iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 7 **Issue:** IV **Month of publication:** April 2019

DOI: https://doi.org/10.22214/ijraset.2019.4631

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

A Review on Investigation on Dynamic Behavior of different types of Retaining Walls with different Heights

Ankit C. Mahure[1], Prof. M. N. Umare [2]
PG Student[1], Professor[2], KDK College of Engineering, Nagpur (Maharastra) India[1,2]

Abstract: ***Analyzing the behavior of earth retaining structures under seismic conditions has been very important issue due to their wide applications in several infrastructural applications and other structures. The problem of instability of walls is mainly related to earth pressure distribution on the wall and the response of wall against the earth pressure, especially, under dynamic loading condition.***
Soil – wall interaction is an important property which governs the dynamic behavior of the wall. Even after a large number of studies, the dynamic behavior of soil-wall system is still not completely clarifying. The objective of this research is to study the dynamic behavior of cantilever retaining wall along with the earth pressure distribution of soil in seismic conditions. In this paper we want to show design of different types retaining wall such as cantilever retaining wall and L-shape retaining wall with variable height and find out factor of safety against sliding, overturning and Bearing Failure mode.
Keywords: Cantilever Retaining wall, Design, seismic Analysis

I. INTRODUCTION

Analyzing the behavior of earth retaining structures under seismic conditions has been very important issue due to their wide applications in several infrastructural applications and other structures. The problem of instability of walls is mainly related to earth pressure distribution on the wall and the response of wall against the earth pressure, especially, under dynamic loading condition. Soil – wall interaction is an important property which governs the dynamic behavior of the wall. Even after a large number of studies, the dynamic behavior of soil-wall system is still not completely clarifying. The objective of this research is to study the dynamic behavior of cantilever retaining wall along with the earth pressure distribution of soil in seismic conditions (from paper ISSN 2348-7607)

The response analysis of the systems at hand aimed at shedding light onto the salient features of the problem, such as:

1) The magnitude of the soil thrust and its point of application;
2) The relative sliding as opposed to rocking of the wall base and the corresponding failure mode;
3) The importance/interplay between soil stiffness, wall dimensions, and excitation characteristics, as affecting the above.

Dynamic earth pressures depend on a large number of parameters such as backfill density, angle of internal friction of soil, structural design of wall, ground motion parameters like peak ground acceleration, duration of strong motion and predominant frequency of the earthquake.

The predominant frequency of earthquake plays a vital role in behavior of a retaining wall during a seismic event. Dynamic response of retaining walls to ground motion has been the subject of several studies including both physical modeling and mathematical modeling.

The objective of this work is to study the dynamic behavior of a retaining wall along with the earth pressure distribution of soil in seismic conditions. Among various types of retaining structures, cantilever retaining wall is adopted for the present study (from paper (IJERT) ISSN: 2278-0181 Vol.)

A. Cantilever Retaining Wall

The cantilever wall generally consists of a vertical stem, and a base slab, made up of two distinct regions, viz. a heel slab and a toe slab. All three components behave like one-way cantilever slabs: the „stem" acts as a vertical cantilever above the lateral earth pressure; the „heel slab" and the „toe slab" acts as a horizontal cantilever under the action of the resulting soil pressure. The weight of the earth retained helps in maintaining the stability of the wall.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 6.887
Volume 7 Issue IV, Apr 2019- Available at www.ijraset.com

