Ground Improvement: A Discussion on Dynamic Compaction

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ABSTRACT #1:

Founded by Louis Menard in 1970, dynamic compaction has become one of the most versatile and cost-effective methods of ground improvement in the United States. Primarily applicable to granular soils, dynamic compaction has been proven to be equally as successful at improving urban fill materials, mine spoils, liquefiable sands, and collapsible soils.

Additionally, the implementation of dynamic compaction programs where karst geology is encountered has allowed for high-energy weight drops to be performed across a given site to identify buried sinkholes. This presentation will provide a brief history of ground improvement, will focus on the design and implementation of a dynamic compaction program, and provide general details about several sites, all with various characteristics, where dynamic compaction has been successfully implemented. Additionally, the various methods of post-improvement testing and evaluation that are currently being implemented throughout the United States will be discussed.

ABSTRACT #2:

Ensuring satisfactory response of pile foundations undergoing complex behavior during earthquakes is of paramount importance in developing dependable seismic response of structures. The complexity in the behavior of pile foundations is further increased when weak soils such as soft clays and liquefiable loose sands surround the foundation. The behavior of pile foundations in liquefiable sands has been studied extensively; however, similar investigations for soft clays and seismic response of piles in improved soils have only begun to emerge through NEESR projects such as the NEES-pilEs (piles in low E soils) project.

In case of weak soils (e.g., soft clay), the current design practice is to use increased number of more ductile larger diameter piles, which are difficult and expensive to design and construct. An innovative, more cost-efficient solution to this problem, which has not found wide usage due to lack of knowledge under seismic conditions, is to use Deep Soil Mixing to improve the soil surrounding the pile foundation, thereby increasing its lateral stiffness and resistance.

Introducing an improved soil condition with Deep Soil Mixing to surround the pile at the ground surface and some distance below creates a stiff region that helps to increase the lateral pile resistance while minimizing its lateral deformation. Recent full-scale field tests and centrifuge tests from a NSF sponsored NEESR project confirm that the improved ground may increase the lateral resistance by a factor of 9 at an acceptable horizontal deformation of 2 inches. This presentation highlights the findings from the research project and serves to illustrate the potential benefits of Deep Soil Mixing ground improvement to enhance pile lateral resistance.