Ground Improvement Methods

Purpose and Background

When difficult ground conditions are encountered there are a number of alternatives that can be employed to achieve project objectives. These alternatives include: (1) completely abandoning the project; (2) bypassing the poor soil through relocation of the project to a more suitable site or through the use of a deep foundation; (3) removing and replacing the unsuitable soils; (4) designing the planned structure to accommodate the poor/marginal soils; or (5) modifying (improving) the existing soils, either in-place or by removal, treatment and replacement of the existing soils. Through a wide-variety of modern ground improvement and geoconstruction technologies, marginal sites and unsuitable in-situ soils can be improved to meet demanding project requirements, making the latter alternative an economically preferred solution in many cases. In essence, the modern builder has the option to fix the poor ground conditions and to make them suitable for the project's needs. A variety of terms are used to describe this fixing the ground: soil improvement, ground improvement, ground treatment, or ground modification. It has been noted that the process of altering the ground is ground treatment, while the purpose of the process is ground improvement, and the result of the process is ground modification. For better or worse the treatment has modified the ground's properties.

Within this course, ground modification is defined as the alteration of site foundation soils or project earth structures to provide better performance under design and/or operational loading conditions. Ground modification objectives can be achieved using a large variety of geotechnical construction methods or technologies that alter and improve poor ground conditions where soil replacement is not feasible for environmental, technical or economic reasons. Ground modification has one or more of the following main functions, to:

- increase shear strength and bearing resistance
- increase density
- decrease permeability
- control deformations (settlement, heave, distortions
- improve drainage
- accelerate consolidation
- decrease imposed load
- provide lateral stability
- increase resistance to liquefaction an
- transfer embankment loads to more competent layer

The instructor presents the critical knowledge and skills you need in order to take advantage of the cost effective use of ground improvement methods in urban construction for transportation, commercial and industrial development. From start to finish - from design to construction and general site development - the instructor will lead you through the myriad of more than 50 different ground improvement methods from which you can choose.

Ground improvement Methods have been found to provide benefits in the following five major areas:

- Utilization of less costly foundation system
- Reduction in right-of-way acquisition
- Less environmental disturbance
- Reduction in construction time
- Improved traffic control through construction zones

The impetus for ground improvement has been both the increasing need to use marginal sites for new construction purposes and to mitigate risk of failure or potential poor performance. During the past several decades, ground improvement has come of age and reached a high level of acceptance in the geotechnical community. Its use is now routinely considered on most projects where poor or unstable soils are encountered, especially on sites underlain by suspect or uncontrolled fills. From the geotechnical design engineer's point of view, ground modification means the increase in soil shear strength, the reduction of soil compressibility, and the reduction of soil permeability–the modification of the relevant engineering property. From the contractor's point of view, ground modification may mean a reduction in construction time and/or a reduction in construction costs. Both points of view are valid reasons to consider the use of ground modification techniques.

During this two-day program the instructor presents a logical sequence of topics and activities to allow participants to demonstrate their knowledge and skills. These activities include: lecture, student exercises, instructor lead example problems and lively discussion periods. All participants will receive a PDF copy of the lesson PowerPoint files.

The course material provides direct standard of practice design and construction guidance for all Civil Engineering applications required for application on structural foundations, engineered earthworks, and earth retaining structure for new and rehabilitated facilities.

- **For group training, contact John Wyrick (JWyrick@asce.org) or Stephanie Tomlinson (STomlinson@asce.org)**

Seminar Instructor

JERRY A. DIMAGGIO, P.E., D.GE, M.ASCE, is a principal civil engineer at Applied Research Associates, Inc. in Maryland. He is internationally recognized for his work on design, construction, evaluation, forensic assessment and disputes resolution of structural foundations, earth retaining structures, ground improvement techniques and earthworks. Mr. DiMaggio has served on a number of projects related to limit state design (LRFD), risk management assessment and management, innovative contracting and accelerated construction. He is the retired Principal Bridge Engineer, and Geotechnical and National Program Manager with the U.S. DOT.

He is an experienced meeting and workshop facilitator for business and technology deployment activities and is recognized for written and oral communication skills and experience. He has provided consulting services on over 1000 civil construction projects in all 50 states, throughout the Americas, several Middle Eastern countries and Australia. He has presented hundreds of seminars and workshops on the geotechnical and foundation features of bridges, buildings, energy facilities, retaining structures and engineered earthworks. He has been a member of the adjunct faculty at several renown universities and an invited Keynote speaker at many national meetings and conferences. Mr. DiMaggio has authored numerous technical papers, edited three civil engineering books and received numerous national and international recognitions for his career contributions.

Mr. DiMaggio has served on the Geo-Institute National Board of Governors and is a Diplomate in the Academy of Geo-Professionals (AGP). He holds B.S. and M.S. degrees in Civil Engineering from Clarkson University in New York and Arizona and is a certified Master Trainer and licensed Contract Arbitrator (AAA).

Who Should Attend?

- Geotechnical Specialists
- Construction engineer
- Contractors
- Structural engineers
- Owners
- Professionals involved in the design, construction, inspection, testing and specification of buildings, energy facilities and transportation features

Summary Outline

DAY ONE

- Introductions, Learning Outcomes and Course Overvie
- Introduction to Ground Improvement Methods, their Functions, Applications and Selectio
- Soil and Rock Parameters (tests and soil and rock parameter selection)
- Prefabricated Vertical Drains
- Lightweight Fill Materials
- Dynamic Compaction and Vibro-Compaction
- Mechanically Stabilized Earth Walls and Reinforced Soil Slopes

DAY TWO

- Stone Columns, Geopiers and Controlled Modulus and Load Transfer Platforms
- Soil Nailing Wall
- Deep Soil Mixin
- Grouting Techniques and Applications
- GeoTechTools (www.GeoTechTools.org)
- Course Summary and Closure

Seminar Benefits & Learning Outcomes

- Recognize potential applications for Ground Improvement Methods used in civil engineering applications
- Select the most technically appropriate and cost-effective Ground Improvement Method for your application
- Examine and select appropriate material properties, soil/ rock design and construction parameters
- Prepare conceptual and basic designs using appropriate design methods, factors of safety, and field verification methods
- Evaluate and review contractor submitted designs and construction installation plans
- Select appropriate specification/contracting method(s) and prepare contract documents
- Demonstrate a clear understanding of Ground Improvement Methods construction, inspection and preservation

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ASCE seminars are available for On-Site Training. For details regarding On-Site Training and/or needs-based training opportunities, please contact:

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