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"Evaluation of Suitability of Retaining Wall for Different Height's"

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Abstract: *Retaining structures hold back soil or other loose material where an abrupt change in ground elevation occurs. The retained material or backfill exerts a push on the structure and thus tends to overturn or slide it, or both. There are different types of retaining wall like Gravity, cantilever, counter fort, anchored retaining wall but cantilever is the most common type of retaining wall and is used for walls in the range of 6 to 7.5m in height. This study presents analyses and design of cantilever retaining wall for different height which is made from an internal stem of steel-reinforced, cast-in-place concrete (often in the shape of an inverted T with shear key). In this work a detailed analyses and design for this type of walls which include estimation of primary dimensions of the wall, then these dimensions were checked. The factor of safety against sliding, overturning and bearing were calculated.*
Keywords: *Retaining wall, Reinforcement, Overturning factor*

I. Introduction

Retaining walls are relatively rigid walls used for supporting the soil mass laterally so that the soil can be retained at different levels on the two sides. Retaining walls are structures designed to restrain soil to a slope that it would not naturally keep to (typically a steep, near-vertical or vertical slope). 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. Retaining walls shall be designed to withstand lateral earth and water pressures, the effects of surcharge loads, and the self-weight of the wall and in special cases, earthquake loads in accordance with the general principles specified in this section. Retaining walls shall be designed for a service life based on consideration of the potential long-term effects of material deterioration on each of the material components comprising the wall. Permanent retaining walls should be designed for a minimum service life of 50 years.Temporary retaining walls should be designed for a minimum service life of 5 years. The quality of in-service performance is an important consideration in the design of permanent retaining walls. Permanent walls shall be designed to retain an aesthetically pleasing appearance, and be essentially maintenance free throughout their design service life. The Service Load Design Method shall be used for the design of retaining walls except where noted otherwise.

II. Retaining wall

The structure which is designed and constructed to resist the lateral pressure of the soil, when there is a desired change in ground elevation that exceed the angle of repose of the soil. A basement wall is thus one kind of retaining wall. But the term usually refers to a cantilever retaining wall, which is a freestanding structure without lateral support at its top. These are cantilevered from a footing and rise above the grade on one side to retain a higher level grade on the opposite side. The walls must resist the lateral pressures generated by loose soils or, in some cases, water pressures. Every retaining wall supports a "wedge" of soil. The wedge is defined as the soil which extends beyond the failure plane of the soil type present at the wall site.

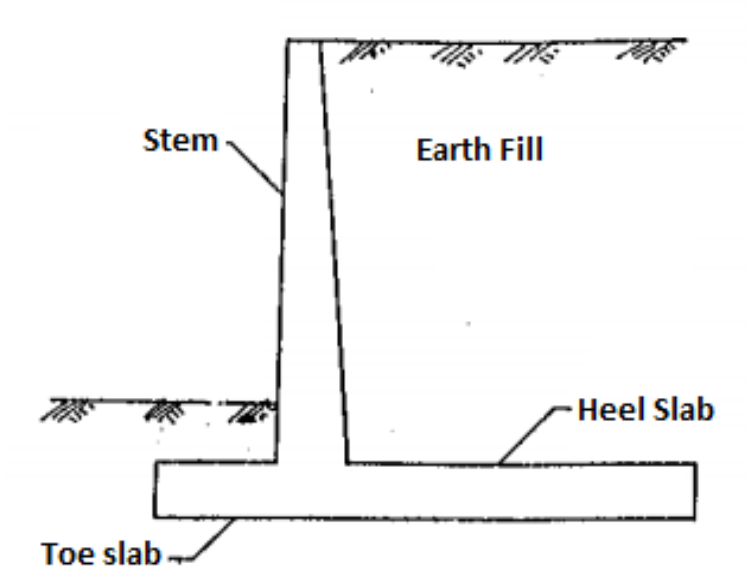


Figure no. 1 Retaining wall

III. Objective Of Retaining Wall

1. Improve Property's Appearance

With proper materials selection, retaining walls can become a highly attractive aesthetic feature of your property. A curvilinear, architectural retaining wall (above) can look stunning all by itself. Add landscape lighting, appropriate plantings, and perhaps a set of stairs or two, and your property will stand out as something special. Retaining walls are sometimes installed along driveways and corridors to define the space. They are wonderful devices for creating interest features in a landscape. You have probably seen many upscale entryways that utilize retaining walls to create a raised area for signage or to frame the entrance with raised landscaping beds.

2. Create a Flat Area

It's simply a fact: Flat ground is almost always more useful than a steep slope. A retaining wall can convert a slope into a flat level area. This can allow for the construction of structures that otherwise couldn't be built on such a property, like a parking lot, sports field, or building.

3. Make a Slope Useful

In many places around the world, whole mountainsides are cut into a series of steps supported by a series of retaining walls. Called terracing, this technique turns land that is too steep to grow crops into useful farm land. Farmers aren't the only ones to benefit from terracing. You can utilize this technique on your commercial property, too. Terracing can prevent erosion on steep areas, and can make a steep landscape far easier and less costly to maintain. Terracing can also be used to transition a grade, or create pedestrian access on a slope.

