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A REVIEW ON BEHAVIOUR OF RETAINING WALL

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ABSTRACT—The seismic analysis of the retaining wall is designed and analyzed both by theoretical as well as by CSI & BENTLEY software tool. The theoretical investigation studied includes check for sliding, overturning and shear for lateral loadings & uplift pressure the analytical approach for the design retaining wall for the seismic analysis is also performed to check the effectiveness of the design an analytical modeling of the design retaining wall for the stress distribution for the loading combinations & for the seismic force will give the idea of the behavior of the retaining wall[1]. In this study will do analysis of both cantilever & counter fort retaining wall to find behavior against all loading combinations based on these results of CSI & BENTLEY software & theoretical study will check internal stability of the retaining wall under different loading combinations.

Keywords— Retaining wall, Seismic load, Software tools.

I. INTRODUCTION

A retaining wall is structure which is constructed to retain lateral earth pressure of soil[1]. The main function of retaining wall is to stabilize hill slide and control erosion. Retaining walls are mainly provided in construction of Roads, Embankment, Bridge abutments, basement in building etc. The forces acting on retaining wall are:

i. Resisting forces.
ii. Driving forces.
iii. Earth pressure.
iv. Lateral earth pressure.

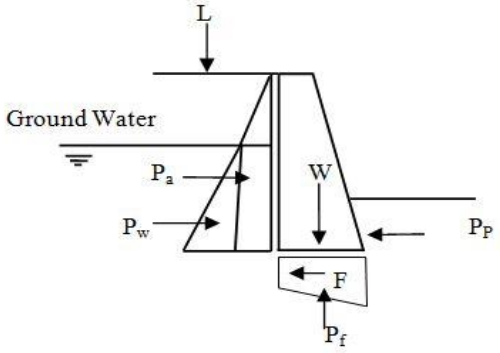

Fig. 1- Forces acting on retaining wall.

II. TYPE OF RETAINING

1. Gravity retaining wall.
2. Cantilever retaining wall.
3. Counterfort retaining wall.
4. Buttress retaining wall.

1. Gravity retaining wall :

The retaining wall in which the self weight of the retaining wall retains the backfill pressure of soil & provides stability against the backfill pressure is known as Gravity retaining wall. The material used for this retaining wall is Stone masonry or plain cement concrete. The maximum height of gravity retaining wall is 3m.

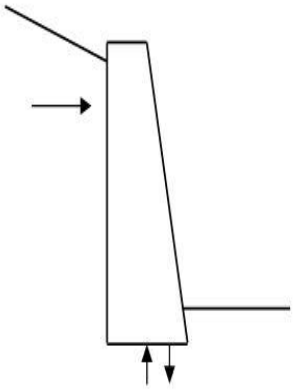

Fig. 2– Gravity retaining wall

2. Cantilever retaining wall:

The cantilever retaining wall is most commonly used retaining wall[4]. This wall is consist of three parts a. Stem (Vertical standing portion retain backfill). b. Toe Slab (Toe and Heel slab) c. Heel slab. d. Shear key (provided when failure in check for stabilizing moment condition occurs.) The maximum height of cantilever retaining wall is 6m.
There are two types of cantilever retaining wall:

i. L-Shape cantilever retaining wall.
(Contains Stem, Heel and Toe.)
ii. T-Shape cantilever retaining wall.
(Contains Stem and Heel.)

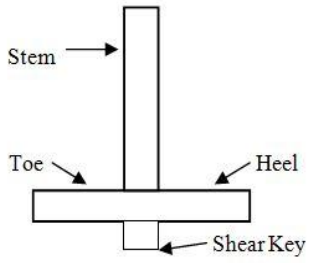

Fig. 3– Cantilever retaining wall.

3. Counterfort retaining wall :

In counter fort retaining wall the stem and heel slab is connected by counterfort to increase the stability of retaining wall[8]. The counterfort wall is provided for height more than 6m.

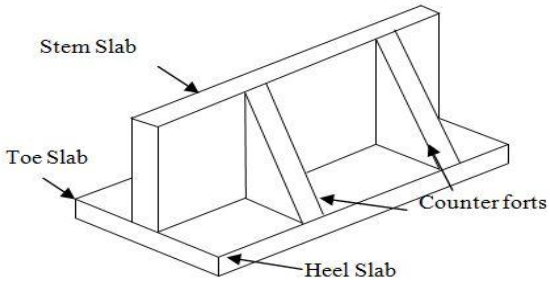

Fig. 4– Counter fort retaining wall.

4. Buttress Retaining wall :

The buttress retaining wall is as same as counterfort retaining wall. The counterforts are replaced by providing buttresses wall on the opposite side of the backfill pressure.

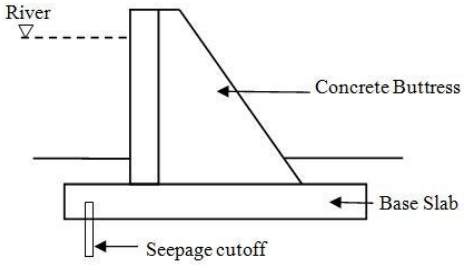

Fig. 5– Buttress retaining wall.

