

Design Charts for Strip Footing on Untreated and Cement Treated Sand Mat over Underlying Natural Soft Clay

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Abstract : Shallow foundations on unimproved soft natural soils can undergo a high consolidation and secondary settlement. For low and medium rise building projects on such soil condition, pile foundation may not be cost effective. In such cases an alternative to pile foundations may be shallow strip footings placed on a double layered improved soil system soil. The upper layer of this system is untreated or cement treated compacted sand and underlying layer is natural soft clay. This system will reduce the settlement to an allowable limit. The current research has been conducted with the settlement of a rigid plane-strain strip footing of 2.5 m width placed on the surface of a soil consisting of an untreated or cement treated sand layer overlying a bed of homogeneous soft clay. The settlement of the mentioned shallow foundation has been studied considering both cases with the thicknesses of the sand layer are 0.3 to 0.9 times the width of footing. The response of the clay layer is assumed as undrained for plastic loading stages and drained during consolidation stages. The response of the sand layer is drained during all loading stages. FEM analysis was done using PLAXIS 2D Version 8.0. A natural clay deposit of 15 m thickness and 18 m width has been modeled using Hardening Soil Model, Soft Soil Model, Soft Soil Creep Model, and upper improvement layer has been modeled using only Hardening Soil Model. The groundwater level is at the top level of the clay deposit that made the system fully saturated. Parametric study has been conducted to determine the effect of thickness, density, cementation of the sand mat and density, shear strength of the soft clay layer on the settlement of strip foundation under the uniformly distributed vertical load of varying value. A set of the chart has been established for designing shallow strip footing on the sand mat over thick, soft clay deposit through obtaining the particular thickness of sand mat for particular subsoil parameter to ensure no punching shear failure and no settlement beyond allowable level. Design guideline in the form of non-dimensional charts has been developed for footing pressure equivalent to medium-rise residential or commercial building foundation with strip footing on soft inorganic Normally Consolidated (NC) soil of Bangladesh having void ratio from 1.0 to 1.45.

Keywords : design charts, ground improvement, PLAXIS 2D, primary and secondary settlement, sand mat, soft clay

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