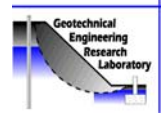




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**DEPARTMENT OF CIVIL AND
ENVIRONMENTAL ENGINEERING**

Samuel G. Paikowsky, Sc.D
Professor



14.533 ADVANCED FOUNDATION ENGINEERING

Fall 2013

Monday, 6:30 – 9:20PM, in KI-310 and Online

Recommended Textbook: “Foundation Analysis and Design”, Joseph E. Bowles, 5th. ed., 1996, McGraw Hill.

The class does not follow any specific text. The above reference is recommended with additional material from different sources to be distributed. The class syllabus refers to chapters in the above text. The following reference texts will be used and/or referred to.

Class Website: <http://faculty.uml.edu/spaikowsky>

Reference Texts:

1. *Foundation Engineering Handbook*, edited by Hsai-Yang Fang, Van Nostrand, 2nd ed. (1991).
2. *Principles of Foundation Engineering*, B.M. Das, PWS-Kent, 5th ed. (2004), 6th ed. (2006), and 7th ed. (2010).
3. *NCHRP Report 651 LRFD Design and Construction of Shallow Foundations for Highway Bridge Structures*, Paikowsky et al., 2010.
http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_651.pdf (Google “NCHRP 651”)
4. *Soil Mechanics, and Foundations and Earth Structures*, NAVFAC DM7.1 and 7.2, May 1982.
http://www.wbdg.org/ccb/DOD/UFC/ufc_3_220_10n.pdf
5. *Soils and Foundations*, Workshop Manual, National Highway Institute, NHI course No. 132012, Pub. No. FHWA-HI-88-009 <http://www.nhi.fhwa.dot.gov/home.aspx>
6. *Geotechnical Engineering Circular No. 5 – Evaluation of Soil and Rock Properties*, Sabatini et al., Pub. No. FHWA-IF-02-034, 2002.
http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm
7. *Geotechnical Engineering Circular No. 6 – Shallow Foundations*, Kimmerly, Pub. No. FHWA-IF-02-054, 2002. http://www.fhwa.dot.gov/engineering/geotech/library_listing.cfm
8. *Canadian Foundation Engineering Manual*, Canadian Geotechnical Society, 3rd ed (1992), 4th ed. (2007).
9. *Shallow Foundations*, NHI Course No. 13237 – Module 7, June 1999.
10. *Manual on estimating soil Properties for Foundation Design*, EPRI EL-6800, Aug.1990.
http://www.geoengineer.org/EPRI_reports/EL-6800.pdf
<http://my.epri.com/portal/server.pt> then search “EL-6800” for PDF download
11. *Manuals for the Design of Bridge Foundations*, Transportation Research Board, NCHRP Report. #343.
12. *Steel Sheet Piling Design Manual*, USS, reprint by FHWA, 1984.
13. *Load and Resistance Factor Design (LRFD) for Highway Bridge Substructures*, NHI Course No. 13068, July 1998.
14. *Foundation Analysis*, R.F. Scott, Prentice-Hall, 1981

Web Sites

FHWA Geotechnical Publications:

<http://www.fhwa.dot.gov/bridge/geopub.htm>

FHWA Geotechnical Software:

<http://www.fhwa.dot.gov/bridge/geosoft.htm>

US Army Corps of Engineers – Engineering Manuals

<http://www.usace.army.mil/inet/usace-docs/eng-manuals/em.htm>

Geotechnical Software Directory

<http://www.GGSD.com>

Software

1. A simple straightforward Geotechnical Software package by the name of GEOPRO 4.0 (by DataSurge, Bradford, MA). In most cases this software will be used for verification/check of hand calculations only. The software is up and running in the PC lab. You need to go in and select the specific application as the general icon is not active. This package is capable of carrying out a variety of analyses including those that are relevant to the class:
 - a. Stress distribution – Vertical stress below surface and lateral stress due to surcharge.
 - b. Settlement Analyses - consolidation, immediate settlement, time rate settlement
 - c. Foundation Design - bearing capacity
 - d. Retaining Structures - earth pressures, cantilever sheet pile wall (clay and sand), anchored sheet pile wall
2. LimitState geo version 2.0 by Limitstate Ltd., UK
3. DEEP2010, Deep Excavation Engineering Program
4. PLAXIS2012 – Geotechnical Finite Element Program

Final Grade

The approximate grade components are:

- | | |
|---|-----|
| 1. Attendance and guest lecture summaries | 10% |
| 2. Homework and computer exercises | 25% |
| 3. Project | 25% |
| 4. Final Exam | 40% |

Planned Schedule and Details of Class Conduct

1. Attached please find the outline of the planned schedule. The classes consist of regular, guest lectures, and online classes. Your **participation** in the events is mandatory and will be considered part of your grade.
2. The instructor, Prof. Paikowsky, will not be able to physically attend classes at the University starting with the September 30, 2013 class. Guest lecture and online lectures will be given as detailed below. The instructor plans to come back to the class of November 18, but it is possible that he will not attend classes to the end of the term.
3. Classes via GoToMeeting.com will require your live web attendance, meaning you will have to be connected to the web at the time of the lecture wherever you want to be at the time.
4. In the meeting following each of the **guest lectures**, you will be required to submit a short (1 to 2 page) typed summary, based on your notes during that lecture.
5. Each of the students will conduct an independent **project** according to the attached material. The final grade of the project will consider your performance during all of the required stages, i.e. preparation submittal, manuscript, review and presentation.
6. Mr. Seth Robertson will assist in collecting and distributing material. Details will be provided.
7. There will be a **final exam** currently planned for December 09, 2013.

