Review Of Study On Analysis And Design Of Retaining Wall

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Abstract- *A Retaining wall is structure design designed to retain the earth behind it. It also retains earth mass behind it. Retaining wall mainly useful to provide strength to weak surrounding.*

The retained material exerts a force on structures and it results to overturn and failure. Other than the self-weight, important force for analysis and design of the retaining wall is lateral earth pressure.

Many forces plays vital role in design of retaining wall. The lateral earth pressure behind the wall depends on the angle of internal friction and the cohesive strength of the retained material, as well as the direction and magnitude of movement of the stems. Its distribution is typically triangular, least at the top of the wall and increasing towards the bottom.

The earth pressure could push the wall forward or overturn it if not properly addressed. Retaining walls are constructed in various fields of engineering such as roads, harbors, dams, subways, railroads, tunnels, mines and military fortifications.

Keywords- Retaining wall, design and analysis, analysis, reinforcement, stability.

I. INTRODUCTION

Indian sub-continent is highly vulnerable to natural disasters like earthquakes, draughts, floods, cyclones etc. Majority of states especially north-east india and union territories are prone to one or multiple disasters. These natural calamities are causing many casualties and innumerable property loss every year. Earthquakes are major contributor in vulnerability. Earthquakes cannot be predicted or be stopped from happening. Hence, it becomes matter of importance to analyse the structure using dynamic analysis method like time history analysis. Elevated water tanks supply water to large areas hence for supplying water at high pressure, they are built on tall structures. Also, it becomes important that this structures should not be fall down if earthquake occurs, but most of the time, elevated water tank fell because of insufficiency in analysing and detailing.

Hence, the objective of this paper is to present a review of literature on, non-linear time history analysis of elevated water tank.

II. LITERATURE REVIEW

D.R. Dhamdhere1 , Dr. V. R. Rathi2 , Dr. P. K. Kolase [1] studied analysis and design of cantilever and relieving platform retaining wall with varying height from 3m to 10m and SBC 160KN/m2 . It also shows comparative study such as cost, economy, bending moment, stability against overturning &sliding between both the retaining wall. The comparative study is carried out along with the cost and optimum or least cost estimate is chosen as the best option. In this paper it is also shown that the relieving platform retaining wall is economical, more stable than cantilever retaining wall and it also relives the bending moment of heel portion.

Punde Gayatri V. 1 , Auti Akanksha S. 2 , Yendhe Rutuja R. 3 , Yendhe Aishwarya A. 4 ,Shelar Trijeta R. 5 (2018) [2] the analysis and design of the cantilever retaining wall. The design involves two major steps: the first one is the evaluation of the stability of the whole structure under the service loads, which includes the overturning , sliding and bearing failure modes, and the second one is the design of the different components, such as the stem, heel and toe for bending and shear, under the combined factored loads.All analysis and design are based on the ACI code.

Ch Keerthi, A Rajendra, Dumpa Venkateswarlu (2019) [3]. retaining walls of height 6m, 9m and 12m are considered for study and the length of the walls considered as 30m and the material properties considered are M20 and Fe415 steel bars and the supports considered to be fixed at the base. It is observed that with increase in the height of walls from 6m, 9m and 12m the results are found to be increased.

1. It is observed that counterfort retaining walls shown better results when compared with the t flanged and free cantilever retaining walls.
2. It is observed that the support reactions and support moments are increased in counterfort retaining walls

when compared with the t flanged and free cantilever retaining walls.

3. For higher height of retaining walls counterfort retaining walls are better suitable.
4. Displacement in counterfort retaining walls are 87.72% lesser when compared with cantilever retaining walls and 75.57% lesser when compared with T flanges retaining walls.
5. Support reactions and moments in counterfort retaining walls are 67.57% higher when compared with cantilever retaining walls and 67.57% higher when compared with T flanged retaining walls.
6. Wall moments in counterfort retaining walls are 76.46% lesser when compared with cantilever retaining walls and 55.95% lesser when compared with T flanges retaining walls.

André Luís Brasil-Cavalcante & Juan Felix Rodriguez-Rebolledo (2017) [4], a probabilistic analysis has been used in this paper to illustrate an application of the design of retaining walls. This paper presents a Mathematica code [21], which was developed for the Rosenblueth point estimate approach [16]. The authors successfully verified the code by computing the overturning failure probability of a retaining wall under static and seismic loading conditions. Based on these results, a design analysis was evaluated.

