Comparative Study of Cantilever, Counterfort, Cantilever With Strands Retaining Wall

Prof. A.P. Khatri[1], Prof. R.S.Kognole[2], Adhav Ishwar S[3], Autade Sandip T[4], Thorat Madhavi K[5], Telange Anuradha V.[6]
Department of Civil Engineering
[3,4,5,6] UG Students, TSSM's BSCOER Narhe, Pune
[1,2] Assistant Professor, TSSM's BSCOER Narhe, Pune

Abstract- *It is necessary to check the relevance & suitability of type of retaining wall in the field, the economy of the wall, the amount of reduction in the section of wall. Therefore, it is necessary to study the theoretical & practical aspects & model studies in this area of field. In this project we perform the required lab tests on the backfill and foundation soil And from that calculated data and parameters we design the Cantilever, Cantilever with Strands, Counterfort, Retaining walls. The stability of retaining wall is studied for retaining soil mass. The aim is to find the best solution for the wall among these three walls by analyzing their stability and performance. We perform a comparative study of above three types of retaining walls. and finally Cost effective analysis between all three types of retaining wall and choosing the best alternative for 12m height*

Keywords- Retaining, Stability Checking, Cost estimation, optimum analysis, 12 m height

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 of the soil. 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, roadway overpasses, railway engineering, land reclamation and costal engineering etc.
Necessary reinforcements are provided to take care of flexural stresses. The tendency of the wall to slides forward due to lateral earth pressure behind the wall depends on angle of internal friction and cohesive strength of retained material, as well as the direction and magnitude of movement of the stems.

II. LITERATURE REVIEW

1. **Yash chaliawala, gunvant s olanki, Anuj.K.Chandiwala, 'Comparative Study of Cantilever and Counter fort Retaining wall', International Journal of Advance Engineering and Research Development,December-2015,Volume2,ISSN(P)**

23486406,Issue 12.

In this paper the study of the behavior and optimal design of two types of reinforced concrete walls of varying heights namely cantilever retaining wall, counter fort retaining wall. Cost against each optimal design of wall for particular height is calculated by using the volume of concrete and the amount of steel. Amidst the cost estimates of all the two optimal designs for particular height, a comparative study is carried out and the alternative with the least cost estimate is chosen as the best design solution Read already published work in the same field.

2. Haifa Fakhira Hittayatullah, IrAzhar Ahmad'Optimum Analysis and Cost Estimation of Catilever Retaining Wall'

This paper presents an optimum analysis and cost estimation of cantilever retaining wall to produce an interactive program that provides a safe and effective conventional cantilever wall for a single layer with different type of soil (backfill) and two different layer of soil (backfill). In order to obtain an optimum dimension of cantilever retaining wall, a preliminary dimension proportion is determined at the beginning. The height of the wall that used in design is limited from 3 meters to 6 meters only, based on commonly used retaining wall height. Stability checking such as overturning, sliding and settlement also has been analyzed with factor of safety of 1.5. This analysis and design of the cantilever retaining wall is performed by using Microsoft Office (Excel) based on the European standards

III. STUDIES AND FINDINGS

Objectives

1) To study and design the Cantilever, Counterfort, Cantilever With Strands retaining wall

2) In addition, It is of great interest to study the effect of different parameters such as the height of the wall, friction angle of the backfill, backfill slope, cohesion on Retaining wall

3) Cost comparison of the all three types of retaining wall.

4) To find the best solution for the wall among these three walls by analyzing their stability, performance and cost.

Scope of Study

The Scope of this study to provide the optimum dimension together to produce safe, effective conventional and cost efficiency of Cantilever, Counterfort and Cantilever With Strands retaining wall for particular 12 meter height. Generally, Cantilever and Counterfort retaining wall are design for 6m to 8m height only, This study is helpful to design these two walls for unto 12m height. Also the new concept is Design of cantilever retaining wall with strands for 12m height.