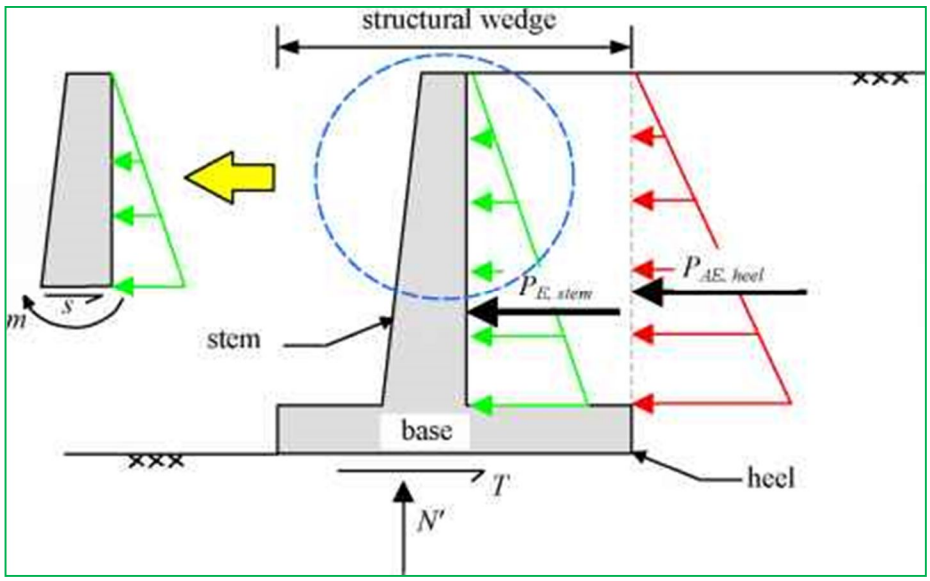


Fig. 1 Cantilever Retaining Wall

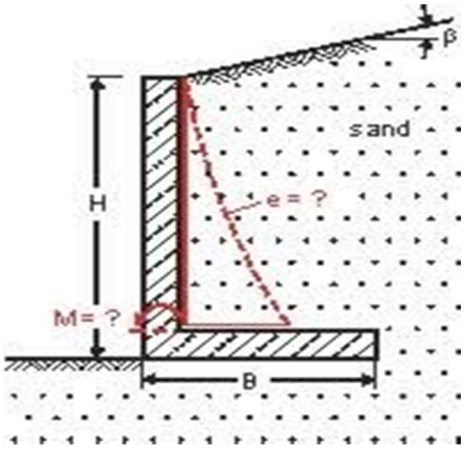


Fig. 2 L- Shaped retaining wall

B. Dynamic Earth Pressure Computation

The methods that are used to compute the dynamic earth pressure on the retaining walls nowadays can be classified into three main groups:

1) Limit state analyses, in which a considerable relative movement occurs between the wall and soil to mobilize the shear strength of the soil
2) Elastic analyses, in which the relative movement in between the soil and wall is limited, therefore the soil behaves within its linear elastic range. The soil can be considered as a linear elastic material.
3) Numerical analyses, in which the soil is modeled with actual non-linear hysteretic behavior.

The most commonly used method to design retaining structures under seismic conditions is force equilibrium based pseudo-static analysis (e.g. Mononobe-Okabe 1926, 1929). The limit-state analyses were developed by Mononobe and Okabe (Mononobe and Matuo 1929; Okabe 1924). The Mononobe-Okabe approach has several variants (Kapila 1962, Arango 1969, Seed and Whitman 1970; Richards and Elms 1979; Nadim and Whitman 1983, Richards et al 1999, Choudhury 2002). A wedge of soil bounded by the wall is assumed to move as a rigid block, with prescribe a horizontal and a vertical acceleration. This method was basically developed to calculate the active and passive earth pressure for dry cohesion less materials by Mononobe-Okabe. The use of a graphical construction, such as Coulomb or Mel bye construction procedure, has been described by Kabila (1962). Arango (1969) has developed a simple procedure for obtaining the value of the dynamic lateral earth pressure coefficient for active conditions from standard charts for static lateral earth pressure coefficient for active condition using Coulomb method (from paper ISSN2248-9622).

II. LITERATURE REVIEW

A. Design of Cantilever Retaining Wall with 4m Height" Tamadher Abood1, Hatem E.Younis Eldawi2, Faeza R. Elnaji Abdulrahim3 in present study author want to say 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. The cantilever is the most common type of retaining wall and is used for walls in the range of 3to 6m in height. This study presents analyses and design of cantilever retaining wall which is made from an internal stem of steel-reinforced, cast-in-place concrete (often in the shape of an inverted T). 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. The shear resistance for the base, the tension stresses in the stem and the tension stresses for the base was checked. Calculations of reinforcement for each part of the wall were done. All analysis and design are based on the ACI code.

