TAYLOR'S UNIVERSITY

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SCHOOL OF ARCHITECTURE, BUILDING AND DESIGN
BACHELOR OF QUANTITY SURVEYING (HONOURS)

BUILDING SERVICES 2 (QSB 2714/ BLD 60503)
INDIVIDUAL ASSIGNMENT

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TABLE OF CONTENT Page

Introduction of earth retaining wall system

Earth retaining wall is a structure that retains earth behind it and prevent soil from sliding and eroding away. They are used to bound soils between two different elevations often in areas of terrain possessing undesirable slopes or in areas where the landscape needs to be shaped severely and engineered for more specific purposes like hillside farming or roadway overpasses.

Type of Retaining walls

1. Gravity Walls
    - Mass construction
        i. Concrete wall
        ii. Concrete wall with masonry facing
        iii. Unreinforced masonry wall
        iv. Gabion wall
        v. Crib wall
    - Semi-mass construction
    - Reinforced construction
        i. Concrete cantilever
        ii. Counterfort/ Buttressed
        iii. Precast
        iv. Masonry
        v. Prestressed
1. Reinforced Soil Walls
    - Geogrid/metal strip reinforced soil
    - Soil Nailed
    - Ground anchors
2. Embedded walls
    - Reinforced concrete bored pile
    - Driven steel sheet piles
    - King post
    - Secant walls
    - Diaphragm walls

3. Hybrid System
    - Anchored earth
    - Tailed gabion
    - Tailed concrete block
    - Miscellaneous

Gravity walls

Gravity walls rely on their huge weight and geometrical dimensions to retain the material behind it and achieve stability against sliding, overturning and failure. Material of gravity walls to be can be concrete, stone or brick masonry.

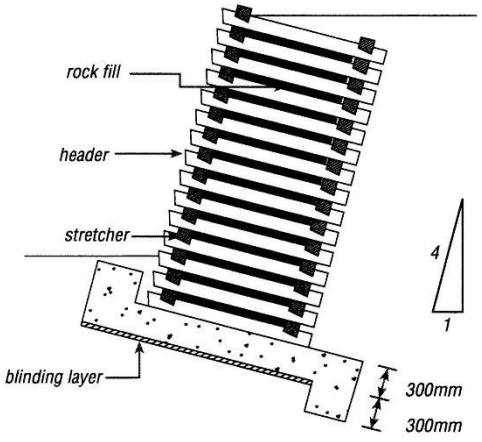
Gravity walls can be categorized into 3 groups

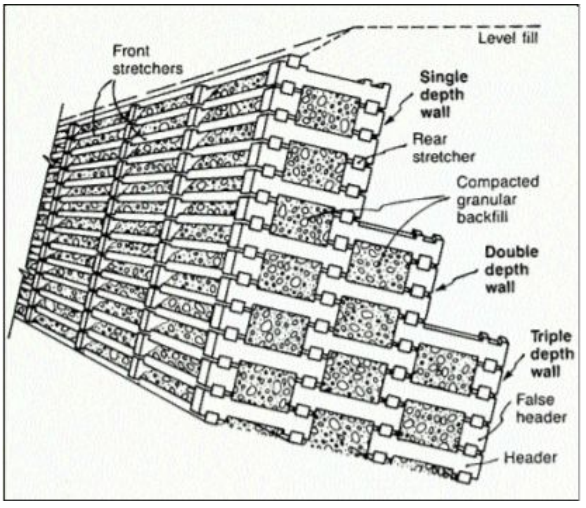
i. Mass construction: rely only on their significant mass
ii. Semi-mass construction : Composite mass concrete with low material content of reinforced concrete
iii. Reinforced construction : Gravity structures used the weight of wall and retained material which rest on the slab to against overturning

Characteristic of crib wall

- One of the oldest gravity wall systems.
- Is a cell-based retaining system.
- It resists earth pressure by a combination of its own weight and friction on the effective back of the wall.
- They are assembled and stacked together with the infill material
- Can built economically 6 to 40 feet or even higher
- The standard lean back for crib wall is 1H:4V (76 Degrees)
- Walls can be straight, curved or angled and incorporate landscape features if required.

Component of crib wall





- Unit
  - Front stretcher
  - Rear stretchers
  - Header
  - False Header
  - Spacer block unit
- Base slab/ concrete footing

- Infill material
- Retained fill

Typical applications include:

- Commercial walls
- Residential walls
- Abutment walls
- Embankments
- Slope stability
- Drainage channels
- Landscape walls

Material of block unit

- Pressure treated timber
    - Suitable for rural roads where it blends well with the surroundings
    - Long-term durability of such units should be critically considered

- Precast reinforced concrete
    - Mostly used for building crib walls
    - Plain concrete units are not recommended to use for crib walls due to the ease of cracking.

