SLIM RIVER
 QTY : 100m²
 DURATION : 4 HOUR

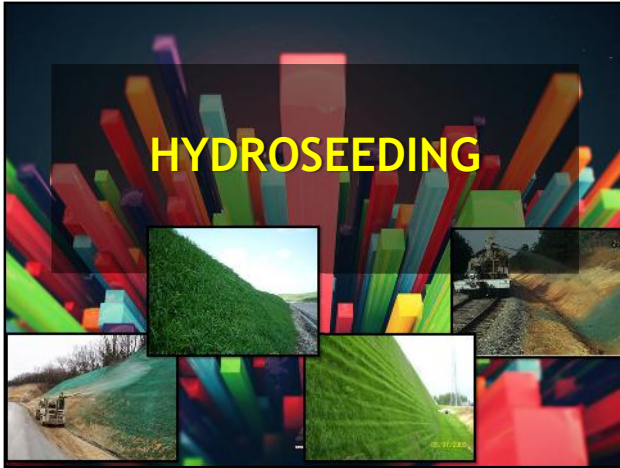










HYDROSEEDING

- Application of **grass seed mixed with fertiliser** and nutrient by **spraying method** over the ground.
- The **grass seed will grow** eventually and the root of the grass will **act as an organic reinforced fiber** and hold the surface soil.




HYDROSEEDING WORKS



GRASS SEED, FERTILIZER AND NUTRIENTS ARRIVED AT SITE



EXAMPLE OF GRASS SEED



SPRAY GRASS SEED



FINISH HYDROSEEDING WORKS



GRASS BEGIN TO GROW



SPRAY GRASS SEED

VIDEO OF HYDROSEEDING



BEFORE AND AFTER HYDROSEEDING



TURFING



TURFING

- Turfing is a **direct application of grass** with **developed roots** on a slope surface
- The relatively **matured grass** will grow easier and extend its root into the soil **to strengthen the overall surface**.



EXAMPLE OF TURFING WORKS

LIBBANG, SARAWAK



BEFORE REMEDIAL

AFTER REMEDIAL



EXAMPLE OF TURFING WORKS



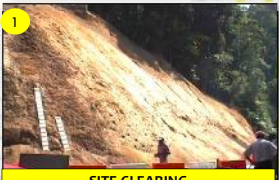


POWERMESH

- The POWERMESH System is **used primarily for slope stabilization, land protection**, riverbed protection and greenery project (landscaping).
- lightweight and flexible, soil confinement ring that is formed with the use of galvanized wave wire




EXAMPLE OF POWERMESH WORKS



1
SITE CLEARING



2
INSTALL POWER MESH AND J PIN



3
BACKFILL SOIL INTO THE RING



4
TURFING WORK



GEOCELL

- Geocell is cellular confinement system utilizes the strength and permeability to create a 3-Dimensional cellular confinement system




- Ships in compacted panel form and expands into a honeycomb formation to the desired shape and dimension on-site.

- The unique, lightweight, flexible material conforms to surface variations to improve ease of installation while resisting impact damage



SEQUENCE OF WORK GEOCELL



GEOCELL DELIVERY AT SITE



SITE CLEARING



INSTALL CLOSE TURFING



LAYERING GEOTEXTILE AND GEOCELL

