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Analysis of Cantilever Retaining Wall by STAAD PRO

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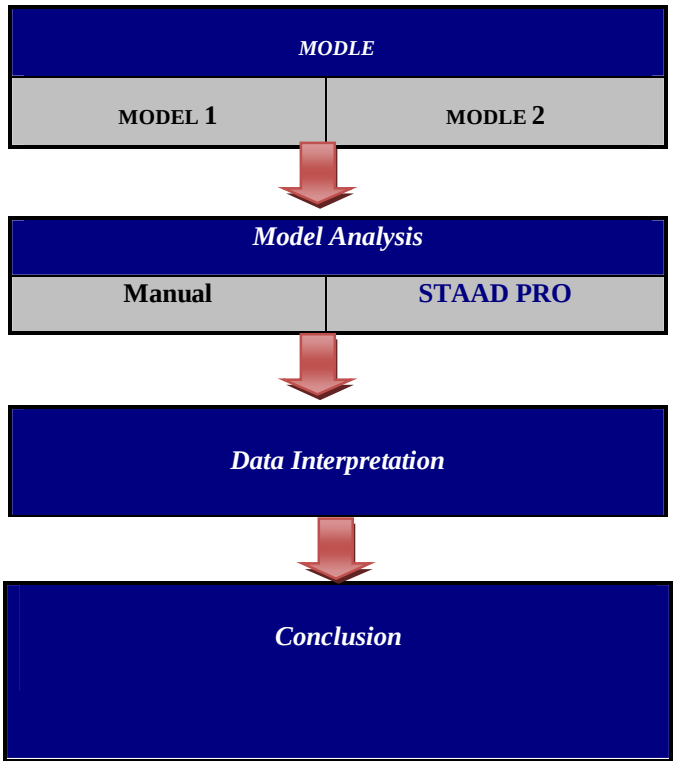
Abstract: ***Retaining wall is a structure which is used to hold the back fill soil. Retaining wall is commonly used in roads railways and tunnel. There are many type of retaining wall but cantilever wall is commonly used because of its economical benefits. Shelves are the new concept in retaining wall, it is more effective and economical when soil pressure is high and height of wall is greater. This paper is conduct two type of model which is analysis by manual and by STAAD PRO. 1) Model 1: R.C.C cantilever retaining wall without shelve, 2) Model 2: R.C.C cantilever retaining wall with single shelve. The analysis and design is to be done by as per Indian Building Code (IS Code). Paper concludes the economical position of the shelve.***
Keywords: Cantilever retaining wall, shelves, soil pressure, Indian building code, STAAD PRO.

I. INTRODUCTION

Retaining wall is used to hold the soil or back soil at difference level. The force and pressure exert on retaining due to backfill soil or backfill mass. This pressure is used to design the retaining wall. The pressure and force exert to push the retaining wall, due to this overturning and sliding happen. The weight of the retaining wall structure is used to maintain the stability of the structure. There are some other types of retaining structure such as basement, wall retaining wall, sheet pile, etc. Some other temporary retaining structure is used to retain the soil during earth work.

Now a retaining wall is used every were such as garden, roads, railways, dams, tunnels, also used in high-rise building for underground parking. Continuous study or method is excited on the retaining wall to achieve economy and strength and durability. That only be possible when the backfill pressure reduce on the wall.

II. METHODOLOGY



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III. MODEL DESCRIPTION

Two type of model should be Analysis and design by STAAD PRO

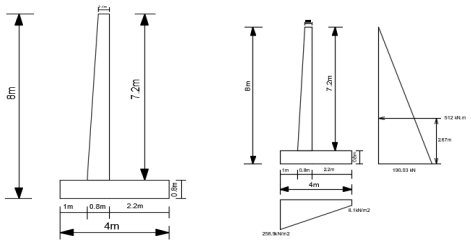
A. Cantilever retaining wall without shelve
B. Cantilever retaining wall with single shelve

In STAAD PRO analysis beam should be consider as a beam retaining wall. Analysis and design should done by as per Indian building code (IS Code).
Height of retaining wall = 8m
Unit weight of concrete = 25 kN/m³
Unit weight of soil = 18 kN/m³
Bearing capacity of soil = 200 kN/m³
Angle of friction = 30º
Coefficient of friction = 0.5

IV. ANALYSIS AND RESULT

A. Model I: Retaining wall without shelve

Data:
Height of wall = 8 m
Width of base = 0.8 m
Height of stem = 7.2 m
Top width of stem = 0.4m
Bottom width of stem = 0.8 m
Length of toe = 1m
Total base length = 4m



Bending moment at the base = 380 kNm

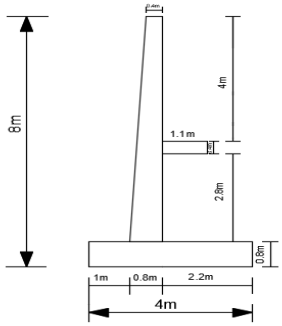
$$\text{area} = \frac{1}{n+1}(bh)$$

Area of bending moment = 760

B. Model II: Retaining wall with Single Shelve

Data
Height of wall = 8 m
Width of base = 0.8 m
Height of stem = 7.2 m
Top width of stem = 0.4m
Bottom width of stem = 0.8 m
Length of toe = 1m
Total base length = 4m
Length of shelve = (length of toe/2) = 1.1m
Thickness of shelve = (thickness of base/2) = 0.4m

