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# "A Study on Behavior of MSE wall under Different Earthquake Conditions"

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**ABSTRACT**
Now a day's construction of seismic resistant building is the utmost step taken in the construction field. Therefore the construction of MSE walls also needs this technique where these walls are necessary in the high risk earthquake zones. The reinforcement technique is older one and now it has evolved from use of small metal strips to the use of larger stirrups and also the modern geo-synthetic materials such as Georgics and geo textile. In present work, a MSE wall of 44 m high was designed and analyzed using finite element tool. Plaxis, 2D FEM based computational tool, used for simulation of the MSE wall and for studying its deformations and stability under seismic conditions. The failure modes of MSE walls are studied under different dynamic conditions. Influence of seismicity on MSE forces, horizontal displacements and vertical displacements also studied under different seismic conditions. Also we will compare the influence of earthquake intensity on MSE wall for different tiers. The three earthquake intensities are produced using accelograms of ISGS and observed the effect of earthquake on different tier of MSE wall.
**Keywords ;**Accelogram, Displacement, Excitation, FEM, MSE wall, Plaxis, Retaining wall, Seismic,

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## I. INTRODUCTION

This work explains with the case study of a 44 meter height MSE retaining wall built at Vijayawad, AndhraPrdesh state India. In this present work, MSE wall of 44 m high was designed and analyzed, using Plaxis (Lazarte et al., 2003[1]). Plaxis is a 2D FEM based computational tool, used for simulation of the MSE wall and for studying its deformations and stability under seismic conditions. The failure modes of MSE wall was studied under dynamic conditions. Influence of seismicity on MSE forces, horizontal displacements and vertical displacements also studied under seismic conditions. Three earthquake data's are utilized for the artificial generation of earthquake. Accelograms of three earthquakes namely Van turkey earthquake, Chile earthquake and Northridge earthquake are used.

## II. LITERATURE SURVEY

Theory of reinforced earth and MSE walls initially proposed by Henri Vidal. In zones of high seismic action, quake impacts on the security of MSE dividers accepting Considerable significance and MSE dividers are considered as valuable alternatives in this specific situation. An audit of writing demonstrates that MSE dividers have performed well amid solid ground movements conversely with the for the most part poor execution of gravity holding structures.

After 1989 Loma Prieta earthquake and 2001 Nisqually seismic tremors, it was accounted for that MSE dividers hinted at no misery or huge lasting avoidance, regardless of having encountered, at times, ground increasing velocities high as 0.7g (Felio et al., 1990[2]; Tatsuoka et al., 1996[3]). These perceptions demonstrate that MSE dividers seem to have an intrinsic palatable seismic reaction. This has been ascribed to the inborn adaptability of MSE dividers and potentially to a few levels of conservatism in the current plan methodology (Tufenkian and Vucetic, 2000).

In any case, any point by point examination on the execution of MSE dividers is not acquired out the above reviews. It is additionally attractive that a point by point numerical investigation is required as to the utilization of the system in Indian setting utilizing proper tremor information.

## III. OBJECTIVES

- To model 4 tiered 44 meter MSE wall using FEM tool (Plaxis 2D).
- To Analysis the MSE wall model under various seismic excitations
- To find out the deformation of reinforcement in the wall

- To find maximum horizontal and vertical displacements
- To study the deformation of each tier under the seismic condition

## IV. METHADOLOGY

The simulation of earthquake is done using accelograms provided by USGS. The plane strain model of fine mesh generation is done using Plaxis 2D. The wall is modeled for undrained condition and plain strain condition with Mohr-Coulomb model. The wall face is modeled using plate elements and assumption is that plain strain state stresses. The wall is constructed and modeled in 4 tiers, each of 11 meters high. This wall is modeled using Plaxis software for three different earthquake conditions keeping same lengths of reinforcements. For the simulation purpose the corrected aacelegrams Van turkey earthquake, Chile earthquake and Northridge earthquake are used. The typical acceleogram of Van turkey earthquake is shown below.