Take, for example, a project we did for the Georgia Power Company on an impoundment of theirs on Lake Sinclair near Milledgeville, GA. The back of the property featured a 40-foot drop to the lakefront. By installing a series of retaining walls we carved the bluff into switchback ramps that allow people to easily access the lakeshore on foot.

4. Provide Handicapped Accessibility

Retaining walls are often used to create gently sloped ramps for wheelchair access.

IV. Evaluation Of Design Results Of Cantilever Retaining Wall For Different Height

Sr No	Particulars	Obtain results at 6.5m Ht.	Obtain results at 7m Ht.	Obtain results at 7.5m Ht.	Obtain results at 8.0 m Ht.	Obtain results at 8.5m Ht.
1	Width of toe slab (m)	1.700	1.850	2.000	2.080	2.090
2	Width of heel slab(m)	2.250	3.100	2.625	2.750	2.900
3	Depth of base slab (m)	0.550	0.600	0.625	0.670	0.810
4	Total slab (m)	4.500	5.000	5.250	5.500	5.800
5	Stem thickness at top(m)	0.200	0.200	0.200	0.200	0.200
6	Stem thickness at bottom (m)	0.550	0.575	0.625	0.670	0.810
7	Sum of load	331.406	391.242	439.205	493.486	562.622
8	Sum of moment	512.572	667.709	773.93	927.186	1154.39
9	Active pressure (P_a)	143.285	164.170	196.37	184.65	232.799
10	Passive pressure(P_p)	103.155	120.560	130.96	140.44	169.34
11	Safety against overturning	2.689	2.650	2.66	3.22	2.79
12	Safety against sliding	1.077	1.099	1.19	1.24	1.12
13	Uplift pressure of soil (q_{max})	101.6	109.560	113.94	100.49	131.97
14	Uplift pressure of soil (q_{min})	45.66	49.08	53.37	78.95	61.88
15	Minimum steel (mm^2)	2677.5	2998.760	3403.12	3826.26	4660.14

Here we have designed the retaining wall considering all the important aspect and different factors such as stability factor, overturning factor etc. also the appropriate proportion of width, depthheight is taken so as to make it stable to resists all loads safely.

In this structure we have designed and made a model in which actual designed reinforcement is taken. We have designed it for 6.5m height to check whether it withstands all loads safely or changes are needed.

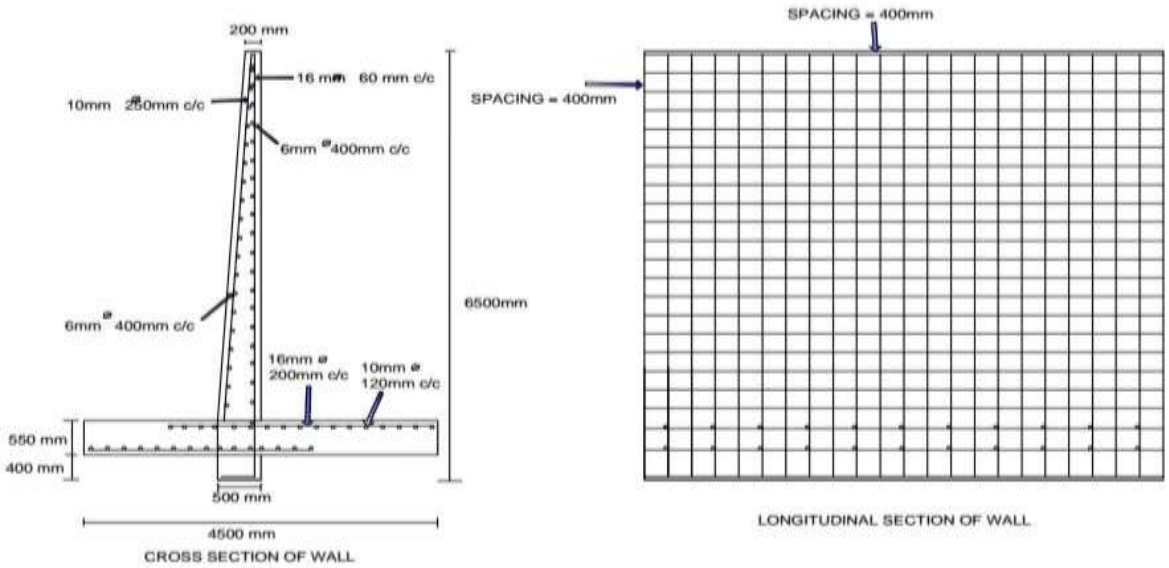
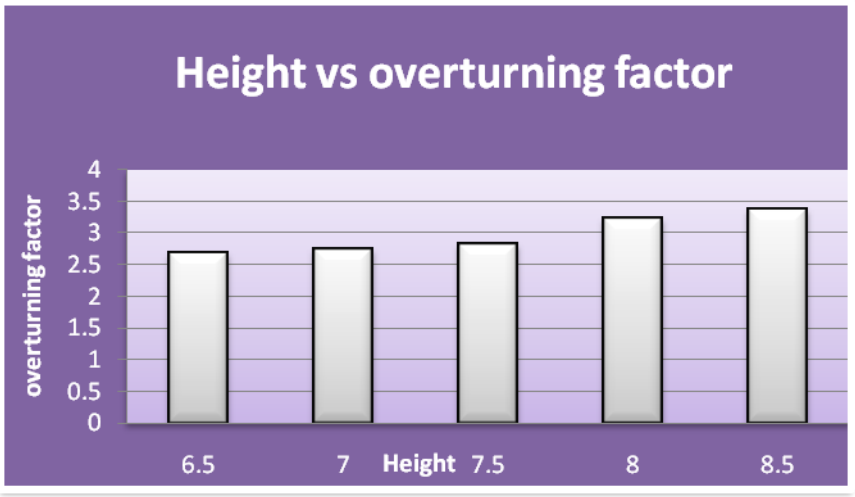