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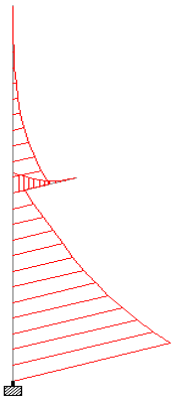


Figure: BM diagram for single shelve

Table: values of BM for single shelve

Position of shelf from top of stem	BM at node 3 due to soil wt just above shelf (kNm)	BM at node3 (kNm)	BM just below node 3 (kNm)	BM at node1 (kNm)
1m	10.89	1	-9.980	354.110
2m	21.780	8.00	13.780	-274.220
3m	32.670	-27.00	-27.00	-254.330
4m	43.560	-64.00	-20.440	-276.440
5m	54.450	-125.00	-70.550	-322.550
6m	65.340	-216.00	-150.660	-374.660
7m	76.230	-343.00	-226.770	-414.770

Table: value of deflection for single shelve

Position of shelf from top of stem	deflection
1m	107.616
2m	81.853
3m	82.687
4m	98.343
5m	119.419
6m	139.675
7m	156.826

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V. RESULT AND DISCUSSION

Best or economical shelve position for retaining wall is 4m from top of stem.

Position of shelf from top of stem	Area of steel (mm^2)
without shelves	7740
economical shelve	4950

Table: stability and overturning

Position of shelf from top of stem	Stability	overturning
without shelves	2.2	1.2
economical shelve	3.5	2.5

VI. CONCLUSIONS

A. Retaining wall with shelves is more economical as compare to wall without shelve.
B. Retaining walls with shelves save 40% of steel.
C. The best economical position of shelve is at the “center of wall”
D. In a retaining wall with shelves, “as the height of the wall increases”, “percentage saving of material increases”.

VII. ACKNOWLEDGMENT

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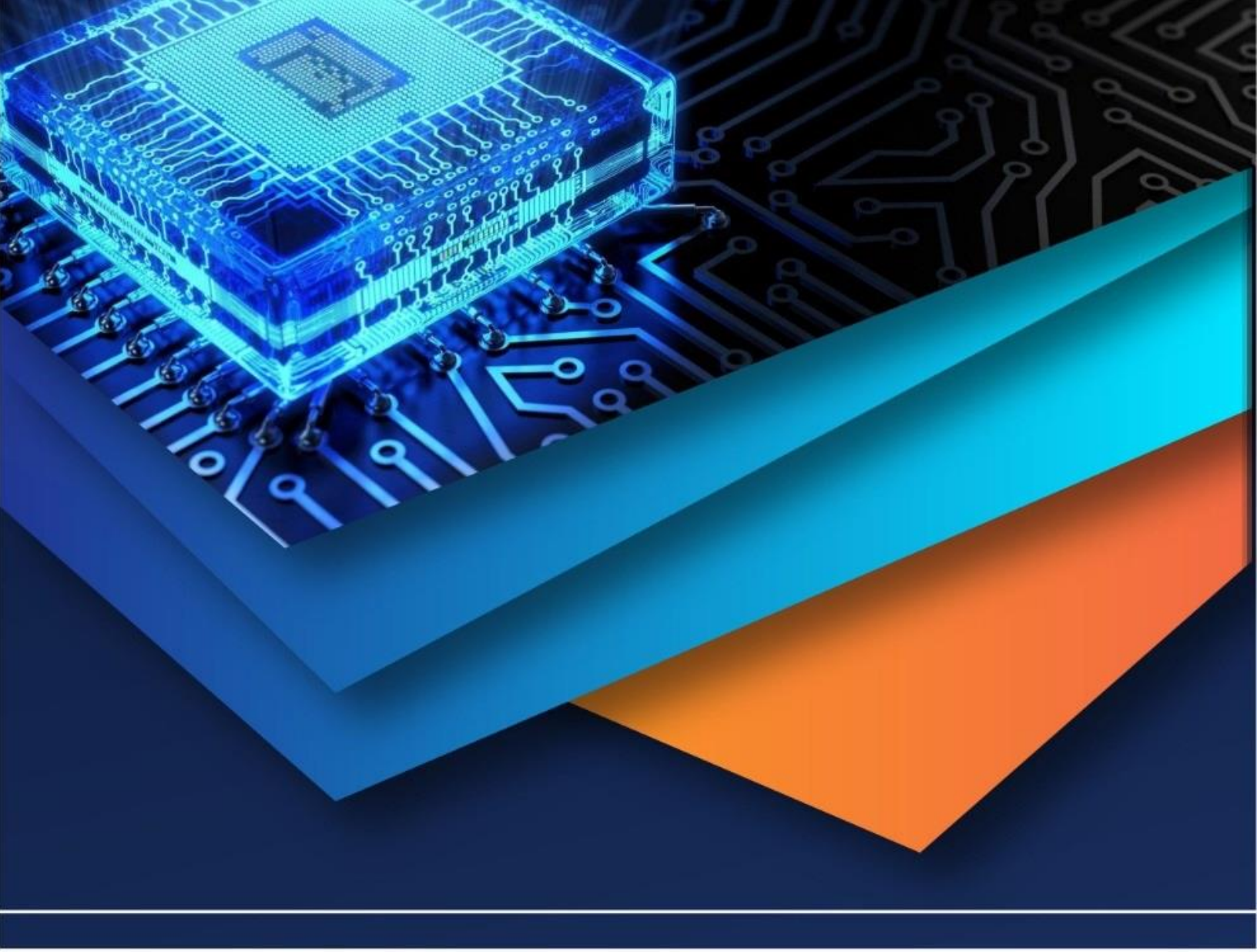
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