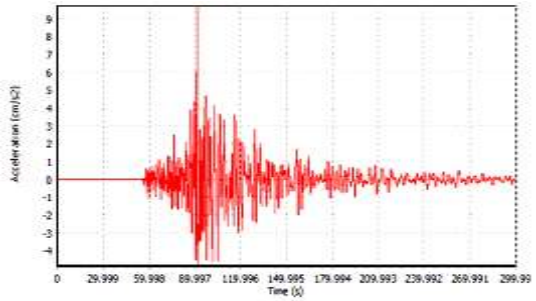

**Fig 1:** Van turkey earthquake aacelogram

The wall geometry and the properties of soils are given below. Here we can get the deformation of the structure, stresses on the structure and also we can find the acceleration and velocity on the reinforcement as well as wall structure.

| Mohr-Coulomb | | Backfill soil |
|---|---|---|
| Type | Unit | Undrained |
| Gamma sat | KN/m³ | 20 |
| Gamma dry | KN/m³ | 18 |
| Cref | KN/m² | 10 |
| V | - | 0.3 |
| Phi | Degree | 30 |
| Kx | m/day | 0.0 |
| Eref | KN/m² | 6000 |
| Ky | m/day | 0.0 |
| Psi | Degree | 0.0 |
| Gref | [KN/m²] | 2307.692 |
| Eoed | [KN/m²] | 8076.923 |

**Table 1: Soil data sets parameters**

## V. RESULT AND DISCUSSION

The graphs show that the magnitude of earthquake impacts on the deformation of MSE wall. It is also observed that epicentre distance also plays vital role in the analysis process. It was observed that in case of Ocean side earthquake the magnitude was 5.40 and epicentre distance was also less which is 71.80 Km. The resulted analysis showed that the deformation is maximum in this case. . It observed that total deformation is 3.14m. Whereas in case of Chile earthquake the moment magnitude is as high as 8.80 and the epicentre distance is also high, the resulted deformation is lesser. It observed that total deformation is 1.26 m only.

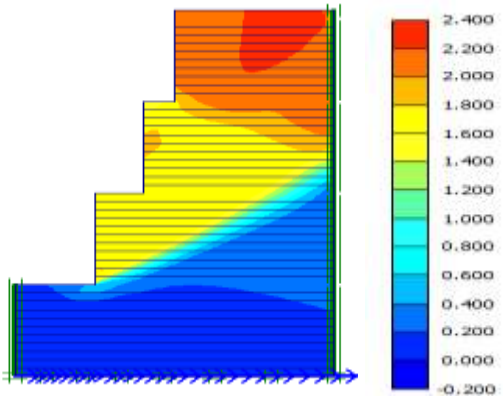


**Fig 2:** Total wall movement for Van, Turkey earthquake

The wall shows the total deflection of 2.31 m after the simulation. The deformation was more at the top and decreases downwards. The red color in the shading contour indicates the maximum deflection at top of the wall and the blue color contours indicates the lesser deformation as compared to upper part of the wall.

## VI. CONCLUSION

From the study we can conclude that, as the magnitude of earthquake increases, wall deformations were increased. And also, deformations obtained for all four earthquake excitations depend on epicentral distance. It is seen that Earthquake with higher magnitude and shorter epicentral distance shows higher deformations compared to other earthquakes.

From above study the following conclusions can be drawn. The present study shows the results of FEM method, in which analyzed values are in well acceptable ranges and are in good agreement. Finite element modeling shows the maximum horizontal and vertical movements/displacement of MSE wall at its top, at foundation and at reinforced soil zones. Also the study gives the effect of soil and reinforcements on stability of mechanically stabilized earth retaining wall. As reinforcement is kept constant the deformations observed increasing in higher walls.

The study could be extended to determine the settlement of foundation of MSE wall using GEO5 MSE.

## FUTURE SCOPE

The present study has been carried out with a four tired MSE wall design and analysis only. So further study can be performed to design and analyses the multi tired MSE walls more than four tiered wall. The present study has been carried out without considering the water table and seismic effects to the MSE wall so further study can be performed by considering water table and hydrostatic pressures to MSE retaining wall.

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