Figure No: 2. Reinforcement detailing of cantilever retaining wall.

V. Methodology

Inpresent the selection of retaining wall and its design is done to achieve objective, namely adequate economical height. With reference of IS cantilever is suitable for 6m to 7.5m height and in condition to built wall for more than 7.5m height all the factors are given in this chapter, actual reinforcement detaining is done through modelling.All the IS provisions are considered while design with objective of achieving suitable height.

VI. Result and Discussion



Graph No: 1.Height Vs Overturning Factor

Here is the graph showing height vs overturning factor. These are directly proportional to each other. As the height increases the overturning factor also increases.

Table No: 2. Evaluation of design results (Height vs Overturning factor).

particulars	6.5	7.0	7.5	8.0	8.5
Overturning factor	2.689	2.70	2.85	3.22	3.45

From above graph we observed that factor of safety against overturning factor is increases gradually as increase in height. To prevent the overturning of cantilever retaining wall we need to increase the width of footing as increase in height of cantilever retaining wall.

VII. Conclusion

From the above study, we concluded that cantilever retaining walls are economically suitable for height up to 7.5m height and hence up to 7.5m no other alternate in necessary. There are many factors of safety consider while design of cantilever retaining wall such as overturning, sliding, earth pressures, self weight. The value s of these factors is gradually increases as increases in the height of retaining wall.

References

[1]. Choudhary D, Chatterjee S (2006) Displace ment- based seismic active earth pressure ion rigid retaining walls. Electron. J GeotechEng, (ISSN:1089-3032).USA.Vol.11. Bundle C Paper No.0660
[2]. Ghosh S, Saran S (2007) Pseudo static analysis of rigid retaining wall for dynamic active earth pressure. Cenem B.E. College, Kolkata.
[3]. Richard R, Elms D (1979) Seismic behaviour of gravity retaining wall. J GeotechEngDiv ASCE 105 (GT4): 449-464
[4]. Tamadherabood, Haten E. YounisEldawi, Faeza R. ElnajiAbdulrahim, "Design of Cantilever retaining wall with 4m height ", Imternational journal of civil and structural engineering research, vol. 3, April 2015, pp 318-326
[5]. S. S.Patil and A. A. R. Babgan, "analysis and design of reinforced concrete stepped cantilever retaining wall", IJRET, vol. 04, Feb-2015, page 46-67
[6]. ShravyaDonkada and Devdas Menon, "Optimal design of reinforced concrete retaining walls", The Indian concrete journal. April 2012, page 9-18
[7]. Rupa B. Patil, G. R. Patil, "Design and detailing of counter fort retaining walls for construction site", International journal of informative &fururistic research, Vol. 3, September 2015, page 61-71
[8]. Swati Nagare, RutujaShinde, SushmaLadkat and KomalMahisare, "Case study of retaining wall", April 2017
[9]. Su Yang, Amin Chegnizadeh and Hamid Nikraz, "Review of studies on retaining walls behavior on dynamic/ seismic condition", vol. 3, Nov 2013, pp. 1012-1021
[10]. S. Tatahari, R. Sheikoleslami, M. Shadfaran and M. Pourbaba, "Optimum Design of gravity retaining walls using charged system search algorithm", Hindawi Publishing corporation, sep. 2012
[11]. YashChaliawala, Gunvant Solanki, Anuj K. Chandiwala, "Comparative study of cantilever and counter fort retaining wall", International journal of advanced engineering and research development, Vol. 2, Dec. 2015, pp. 221-224.
[12]. IS 14458 (1998): Guidelines for retaining wall for hill area, part-1: selection of type of wall
[13]. IS 14458 (1998): Guidelines for retaining wall for hill area, part-2: Design of retaining/ breast walls.
[14]. IS 14458 (1998): Guidelines for retaining wall for hill area, part-3: Construction of Dry stone walls.