Thesis Title:

INTERFERENCE EFFECT OF CLOSELY SPACED SQUARE FOOTINGS ON GEOCELL REINFORCED SAND AND CLAY BEDS: EXPERIMENTAL AND NUMERICAL STUDIES

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Abstract

With rapid growth of construction rate and lack of suitable land sites for construction, placing building foundations close to each other and on soft-grounds is inevitable. When the foundations are placed close enough on the similar soil conditions, they behave differently than it would when the foundation was single or isolated. Interference effect causes the soil region between the interfering footings to undergo some sort of confinement due to which the bearing capacity of the soil increases. Taking into the consideration of both interference and application of geocell and geogrid, which in today's scenario has become a necessity, the current study illustrates in details how the interference effect varies with spacing between the footings and when different soils are used (in this study two different type of soil are used 1. sand 2. clay). In this study, the author has illustrated how the soil would behave due to interference in both sand and clay beds and compared that with sand and clay bed reinforced with geocell and geogrid. For this, model test experiments were conducted on geocell reinforced sand and clay beds. 3-Dimensional numerical simulations using FLAC 3D was used to numerically simulate the interference effects with geocell and geogrid. The study found a significant increase (up to 25%) in bearing capacity due to interference effect between the adjacent footings. The optimum spacing(S) between the footings was found to be 0.5 times width of footing (B) for both unreinforced and geocell reinforced beds where bearing capacity is maximum. When the soil was reinforced with geocell and basal geogrid, there was dramatic reduction in the depth of stress distribution and major stress was accumulated in the geocell wall (membrane) preventing the stress distribution to the deeper level. Compared to unreinforced clay bed, I_F increased up to 14% for geocell + geogrid reinforced clay bed. Applying reinforcement (geocell and or geocell) on both sand and clay bed significantly improves the allowable bearing pressure and curbs the propagation of shear strain in to the soil. Improvement in bearing pressure up to 4 times in sand and up to 5 times in case of clay bed when both geocell and geogrid was introduced. Generally, due to interference effect, there is increase in bearing capacity by 15% in unreinforced clay; this becomes higher (18-33%) in reinforced clay; the interference effect becomes highest and the bearing capacity increases up to 33%(clay) and 26%(sand) when clay is reinforced with both geocell and geogrid.