<u>Class #</u>	<u>Date</u>	<u>Topic</u>	<u>Text</u>
1	Mon 9/09/13	• Introduction, Definitions, Classification, • Overview Geotechnical Engineering • Field and Lab Classification of Soils and Rocks	Chapts. 1 & 3
2	Mon 9/16/13	• Soil and Rock Identification • Site Exploration <u>at KI 309 from 4:30PM – 7:00PM</u>	
3	Mon 9/23/13	• Site Exploration (cont'd) • In-Situ Measurements and Laboratory Testing • Submittal of Project Title/ Description/ Extent	Chap. 3 Chap. 3
4	Mon 9/30/13	• Guest Lecture by the Hydrogeologists. David Adilman and Russ Abell of GeoSyntec Consultants: "Subsurface Explorations & the Geology of the New England Area" <u>at KI 309</u> • In-Situ Measurements and Laboratory Testing (Cont'd)	
5	Mon 10/07/13	• Limit Equilibrium and Limit Analysis Theories • Bearing Capacity of Shallow Foundations • Different Influencing Factors e.g.: Eccentric and Inclined Loading, Layered Soils, Slopes, Water. • B.C. Analysis - Examples	Chap. 4 Chap. 4
	Mon 10/14/13	NO CLASS (Columbus Day)	
6	Wed 10/16/10	Monday Class Schedule • B.C. Analysis – Reliability of the B.C. Analysis • Short & Long Term Settlement Analysis of Shallow Foundations	Chap. 5
7	Mon 10/21/13	• Short and Long Term Settlement Analysis of Shallow Foundations (cont'd.) • Reliability of Settlement Analysis • Submittal of Project Abstract, Headings and References	
8	Mon 10/28/13	• MIDTERM	
9	Mon 11/04/13	• Lateral Earth Pressure at rest, active, passive and following Compaction	Chap. 11
	Mon 11/11/13	NO CLASS (Veterans Day)	
10	Mon 11/18/13	• Retaining Structures Including Gravity Walls and Sheet Pile Walls	Chapts. 12&14
11	Mon 11/25/13	• Guest Lecture by Dimitrios Konstantakos, P.E. founder and developer of "Deep Excavations" "From Peck to Virtual Reality" Design of Sheet Pile Walls <u>CEE comp Lab FA 105</u> • PROJECT Due Date	Chap. 13
12	Mon 12/02/13	• Seismic Design of Footings and Walls • Load Resistance Factor Design (LRFD) of Shallow Foundations • Project Review is Due	
13	Mon 12/09/13	• Project Presentations • FINAL EXAM	

14.533 ADVANCED FOUNDATION ENGINEERING

Fall 2013

Term Project

As part of the Advanced Foundations Engineering class you are required to prepare and present a term project. The project may consist of one or more of the following: literature survey, computer program, case history, data analysis or laboratory study. Any topic relevant to Geotechnical or Geo-Environmental Engineering may be applicable.

The project will be submitted typed (double spaced) and will not exceed 20 pages including figures and references. All projects should contain an abstract, table of contents, statement of engineering significance and relevance, conclusions, and a list of references.

Work on the project will proceed according to the following **steps and time schedule:**

9/09 & 9/16	Choose a topic and discuss it's acceptability with the instructor.
9/23	Submit a title for your project with a short description of the subject and the intended extent of your work
10/21	Submit an abstract, headings for the subjects and a list of references.
11/25	Two copies of the completed term projects are due and are exchanged with other students for review.
12/02	Review submittal
12/09	Project presentations

The project grade will reflect the intermediate steps, the soundness of the study, the writing, and the presentation.

General Ideas for Possible Projects:

Computer Programs

1. Simulation of shallow foundation load test
2. Static capacity of shallow foundations
3. Sheet pile wall analysis (cantilever and/or anchored)
4. Interpretation of a shallow foundation load test
5. Beam on elastic foundations
6. Shallow foundation settlement analysis (immediate and/or time dependent)

Others:

1. Drainage problems; foundations or retaining structures.
2. Shear strength parameters including interface friction.
3. Dewatering and/or braced excavations.
4. Field instrumentation following the structure's performance.
5. Frost problems; foundations or retaining walls.
6. Mat foundations/ floating structures
7. Lateral resistance of shallow foundations.
8. In-situ testing/Interpretation methods.
9. Comparisons of load test interpretation methods
10. Mechanically stabilized Earth Walls.
11. Lightweight artificial and waste materials for embankments over soft soils.
12. LRFD of industrial or highway substructures.
13. Comparison between calculated to measured capacity or settlement of shallow foundation.
14. Bridge pier or abutment design.

Project Grading:

- Preparation / Timely submission of subject 15%
- Project 45%
- Presentation 25%
- Review 15%

Project Review

Each student will be assigned to review a project of another student. You are graded on the quality of the review, hence, praising a poor project or “killing” a good project have no merit. In reviewing a project, read the manuscript, make comments on the manuscript and then summarize your review considering the following:

1. Format and Appearance: Table of contents, Abstract, Body of Project, Summary and Conclusions, List of References. Check for numbering and headings, page numbering, appearance of text, titles of tables and figures, and extremely important referencing of all material not original in text, tables and figures.
2. Presentation: Clarity of writing and language, choice of subdivision of headings and sub-headings. Usefulness of graphs, figures, case histories, effectiveness and deficiencies.
3. Content: Comment about the subject engineering interest and merit. Coverage by the project. What is clear and what is not. What is missing and what is good. For that purpose, you wish to make constructive suggestions including spending some time reviewing the subject looking for references, etc., so you can suggest improvements based on your knowledge and findings.