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CASE STUDY OF RETAINING WALL

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ABSTRACT

Retaining walls provide lateral support to vertical slopes of soil. They are used to bound soils between two different elevations often in areas of terrain possessing undesirable slopes or in area where the landscape needs to be shaped severely and engineered for more specific purposes like hillside farming or roadway overpasses. This paper has been written to discuss various types of retaining wall for different heights, their behavior and various types of failures.

Keywords: Economical, Great heights, Gabion wall, segmental wall, stepped cantilever wall)

I. INTRODUCTION

A retaining wall is a structure designed and constructed to resist the lateral pressure of soil. When there is a desired change in ground elevation that exceeds the angle of repose. It is used in variety of structures such as bridge engineering, railway engineering, highway engineering etc. Reinforced concrete retaining walls have a vertical or inclined stem cast with base slab. It resists lateral earth pressure by cantilever action of stem, toe slab and heel slab. The tendency of the wall to slide forward due to lateral earth pressure should be investigated and a factor of safety of 1.5 should be provided against sliding. Cantilever retaining walls are found best up to height of 6m. For greater heights earth pressure due to retained fill will be higher due to lever arm effect, higher moments are produced at base, which leads to higher section for stability design as well as structural design. This proves to be an uneconomical design.

As an alternative to this, one may go for counterfort retaining wall, which demands greater base area as well as steel. As a solution to this difficulty, a new approach that is to minimize effect of forces coming from retained fill, short reinforced concrete members in the form of cantilever steps are cast along the stem on the retaining face. Addition of this steps would counterbalance the locally appearing forces and will result into lesser, moment and shear forces along the stem. Also it will reduce the bending action that is pressure below the base. This paper focuses on finding the solution on providing retaining wall above height of 8 metres.

II. SITE SELECTED FOR STUDY

We got great opportunity to conduct our case study at site of Nyati group's site Equatorial nestled in bavdhan among the hills.

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Fig.1 Nyati Equatorial site

The retaining wall was required on boundaries of the site. The height of the backfill to retain was 8m and SBC was 30T/m^2.

We visited site in of 24June 2016.At that time site was half completed. Project manager of site Rupesh Kannade Sir gave us overview of site. So the issue on the site was they were not getting economical solution of retaining wall to retain the 8meters and above backfill condition. So we decided to work on it.

III. METHODOLOGY

We started study various types of walls suitable for 8metrers height. The walls we studied are as follows:

3.1 Segmental retaining Wall

Segmental retaining walls consist of modular concrete blocks that interlock with each other. They are used to hold back a sloping face of soil to provide a solid, vertical front. Without adequate retention slopes can cave, slump or slide. With the unique construction of segmental retaining walls, higher and steeper walls can be constructed with the ability to retain the force of lateral earth pressure created by backfill soil. Segmental retaining walls can be installed in a wide variety of colours, sizes, and textures. They can incorporate straight or curved lines, steps and corners. They are ideal for not only slope support, but also for widening areas that would otherwise be unusable due to the natural slope of the land. Retaining walls are often used for grade changes, and for other functional reasons such as widening driveways, walkways or creating more space in an outdoor area.

3.1.1 Advantages

- Rapid construction
- Horizontal and vertical curvatures
- A wide variety of colours, sizes and textures
- No need of concrete footing

3.1.2 Limitations

The wall was well suited for higher heights but material required were not easily available in pune .So this was not an economic option since material was available in Mumbai. So we decided to go for next trail.

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Fig.2 Segmental Retaining Wall

3.2 Gravity Retaining Wall

It is that type of retaining wall that relies on their huge weight to retain material behind it and achieve stability gain failures. Gravity retaining wall can be constructed from concrete, stone or even brick masonry. Gravity retaining walls are much thicker in section. Geometry of these walls also help them to maintain the stability. Mass concrete walls are suitable for retained heights up to 3m. The cross section shape of wall is affected by stability the use of space front of the wall, the required wall appearance and the method of construction.

Earlier in the 20th century, taller retaining walls were often gravity walls made from large masses of concrete or stone. Today's as composite gravity walls such as: geosynthetics such as geo cells cellular confinement earth retention or gabions.

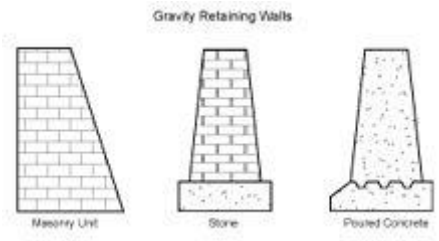

Fig.3 Gravity Walls

3.2.1 Gabion Walls

It is a cage, cylinder or box filled with rocks, concrete, or sometimes sand and soil for use civil engineering, road buildings and landscaping. They are usually bettered or stepped back with the slope rather than stacked vertically. They have advantages over more rigid structure, because they can conform to subsidence dissipate energy from flowing water and resist being washed away and they drain freely.

Their strength and effectiveness may increase with time in some cases as silt and vegetation fill the interstitial voids and reinforce the structure. The life expectancy of gabions depends on the lifespan of the wire, noun the contents of the basket. These walls cannot be used at residential because of space limitations height 7m to 8m.

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Fig.4Gabion Wall

3.2.1.1 Advantages

- Easy handling and construction
- Endurance against repeated wave pounding and stream flow without disintegration
- Various Applications
- Since pebbles and gravel are being used permeability remains good and hence allows sufficient natural drainage.

3.2.1.2 Disadvantages

- It's not good aesthetically
- Requires high maintenance
- Requires regular inspection

3.2.1.3 Failure of this trail

The reason of failure of this trail was the section of gabion wall for this site condition was coming too large. Since it is a residential site space limitations were their so we had go for next trail But this can be best suited for other site conditions.

3.3 Stepped Cantilever Wall

For greater heights conventional walls become very massive and uneconomical. Hence alternative is Stepped Cantilever Wall. Here concrete steps are provided on stem projecting into backfill. The pressure compacted backfill will anchor the concrete step and will develop frictional resistance force; this wall act as indirect support for cantilever retaining wall. In short stem will act as propped cantilever and thus will reduce the destructive forces on stem / retaining wall.

The main concept in this type is supporting the high stem at critical points indirectly by means of pulling force developed due to surface friction of concrete steps with backfill. Here the effect of self-weight of these steps in stabilizing wall against active pressure is not considered as it may be negligible.

The R.C.C. steps projecting in backfill are main key elements in this type of wall. The Resisting force developed due to these steps is function of depth of these steps below top of wall, surface roughness of concrete plates, degree of compaction of backfill and specific weight of backfill. The steps are developing frictional force due to their anchorage in backfill and steps are reinforced with sufficient steel required for tensile stress developed in it

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due to pulling effect. Though these steps are standing as free cantilever in backfill, they will not be designed as cantilever as it is assumed as backfill is compacted.

3.3.1Design Principle

The design procedure is same as conventional cantilever wall but preliminary dimensions would be decided on the basis of load distribution .So based on concept and principle we are going to design a stepped cantilever wall for Nyati Equatorial site .

IV. CONCLUSION

After studying various types of retaining wall we have conclude that

- Stepped cantilever wall is more feasible than gabion and segmental type of retaining wall.
- Gabion wall are most economical type of retaining wall for greater heights and can be used in projects without site restrictions.
- Segmental wall can be used in transportation projects.

V. ACKNOWLEDGEMENT

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