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A Review of Wrap Faced Embankment on Soft Clay

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Abstract

The aim of the paper is to review the different research manuscripts on wrap faced embankment. Wrap faced embankment is basically a sand embankment wrapped around by geotextile layers as a steep embankment. This wrap-faced embankment is filled with different characteristics of sand. In this research, the wrap faced embankment is model by reduce scale in BUET Geotechnical Lab. The shaking table test machine was used to induce earthquake and wave action. The fifteen sensors have been placed in the wrap faced embankment and clay soil layer which was discussion on Hore et al. 2022. The different soil characteristics like accelerations, displacement, pore water pressure and strain has been analyzed in this research. This embankment showed better response to the earthquakes and wave action means stable to seismic and wave action. The results of the research have also been verified by numerical analysis by PLAXIS 3D software. Without knowing the characteristics of the wrap faced embankment during the earthquake, it is impossible to build this type earthquake/ wave resisting embankment. The dynamic behavior of wrap faced embankment on soft soil in Bangladesh has been invented by the Hore's research. Now, it is possible to design and construction of earthquake/ wave resistance wrap faced embankment on soft Bangladeshi soil.

Introduction

The seismic behavior under dynamic loads, these series of tests was performed using two different slope angles, and reinforcements (Latha and Krishna 2006; 2008, Krishna and Latha 2007 and Sabermahani et al. 2009, Latha and Nandhi Varman 2014). The research on seismic response of slurry wall and sandy soil was presented by (Xiao et al. 2014). Zhang et al. (2009) effectively performed more tests to investigate the behavior of excess pore water pressure in different soft soil-foundation. Latha and Manju (2016) described the performance of geo-cell retaining walls inside a laminar box which were under seismic shaking conditions. The shake table test on the different dynamic loading based on the slopy area developed a calibrated numerical model and analyzed the input ground motions (Krishna and Bhattacharjee, 2019 and Yu et al., 2017)) at the base of the rigid-faced reinforced soil-retaining wall. A recent study by Gidday and Mittal (2020) on reinforced soil retaining wall on soil which is facilitated by the shake table test. The embankment analysis of the soft clay soil in Bangladesh is the vital effect on the soil structure interaction. The experimental and numerical analysis (PLAXIS 3D) which were performed by the shaking table platform with laminar box on soft clay soil. The dynamic soil analysis platform is very significant for the analysis of the soil behavior as per seismic response. Moreover, cyclic loading is the vital role on the analysis of the Bangladeshi soft soil (Hore et al. 2021 and 2022).

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In this research, the response of earthquake and wave action on the soft soil in Bangladesh has been analyzed where the different soil type of wrap faced embankment (local and Sylhet sand) on the shaking table test machine used in the experiment Subjected to cyclic loading. This paper is reviewed the different research paper from 2020 to 2022 on wrap Faced embankment at lab of Bangladesh University of Engineering and Technology (BUET).

1. Shaking Table, Laminar Box and Testing

A computer-controlled servo-hydraulic single degree of freedom shaking table facility was used in this experiment, where the platform used for testing was made of steel, the measurement is of 2 m by 2 m size, and with a payload capacity of 1500 Kg. as shown in Figure 1 (Hore et al. 2022). The acceleration range is 0.05g to 2g. A frequency range is 0.05Hz to 50 Hz. The maximum amplitude was ±200 mm. The maximum velocity was 30 cm/sec. Twenty-four (24) hollow aluminum layers of a large-sized shear box is used for this experiment. The friction between the layers is minimum, as shown in Figure 1. In the present study, the height of clay soil foundation is 300 mm. On the other hand, the thickness of the sand blanket is 50 mm as shown in Figure 2 (Chakraborty et al. 2022). The prototype to model scale being N=10 and scale factor 1/N. Figure 3 (Hore et al. 2021) shows the Wrap-faced soil retaining wall.

Figure 1. Seismic analysis of the model embankment

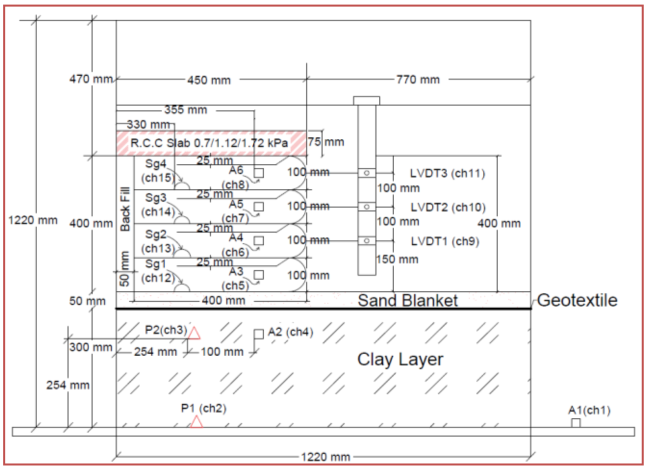

Figure 2: Experimental setup.