G L Sivakumar Babu i), ii) , P Raja and iii) P Raghuveer Rao (2016) [5]c analysis of a cantilever retaining wall for road approach embankments which showed distress in the form of translation, vertical settlements and rotation is presented. Extensive geotechnical soil investigation and field measurements of distress are collected. The paper presents prominent causes of failure of cantilever retaining wall using forensic geotechnical investigation. Back analysis of the cantilever retaining wall is performed using classical conventional methods and finite elements analysis. From the results of the conventional analysis and finite element methods, it is observed the retaining wall designs based on prescriptive guidelines may not lead to satisfactory designs and considerations of deformations is important. Back analysis of failure showed that the mechanism of failure is a combination of sliding and overturning and the deformations are in conformity with the predictions obtained from the numerical analysis.

C.Y. Chin1 , Claudia Kayser2 and Michael Pender3 (2016) [6] This paper provides results from carrying out two-dimensional dynamic finite element analyses to determine the applicability of simple pseudo-static analyses for assessing seismic earth forces acting on embedded cantilever and propped retaining walls appropriate for New Zealand. In particular, this study seeks to determine if the free-field Peak Ground Acceleration (PGAff) commonly used in these pseudostatic analyses can be optimized. The dynamic finite element analyses considered embedded cantilever and propped walls in shallow (Class C) and deep (Class D) soils (NZS 1170.5:2004). Three geographical zones in New Zealand were considered. A total of 946 finite element runs confirmed that optimized seismic coefficients based on fractions of PGAff can be used in pseudo-static analyses to provide moderately conservative estimates of seismic earth forces acting on retaining walls. Seismic earth forces were found to be sensitive to and dependent on wall displacements, geographical zones and soil classes. A reclassification of wall displacement ranges associated with different geographical zones, soil classes and each of the three pseudo-static methods of calculations (Rigid, Stiff and Flexible wall pseudo-static solutions) is presented. The use of different ensembles of acceleration-time histories appropriate for the different geographic zones resulted in significantly different calculated seismic earth forces, confirming the importance of using geographic-specific motions. The recommended location of the total dynamic active force (comprising both static and dynamic forces) for all cases is 0.7H from the top of the wall (where H is the retained soil height).

He Wang , Hongkai Chen , Yali Wang , Linfeng Han & Haizhan Li (2020) [7] The damage of roadbed retaining wall caused by mountain torrent is the most common disaster in geotechnical engineering. Based on the central point method, a reliability analysis model of the gravity retaining wall under mountain torrent load was established in this paper, and the performance functions of the anti-sliding and anti-overturning stability were derived. Finally, the reliability indexes of the anti-slip stability and overturning stability of the gravity retaining wall were obtained. We also analysed the sensitivity of stability reliability by changing the values of five variables which were the angle of mountain torrent load (ε), internal friction angle (ϕ), included angle between the retaining wall and the straight surface (θ), friction angle (δ), friction coefficient f. For the anti- sliding reliability, f, ε and ϕ have the greatest influences on the stability of the retaining wall. The increases of the other two variables have positive impacts on the anti-sliding stability. For the anti-overturning stability, the index coefficient increases with the increases of θ and ε, and decreases with the increase of ϕ until stability. The calculation method proposed in this paper considered the influence of mountain torrent, therefore it has a good practical application value in engineering.

Ryszard Chmielewski,* (2018) [8] The case study of the assurance of retaining wall stability in densely urbanized conservation and cultural heritage areas are described in this paper. During The Second World War many of these historic buildings in Warsaw were completely or partially destroyed and until these days their remains constitute elements of the existing building development of the capital of Poland. This may be connected with a change in the nature of applied loads as well as current functions of these buildings. The results of expert opinions and investigations are presented, regarding the operational and technical state of two retaining walls submitted to an expert before the repair works. When designing the design concept, both the historic character of structures, the technical feasibility of performing construction works in the densely urbanized area, as well as determined water and ground conditions were considered. The first of the analysed cases concerns the retaining wall localised in the vicinity of the Ordynacka Street and the Tamka street. After analysing the historical aerial photographs, it was found that the retaining wall constitutes an underground part of the apartment house destroyed during the warfare. The second case study refers to Warsaw Old Town – the retaining wall ensuring the stability of the Vistula escarpment along Brzozowa Street in Warsaw.

III. CONCLUSION

From the review of literature on, Analysis and design of retaining wall the following conclusions are drawn:

- The bending moment in toe and heel is less for retaining wall with relieving platform than cantilever retaining wall..
- The area of steel for toe and heel is less for retaining wall with relieving platform than cantilever retaining wall
- The retaining wall with relieving platform is much more safer against overturning and sliding than cantilever retaining wall.
- The retaining wall with relieving platform is economical after 5.5m
- The area of steel for toe and heel is less for retaining wall with relieving platform than cantilever retaining wall.
- The steep slopes or cliffs will increase the driving force.
- The design of the retaining wall with sloping wall on the front of the retaining wall gives more force to retain the active pressure.
- The overturning factor of safety increases with the increase in internal friction angle of the backfill, and for stability conditions (FS seismic≥ .15), the horizontal seismic acceleration coefficient must be less than 0.3.

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