B. Behavior Of Cantilever Retaining Walls Under Seismic Conditions Anurag Upadhyay[1], A.Murali Krishna[2] And K.D.Singh In present study author want to say that The objective of this paper is to study the dynamic behavior of a retaining wall along with the earth pressure distribution of soil in seismic conditions. Among various types of retaining structures, cantilever retaining wall was adopted for the present study. Numerical model was developed using finite element method based package to simulate the dynamic behavior of the cantilever retaining wall. The developed numerical model was verified for validation with the available physical model studies in the literature. The validated numerical model was then subjected to seismic records with different predominant frequency. The methodology followed in developing the numerical model and results obtained from the parametric studies are discussed in this paper.

C. "Design of L-shaped retaining wall A. Rouili World academy of science , engineering and technology International journal of civil science and engineering vol.7 no.12, 2013 in oresent study author want to say that Cantilever L-Shaped walls are known to be relatively economical as retaining solution. The design starts by proportioning the wall of dimensions for which the stability is checked for a ratio between the length of the base and stem, falling between 0.5 to 0.7 ensure in most case the stability requirements , however the displacements pattern of the wall in terms of rotation and translation and the lateral pressure profile do not have the same figure for all walls proportioning as its usually assumed.

D. Design and detailing of retaining wall Dr. IR Erizal, Magr. SIL211 MEKANIKA TANAH, 3(2-3). In present study author want to say that the Retaining wall usually build to hold back soil mass. However, retaining wall can also be constructed for aesthetic landscaping purpose. Earth pressure is the pressure exerted by the retaining materials on the retaining walls, this purpose tends to deflect the wall material.

E. Seismic analysis of L-shaped Quay wall considering soil structure Interaction A. Gharavi and K. bargi 15 WCEE LISBOA 2012 In present study author want to say that the seismic behavior of L-shaped quay walls is conisderd in two condition with or without counterfort. Numerical modeling in finite elements method is used to model the wall and soil behind it. Wall elements consist of concrete and reinforcement which have nonlinear behavior in the seismic analysis. More being more specific in modeling the reinforcement of the concrete are considered in a seismic behavior of the wall.

F. Analysis and Design of stepped cantilever retaining wall Dr. S. S. patil and A. A. R. Bagban International journal of engineering research and technology (IJERT) ISSN: 2278-0181 VOL.4 Issue 02 feb 2017 in present study author want to say that the It is extensively used in variety of situations such as highway engineering, railway engineering, bridge engineering and irrigation engineering. Reinforced concrete retaining wall have a vertical or inclined stem cast with base slab and heel slab. These are considered suitable up to a height of 6m. It resists lateral earth pressure by cantilever action of stem, toe slab and heel slab.

G. Design of rigid L-shaped retaining walls A. Rouili World academy of science, Engineering and technology International journals of civil and environmental engineering Vol 7, No. 12,2013 in present study author want to say that the result of a numerical analysis are presented, different wall geometries were considered. The result show that the proportioning governs the equilibrium between the instantaneous rotation and the translation of the wall-toe, also, the lateral pressure estimation based on the average value between the at rest and the active pressure, recommended by most design standards, is found to be not applicable for all walls.

H. Seismic analysis and design of cantilever retaining wall Shoeb mohammad sayeed, sunandan reddy, K. mythili International journal of science engineering and advance technology in present study author want to say that The overall stability of the retaining wall against sliding and overturning must be determined prior to construction giving due regard the site soil condition

in particular the bearing capacity of the foundation strata based upon the ability of the ground to withstand the combined actions of vertical, horizontal and rotational loading that the wall transfers to the ground.

