SYNOPSIS

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SEISMIC COEFFICIENTS FOR DESIGN OF GEOSYNTHETIC REINFORCED SOIL WALL WITH SOIL NON-LINEARITY EFFECT AND DIFFERENT FOUNDATION SOIL

Various case studies suggest that GRS walls have performed better under different earthquakes such as Northridge (1994), Kobe (1995), and Chi-Chi (1999) compared to the conventional retaining walls. It is often attributed to their relatively flexible structure with better energy dissipation besides stability under high seismic loads with conservative static design. Since the damage of the GRS wall can be better related to the lateral displacement, it is essential to understand the facia deformation of the walls. The foundation soil can significantly influence the facia deformation and failure plane of a wall subjected to earthquake loading. The current design guidelines do not incorporate the effect of foundation soil while designing a GRS wall. The influence of foundation soil on the dynamic behavior of wrap faced GRS walls has been studied by using a two-dimensional plane strain finite element model, which is developed in GiD

and analyzed in OpenSees. The soil is modeled as Pressure-Dependent-Multi-Yield material and discretized in quadrilateral elements. The reinforcement is model as elastic-perfectly plastic material and discretized in the linear truss elements. Its interface with soil is defined using coulombs friction law using node to node zerolengthContact2D element. The model is validated by comparing the predicted response with an experimental shake table testing study. In subsequent numerical simulations, the wall was subjected to different earthquake motions scaled to four different PGAs. The analysis is carried out on four different foundation soil classes from AASHTO: class B, class C, class D, and class E. The settlement was maximum for the GRS wall seated on the class E foundation soil due to its low stiffness and large plastic deformations in soil. The lateral displacements were maximum in the case of class E foundation soil resulting in greater reinforcement forces. Further analysis was carried out for two different wall heights 3.6m and 6.6m, and considering different backfill materials. The acceleration amplification response of the wall decreases with increased PHA value due to large plastic deformations and high energy dissipation in soil. The acceleration amplification is observed to be more for the backfill material with lower stiffness and lower friction angle. The dynamic earth pressure forces increase with the wall height due to higher destabilizing forces. It was observed that the pseudo-static method underestimates the reinforcement forces under lower PHA values and overestimates at higher values. This can be attributed to the soil nonlinearity effect, i.e., the increase in seismic forces led to plastic deformation in soil. Thus, major seismic energy is dissipated in the form of plastic deformation of the soil. The kH/PHA value used in the pseudo-static method has a linear variation with the PHA values, which is not observed in our case. It is observed that the average acceleration of the soil in the failure zone better represents the horizontal seismic coefficient to calculate the seismic forces induced in the wall.