Mathematical Approach to Simulate Soil Behavior Under Shallow Compaction

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Abstract

Surface or shallow compaction is one of the earliest, cheapest and commonly used techniques to improve the physical and mechanical properties of loose soil specially for imported structural fill. It is simply rearranging of soil particles to reduce air ratios using surface static or vibrating mechanical effort. Usually, shallow compaction procedure includes subjecting the loose soil to certain number of compacting equipment passes to archive the accepted compaction level; this number of passes is a function of many parameters such as type of soil, initial soil parameters, compacting equipment characteristics and thickness of soil lift. International codes, specifications and handbooks include just guidelines about the required number of passes; accordingly, it is usually determined based on personal experience and field trials. This research has two goals, the first is to estimate the properties improvement of certain natural surface loose soil under certain surface compaction procedure by calculating the enhancement in soil properties after each pass and updating the soil properties for next pass calculations. The second goal is to use the previous approach to develop set of equations to design surface compaction procedure for imported structural fill, this includes calculating minimum compaction equipment characteristics, maximum lift thickness and minimum number of passes to enhance certain imported fill from certain initial condition to certain final condition. The proposed approach for the first goal was verified using case studies and showed good matches, and the developed designing equations for surface compaction procedure were verified using case studies and showed good matches.

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