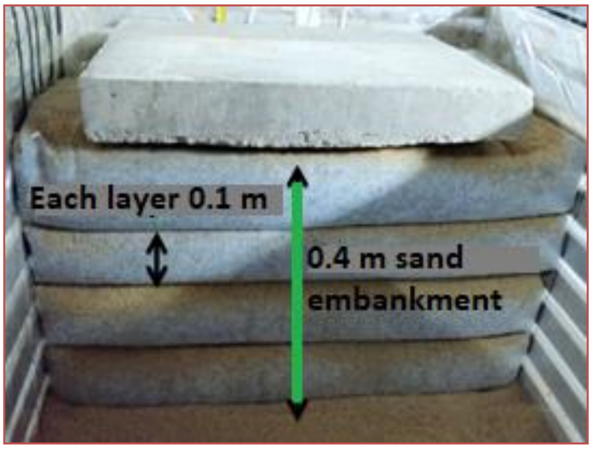

Figure 3: Wrap-faced geotextile reinforced

1. Results and Discussion

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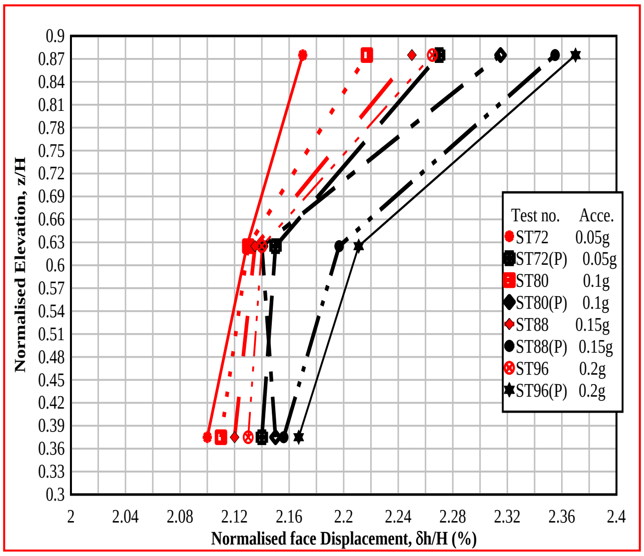
Displacement profile with respect to surcharge and base acceleration has been analyzed in the results and discussion section. Horizontal face displacement along the height of the wall was scrutinized based on different sinusoidal motion where different frequency and acceleration level are fixed presented in Figures 4 to 5 (Hore et al. 2021). Here elevation is denoted as z and horizontal displacements as δh are presented in non-dimensional from after normalizing. The height of the wall is denoted as H. Figure 4 depicts the normalized displacement profile for different base accelerations of 0.05g, 0.10g, 0.15g and 0.20g. The tests are ST72, ST80, ST88, and ST96 respectively. From the Figure a maximum horizontal displacement of 2.26% of the total wall height (H), for 0.20g, was observed compared with 2.16% for 0.05g base accelerations. The maximum displacement is 9.06 mm at a acceleration of 0.2g, whereas it is decreased to 8.67 mm at a acceleration of 0.05g.. The numerical analysis results are 3.97% and 3.85% higher than the experimental results respectively. The effect of different surcharge loadings of 1.72 kPa, 1.12kPa and 0.7kPa as shown in Figure 5. The displacement response against surcharge variation was inversely proportional at all elevations. The maximum displacement of the wall was (δh/H=2.19%) at a surcharge pressure of 0.7 kPa, whereas it was decreased to (δh/H=2.10%) at a surcharge pressure of 1.72 kPa. The numerical analysis results are 3.57% and 3.67% higher than the experimental results respectively.



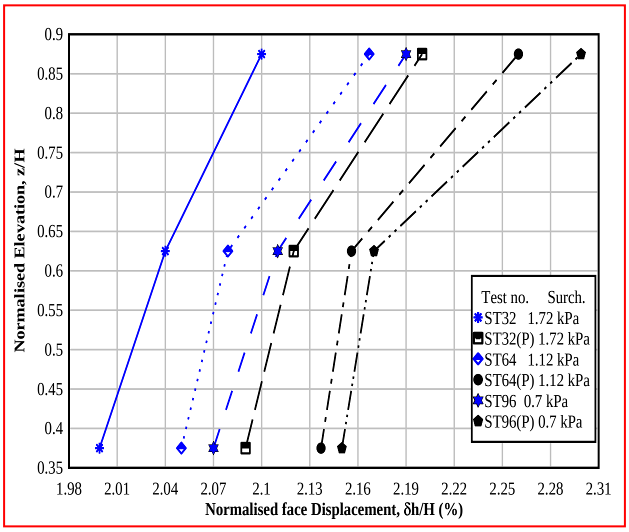


Figure 4: Displacement profile (base acceleration) Figure 5: Displacement profile (surcharge)

2. Conclusions and Summary

The behavior of wrapped-face retaining wall has a significant effect on the soft clay soil in Bangladesh which was presented in Hore et al. 2020 to 2022. Accelerations at the top of the wall were inversely proportional to the surcharge pressures and acceleration response against frequency variation is not directly proportional. On the other hand, acceleration amplifications were increased with increased base accelerations which are proved in the experimental results. Moreover, in all cases, numerically obtained values are higher than the experimental results. The experimental result is found to be lower than the numerical result that is used in PLAXIS

3D for all parameters. These research outcomes are very helpful to analysis of the future research on dynamic behavior of soft soil and forecast a future scenario of the soil profile specially the middle and southern part of the country.

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