Methodology

Technically while designing, all the necessary parameters and requirements (if any) are considered and all the possible solutions are generated. Then a thorough analysis and calculations are carried out considering all the parameters especially cost involved and the risk and the uncertainties involved. Then the solution with the optimal cost is chosen as the best solution. Thus, it is overall a rigorous decision making process. [6]

Finding the suitable sections by Designing
The design of retaining wall includes the following steps:

1. Fixation of the base width and other wall dimensions
2. Performing stability checks and computation of maximum and minimum bearing pressures.
3. Design of various parts like stem, toe slab, heel slab,counterfort

Available data:

Total height of wall	12m
Angle of repose, Φ	30˚
SBC	421.122KN/m^2
μs	0.5
γs	16.46KN/m^3
Fck	25N/mm^2
Fy	415N/mm^2
Df	2m

Design constant:

Mu(lim)=3.45bd^2
Ka=(1-sinΦ)/(1+sinΦ)
Ka=(1-sin30)/(1+sin30)
Ka=0.333

1) cantilever retaining wall

Wall dimensions:
Base width(B)=10m
Slab thickness(t)=2.5m
Height of stem(h)=9.5m
Bottom width of stem wall=750mm
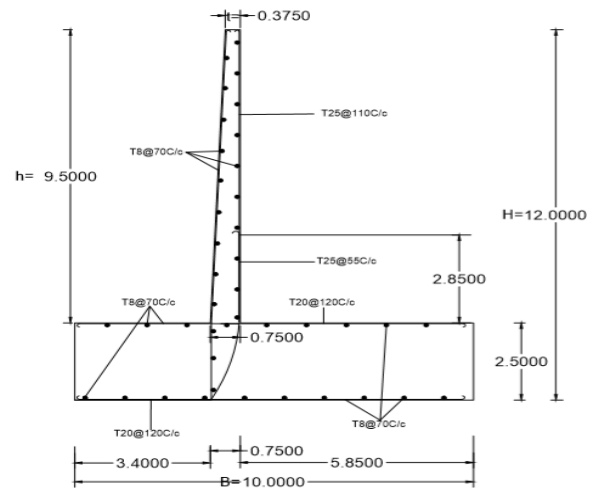Top width of stem wall=375mm
Toe projection=3.4m
Heel projection=5.85m

Figure 1   C/S of cantilever retaining wall

2) Counterfort retaining wall

Wall dimensions:

Base width(B)= 7.8m
Slab thickness(t)= 0.72m
Height of stem(h)= 11.28m
Bottom width of stem wall= 200mm
Top width of stem wall= 200mm
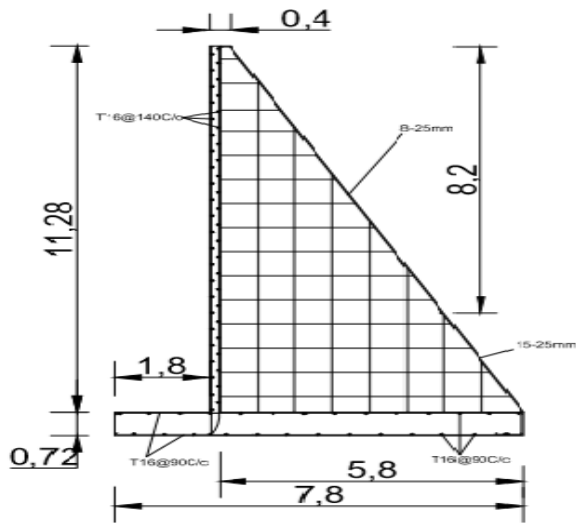Toe projection= 1.8m
Heel projection= 5.8m