- Recycle waste plastic
    - Block unit made of 100% recycled waste polymers

Requirement and consideration

- Units must spaced at close intervals so as the infill doesn't easily spill through the units
- Stretcher must be parallel to the wall face while headers must be perpendicular to the wall face.
- Before constructing the crib wall, it is necessary to confirm the dead and live load. Load applied to the crib walls are directly affect external and internal stability of the crib walls.
- Sealing the top of the crib wall with a compacted clay plug to minimize entry of surface runoff.
- The crib wall units must be filled with a free draining granular material and consolidated using a hand compaction method. The backfill material must be adequately compacted.
- Drainage system is required to protect the surfaces against erosion and prevent surface runoff from entering the crib wall

Manufacturing of Concrete crib wall unit

Concrete crib wall unit made of 20mpa concrete and grade 300 reinforcing steel and then cured for a minimum of seven days. They are wet cast and vibrated in precise steel molds, not pressed to give the greater durability required to comply with the Building Code.

Construction of Crib wall

1. Excavated and removal of all loose rock and soil as required for crib wall slab footing or base dimensions
2. Typically a concrete footing will be required and should be poured at the 1 in 4 batter at the designed thickness
3. Where a temporary batter is to be excavated in front of and within 10m laterally of existing structures, the crib wall shall be constructed in stages
4. Waterproof sheeting should be available to cover the batter slope during any wet weather and the contractor should be prepared to backfill the excavation in the event of prolonged wet weather.
5. Control line for crib wall set out is carried out by a registered surveyor is used to set out the front line of the wall or top front of wall and to provide clear working space.
6. As the wall goes up, work progresses from either the back or front depending on the property line and site restrictions
7. Stretchers and closers are laid the length of the wall. Headers are placed with the H-groove shape interlocking on the front and rear stretchers and closers. Standard

header blocks may alternate with false header blocks along each row of stretchers and closers depending on the design of the wall.

8. Agricultural drainage pipe is then placed at the rear base of the wall with outlets to front of wall at least every 20mm
9. Infill is either crushed rock or other granular material, with compaction carried out manually
10. On completion of the wall, the top front stretchers may be glued in place with epoxy mortar adhesive to prevent displacement.
11. Backfill crib wall with the specified/approved crushed rock backfill in 500mm layers and hand tamper particularly around header components

Advantages of crib walls

- Can be built by hand and do not require skilled labor
- Easily and quickly erected.
- Crib wall section can be pre-cast and transported to site and held in stock for emergency works.
- Compare to other retaining wall systems, crib walls can save up to 30% of construction cost if the height of crib wall is 2 to 12 meters. The taller the height of crib walls, the greater the potential savings
- Some flexibility although not as good as gabions
- Aesthetic

Disadvantages of crib walls

- Usually requires a concrete base
- Timber crib is not highly durable.
- Precasting works needed for concrete walls and transport to site.
- Not very economical for short lengths of wall.
- Not particularly well suited to rapidly varying base level.
- Unit weight of wall is slightly higher than gabions but not as high as concrete walls so wider wall required to provide same resistance.

Case Study

Center Parcs Woburn Forrest

Location: Center Parcs, Woburn Forrest

Max. Retained Height:8.8m

System: Ecocrib system reinforced soil

Face area: 1000m^2

Construction time: 5 weeks

Challenges

-Design of 3 large multi-purpose leisure complexes of over 40000m^2

-Conservation of surrounding forest

-Able to support the Plaza hotel car park and a linking bridge

Solutions

-Providing a one-stop-shop solution consisting of the design, supply and installation over 1000m^2 of geogrid reinforced soil Ecocrib

-Site-won fill material (Woburn sand) was used between horizontal layers of geogrid reinforcement helping further to reduce waste and provide a highly cost effective solution

Advantages

-1000m^2 of reinforced soil Ecocrib used in the scheme equivalent to 18 million plastic bottle tops or 75 tons of plastic waste diverted from landfill and no waste is created during manufacture or installation.

-Ecocrib able reduce the immediate and long-term environmental impact of this new Center Parcs development

Case Study

Lisarow Aged Care Facility - Central Coast, NSW

Lisarow Aged Care Facility - Central Coast, NSW

Location: Lisarow, New South Wales, Australia

Max height: 5.875m

Length: 156 meter

System: Precast concrete crib wall

Construction time: 4 weeks

Challenge

-Current stage consisted of demolition of the existing infrastructure, earthworks, foundation works, a new multi-storey building, new access road, landscaping and replacement of existing timber gravity retaining walls.

-Excavated embankments would not be compromised due to inclement weather conditions experienced throughout the project

Solution

-Utilized both single depth and double depth construction.Single header construction was used in front of the stable gravity retaining walls, while double header construction was used to retain the embankment where the failing timber crib walls were to be removed.

-Each respective completed section of crib wall was then backfilled with 40 to 70mm basalt aggregate up to underside of soil plug, followed by soil batter installation

Advantage

-The wall also incorporated a nicely constructed radii around existing trees and other obstructions

-The high quality precast concrete components provide for long term durability and will not warp easily.

Conclusion

In conclusion, crib wall is one of the common gravity wall used in the wall. Although there are some disadvantages to use crib wall but the benefits are more effective than disadvantages so this is the most reliable thing that crib wall as earth retaining wall.

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