Geotechnical Forensics

Research Experience for Undergraduates At UNC Charlotte

Introduction of REU Project

By Amed Muñoz
Literature review of
Professional paper
Engineering publications
Information Synthesis



Investigation of distress / Foundation problems

What is Geotechnical Forensics?

• Engineering behavior of earth materials

- Soil Mechanics, Properties
- Interaction with Earth Structures
- 18th century 1st theoretical soil design





• Scientific analysis of physical evidence

Famous Geotechnical Failures

Tower of Pisa (1173) Cause: Site Investigation





(http://failures.wikispaces.com)

Famous Geotechnical Failures Transcona Grain Elevator (1913) Cause: Design





(http://failures.wikispaces.com)

Modern Geotechnical Failures

Shanghai Apartment (2009)
Cause: Construction



Pile foundation weakened by digging an underground garage.





(www.dailymail.co.uk/news/worldnews)

Geotechnical Failures



• Collapse



Sinkholes



• Expansive Clays



(septictankinfo.com)



(Sharma & Lewis, 1994)

Montmorillonite



Modified from (Sharma & Lewis, 1994)

 Lateral movement
 Induced by large scale subsidence



(Day, 1999)





Geotechnical Investigation



Crack Mapping



(Zisman, 2010)





SECTION VIEW



PLAN VIEW

(Zisman, 2010)

• Aerial Photography



(Zisman, 2010)

• Pressuremeter





(www.roctest.com)

• Pressuremeter



$\Rightarrow \equiv G \Rightarrow E \equiv 2G(1 \neq V)$



Investigation Electrical Method & Ground Penetrating Radar





(Geotechnical Engineering Investigation Handbook by Hunt, 2005)



Vibroreplacement Stone Columns





Geotechnical Mitigation MethodsDeep Soil Mixing





Geotechnical Mitigation MethodsDeep Dynamic Compaction





Injection





Compaction Grouting



Compaction Grouting



Compaction Grouting



Key ObservationDiffused double layer



Key Observation

• Differential Movement & Active Soils



Key Observation

Synthesis of Investigation

Objectives

Methods & Equipment



References

• Day, R. W. (1999). Forensic Geotechnical and Foundation Engineering. New York: McGraw-Hill. • Sharma, H. D., & Lewis, S. P. (1994). *Waste* Containment Systems, Waste Stabilization, and Landfills. Newy York, NY: John Wiley & Sons, Inc. • Zisman, E. D. (2010). Forensic Considerations in Sinkhole Investigations. In S.-e. Chen, A. Diaz de Leon, A. M. Dolhon, & M. J. Drerup, Forensic *Engineering* 2009 *Pathology* of the Built Environment (pp. 224-233). Reston: ASCE.