I. Experimental investigation of dynamic behaviour of cantilever retaining wall Panos Kloukinas, Augusto penna, anna scotto di santolo, Subhamoy bhattacharya, Matthewdietz, Luiza dihoru, Aldo evangelista, Armando L Simonelli, Collin A. taylor, George Mylonakis second International conference on performance based design in earthquake geotechnical engineering may 28-30, 2012 Taormina, in present study author want to say that The dynamic behaviour of cantilever retaining walls under earthquake action is explored by means of 1- g shaking table testing. Following a brief review of available limit analysis solutions, the paper reports on a systematic investigation carried out on scaled models at the 3m x 3m shaking table of the Bristol Laboratory for Advanced Dynamics Engineering (BLADE), University of Bristol, UK, within the framework of the Seismic Engineering Research Infrastructures for European Synergies (SERIES project), funded by the 7th FP of the European Commission. The experimental program encompasses different combinations of retaining wall geometries, soil configurations and input ground motions (white noise, sine dwells and actual recorded motions from the Italian and American database). Aluminium wall models of height 0.6m were founded on a compliant base layer. Both the base layer and the backfill consisted of dry, coarse grained Leighton Buzzard sand at differing levels of densification (medium dense and loose respectively). The systems were tested dynamically using a large Equivalent Shear Beam container ("shear stack") of dimensions 4.8m long by 1.15m high by 1m wide, installed on the shaking table of BLADE. The response analysis of the systems at hand aimed at shedding light onto the salient features of the problem, such as: (1) the magnitude of the soil thrust and its point of application; (2) the relative sliding as opposed to rocking of the wall base and the corresponding failure mode; (3) the importance/interplay between soil stiffness, wall dimensions, and excitation characteristics, as affecting the above. The results of the experimental investigations were in good agreement with the theoretical models used for the analysis and are expected to be useful for the better understanding and the optimization of earthquake design of this particular type of retaining structure.

III CONCLUSIONS

As per the studied literature review, The cantilever is the most common type of retaining wall and is used for walls in the range of 3to 6m in height. This study presents analyses and design of cantilever retaining wall which is made from an internal stem of steel-reinforced, cast-in-place concrete (often in the shape of an inverted T). 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.

REFERENCES

[1] Design of Cantilever Retaining Wall with 4m Height Tamadher Abood1, Hatem E.Younis Eldawi2, Faeza R. Elnaji Abdulrahim3 1, 2,3 Omar Al-Mukhtar University, Civil Engineering Department –AL- Quba- Libya International Journal of Civil and Structural Engineering Research ISSN 2348-7607 (Online) Vol. 3, Issue 1, pp: (318-326), Month: April 2015 - September 2015, Available at: www.researchpublish.com

[2] BEHAVIOR OF CANTILEVER RETAINING WALLS UNDER SEISMIC CONDITIONS Anurag UPADHYAY[1], A.MURALI KRISHNA[2] and K.D.SINGH 5th International conference on earthquake geotechnical engineering january 2011, 10-13 santiago,Chile.

[3] Seismic design of earth retaining structures by Atop Lego, M.tech (struct.) SSW (E/Z) AP PWD; Itanagar.

[4] Analysis and design of cantilever retaining wall by dr. S. S Patil and A. R. Bagban International journal of engineering research and technology (IJERT)ISSN: 2278-0181 Vol. Issue 02, february-2015.