III. THEOROTICAL INVESTIGATION

Commonly retaining walls are constructed to retain earth pressure called as backfill. Retaining walls are commonly used in large construction works like Highway structures, Railway embankment works. The active earth pressure on retaining wall is lateral pressure exerted by backfill. Counterfort, cantilever and buttress are most common type of walls used to retain the lateral earth pressure. Due to this lateral earth pressure the bending moments are acting on retaining wall. To stabilize the retaining wall and to avoid the failure due to bending moment factor of safety is considered during design of retaining wall[3][7]. During the design following checks to be satisfy:

a) Check for Overturning
b) Check against Sliding
c) Check for Uplift Pressure

PRILIMINARY DIMENSIONS:

- Base width (B) = 0.6 H to 0.8 H
- Thickness of slab(T) = 0.1H
- Toe Projection = 0.25 B to 0.3 B
- Top width of stem = 200 mm to 300 mm.

FAILURE OF RETAINING WALL

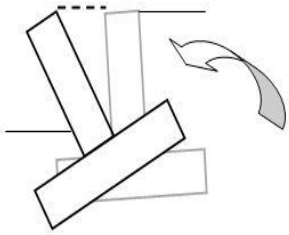

Fig. 6– Failure occurs due to Overturning

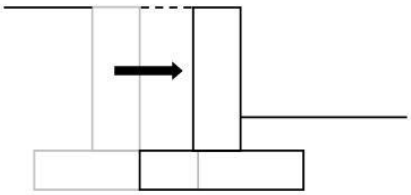

Fig. 7– Failure occurs due to sliding

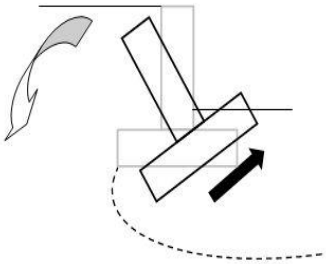

Fig. 8– Failure occurs due to base pressure

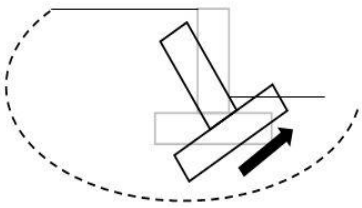

Fig. 9– Deep seated shear failure

LITERATURE REVIEW

From literature review we study on the forces acting on retaining wall and various methods implemented on behavior of retaining wall. Some of the common methods implemented on behavior retaining wall are as follows:

i) Pseudo-Dynamic Method

ii) Shaking Table Test
iii) Horizontal/ Vertical Slice Method

Some software used for analyzing of retaining wall:

i) SAP 2000.
ii) STAAD PRO.

i) Pseudo-Dynamic Method

In the Pseudo-Dynamic Method the soil is assumed to be rigid material and the shear wave velocity is considered to be infinite[2][3][12]. A pseudo-dynamic analysis incorporates a finite shear wave velocity based on the assumption that the shear modulus is constant with depth and only acceleration is varying [2][3][12]. This is a very common method used to study the behavior of retaining wall.

ii) Shaking Table Test :

This test is conducted on small scale retaining wall to check there stability against various seismic loading conditions and lateral pressure. It has been observed that geogrid reinforced retaining wall has more stability against loading conditions.

Equipments and material used in shaking table test are:

a) Shaking Table
(Loading platform dimensions 1m X 1m and Pay Load capacity of 1000kg.)
b) Laminar Box
(Large sized share box consist of several frictionless horizontal layers. It is rectangular in size 500mm X 1000mm X 800mm deep with 15 hollow aluminum rectangular layers.)

iii) Horizontal/Vertical Slice Method :

The technique of slice method has been developed for determination of stability of natural or man-made slopes. Most popular method is vertical slice method used to determine the lateral earth pressure acting by backfill[2][5][9].

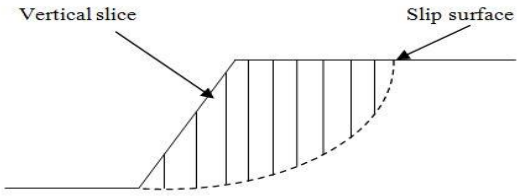

Fig. 10– Vertical slice

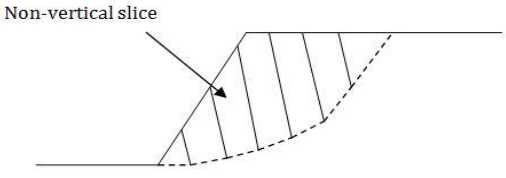

Fig. 11– Non-vertical slice

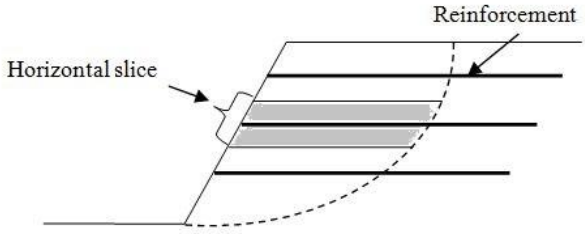

Fig. 12– Horizontal slice

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