Figure 2 C/S of Counterfort retaining wall

3) Cantilever with strand retaining wall

Wall dimensions:
Base width(B)= 7.2m
Slab thickness(t)= 0.9m
Height of stem(h)= 11.2m
Bottom width of stem wall= 700mm
Top width of stem wall= 700mm
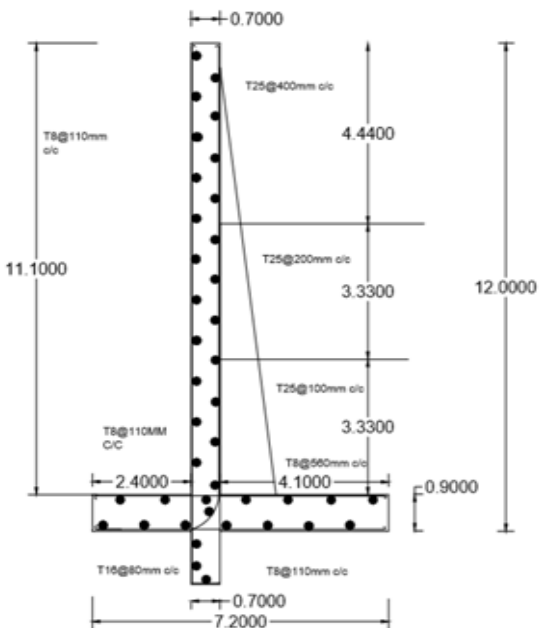Toe projection= 2.4m
Heel projection= 4.1m

Figure 3 C/S of Cantilever with strand retaining wall

Table -1 cost comparison /meter
For 12m height

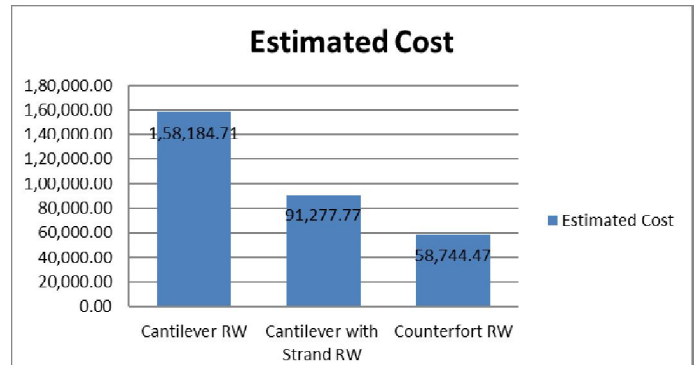| Type of RW	Estimated Cost in (Rs)
Cantilever RW	158184.71
Cantilever with Strand RW	91,277.77
Counterfort RW	58,744.47

Figure 4 final cost comparison

IV CONCLUSION

In this paper by using Quantity Teck Off software has achieved the objectives of the study which is to obtained optimum dimensions from above three walls

1) The Counterfort retaining wall proved to be most cost effective and advantageous over cantilever and cantilever with strand retaining wall.

2) In Cantilever with strand retaining wall, the strands are helpful to reduce horizontal pressure coming on wall.

3) The Cantilever with strand retaining wall is most advantages and cost effective over cantilever wall.

4) This study is useful for designing the retaining wall for 12m height.

REFERENCES

[1] Yash chaliawala, gunvant s olanki, Anuj.K.Chandiwala, Comparative Study of Cantilever and Counter fort Retaining wall', International Journal of Advance Engineering and Research velopment,December-2015,Volume2,ISSN(P) 23486406,Issue

[2] Haifa Fakhira Hittayatullah, IrAzhar Ahmad'Optimum Analysis and Cost Estimation of Catilever Retaining Wall'

[3] Punmia, B. and Jain, A. K. (2005). Soil mechanics and foundations. Firewall Media.

[4] N Krishna Raju Design of Reinforced Concrete Structures (IS:456-2000) 3rd Edition

[5] Indian Standard PLAIN AND REINFORCED CONCRETE-CODE OF PRACTICE (Fourth Revision) IS 456-2000

[6] Prof. Sarita Singla, Er. Sakshi Gupta, "Optimization of Reinforced Concrete Retaining Walls of Varying Heights using Relieving Platforms" International Journal of Engineering Resear