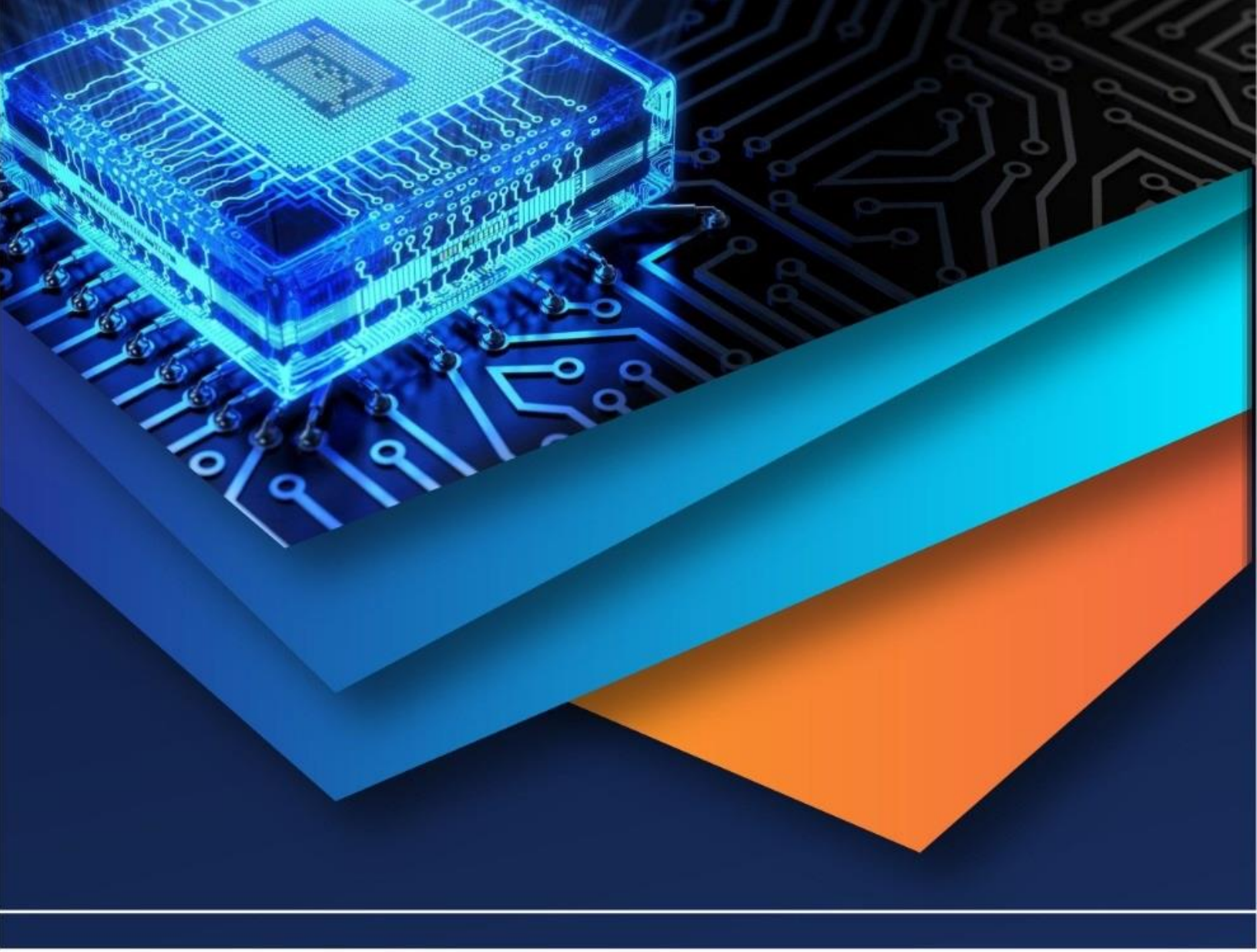
[5] Experimental Investigation of dynamic behaviour of cantilever retaining walls by A. scotto di santolo, A. penna and Evangelista p. kloukinas and G.E. Mylonakis A.I. Simonelli s. Bhattacharya, M. Dietz, L. Dihoru and C.A taylor 15 WCEE LISBOA 2012.

[6] Design of L-shaped retaining wall A. Rouili World academy of science , engineering and technology International journal of civil science and engineering vol.7 no.12, 2013.

[7] Design and detailing of retaining wall Dr. IR Erizal, Magr. SIL211 MEKANIKA TANAH, 3(2-3).

[8] Seismic analysis of L-shaped Quay wall considering soil structure Interaction A. Gharavi and K. bargi 15 WCEE LISBOA 2012.

[9] Analysis and Design of stepped cantilever retaining wall Dr. S. S. patil and A. A. R. Bagban International journal of engineering research and technology (IJERT) ISSN: 2278-0181 VOL.4 Issue 02 feb 2017.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY