



**14.528 DRILLED DEEP FOUNDATIONS**  
**Spring 2014**  
**Thursdays 6:00-9:00 PM Room Kitson 308**

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

**Textbook:** No official textbook is assigned, see reference texts. Additional material from different sources will be distributed as we progress.

**Reference Texts:**

1. FHWA NHI-10-016 - *Drilled Shafts: Construction Procedures and LRFD Design Methods* (Geotechnical Engineering Circular No. 10), May 2010
2. FHWA SA-97-070 - *Micropile Design and Construction Guidelines Implementation Manual*, June 2000
3. FHWA HIF-07-039 - *Design and Construction of Continuous Flight Auger (CFA) Piles* (Geotechnical Engineering Circular No. 8), April 2007
4. *Foundation Engineering Handbook*, edited by Hsai-Yang Fang, Van Nostrand, 2nd ed., 1991.
5. *Foundation Analysis and Design*, Bowles J.E., McGraw Hill, 5th ed., 1996.
6. *Piling Engineering*, Fleming W.G.K., Weltman A.J., Randolph M.F. and Elson W.E., Surrey Press, 1st ed., 1985, 2nd ed., 1992.
7. *Foundations and Earth Structures*, Naval Facilities Engineering Command (NAVFAC) Design Manual 7.02, September 1986.
8. *Proc. of the Congress Foundation Engineering: Current Principles and Practices*, Vols. 1&2, ASCE Conf. June 25-29, Evanston Illinois, 1989.
9. *Proc. Intl. Conference on Design and Construction of Deep Foundations*, Vols I, II, and III, FHWA, Orlando, Florida, Dec. 1994
10. *NCHRP Report 507 Load and Resistance Factor Design (LRFD) for Deep Foundations*, S.G. Paikowsky, with contributions by B. Birgisson, M. McVay, T. Nguyen, C. Kuo, G. Baecher, B. Ayyub, K. Stenerson, K. O'Malley, L. Chernauskas, and M. O'Neill, TRB 2004.  
[http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp\\_rpt\\_507.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_507.pdf)
11. Federal Highway Administration (FHWA) GT-15 *Geotechnical Differing Site Conditions*, April 1996
12. FHWA IF-02-034 - *Evaluation of Soil and Rock Properties* (Geotechnical Engineering Circular No. 5), April 2002
13. FHWA IF-99-025 *Drilled Shafts: Construction Procedures and Design Methods*, August 1999
14. FHWA NHI-01-031 - *Subsurface Investigations - Geotechnical Site Characterization Reference Manual*, May 2002
15. FHWA RD-75-128 - *Lateral Support Systems and Underpinning*, Volume 1, April 1976

16. FHWA RD-75-129 - *Lateral Support Systems and Underpinning*, Volume 2, April 1976
17. FHWA RD-75-130 - *Lateral Support Systems and Underpinning*, Volume 3, April 1976
18. US Army Corp of Engineers EM 1110-1-1804 - *Engineering and Design - Geotechnical Investigations*, Jan 2001
19. US Army Corp of Engineers EM 1110-1-1904 - *Engineering and Design - Settlement Analysis*, Sept 1990
20. US Army Corp of Engineers EM 1110-1-1905 - *Engineering and Design - Bearing Capacity of Soils*, Oct 1992

### **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>

NCHRP Report 507

[http://trb.org/publications/nchrp/nchrp\\_rpt\\_507.pdf](http://trb.org/publications/nchrp/nchrp_rpt_507.pdf)

### **Software**

GeoPro

UML (Data-Surge)

COM624P

Web FHWA (<http://www.fhwa.dot.gov/bridge/geosoft.htm>)

LPile & GROUP

Ensoft Corp.

STAPRO

UML

## **Class Structure and Planned Schedule**

1. Attached please find the outline of the planned schedule. The classes consist of regular lectures, online lectures and guest lectures. Your participation in the events is mandatory and will be considered part of your grade.
2. In the meeting following the guest lectures, you will be required to submit a short (1 to 2 page) typed summary, based on your notes during that lecture and possible handouts.
3. Each of the students will conduct an independent project according to the attached material. A project presentation of about 10 minutes will be conducted on 4/24/2014. The final grade of the project will consider your performance during all of the required stages (see breakdown of project grade under Term Project handout).
4. One field trip is planned to take place during the term. The field trip will be during regular business day hours and will be coordinated with the class two weeks in advance, depending on the site, the project and advance schedule.
5. Online classes will be administrated via GoToMeeting.com. The students will receive email notification and invitation and will require to be present along the meeting. Relevant material will either be distributed in advance or available online.

## **Final Grade**

The approximate grade components are:

- |   |     |
|---|-----|
| 1. Attendance and guest lecture summaries | 10% |
| 2. Homework and computer exercises        | 20% |
| 3. Project                                | 25% |
| 4. Midterm Exam (Expanded Format)         | 30% |
| 5. Final Exam (Limited Format)            | 15% |



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<u>Class #</u>	<u>Date</u>	<u>Topic</u>	<u>Comments</u>
1	1/23/2014	<ul style="list-style-type: none"> <li>• Introduction to Deep Foundations, Historical Perspective, Usage, Definitions, Classifications, General Principles; Overview of economics of foundations, design and construction</li> </ul>	HW #1
2	1/30/2014	<ul style="list-style-type: none"> <li>• Geotechnical exploration and determination of soil and rock engineering properties</li> </ul>	online class HW #2
3	2/6/2014	<ul style="list-style-type: none"> <li>• Drilled shafts design and construction methods</li> <li>• <b>Project submittal no. 1: title and description</b></li> </ul>	HW #3
4	2/13/2014	<ul style="list-style-type: none"> <li>• Guest lecture – John Roma, P.E., Underpinning &amp; Foundations Skanska, NE Area Manager, <i>"Evolution of Drilled Shaft Construction and Techniques in the Northeast"</i></li> </ul>	
5	2/20/2014	<ul style="list-style-type: none"> <li>• Drilled shafts design and construction methods (cont'd)</li> <li>• Micropiles design and construction methods</li> <li>• <b>Project submittal no. 2: abstract, headings, list of references</b></li> </ul>	HW #4
6	2/27/2014	<ul style="list-style-type: none"> <li>• Guest Lecture – Dick Pizzi, P.E., Geotechnical Consultants Inc., Marlborough, MA, <i>"Micropiles Design and Construction – Boston's African Meeting House Project"</i></li> <li>• LRFD design of Deep Foundations</li> </ul>	
7	3/6/2014	<ul style="list-style-type: none"> <li>• Auger cast-in-place (ACIP) piles design and construction methods</li> </ul>	HW#5

8	3/13/2014	<ul style="list-style-type: none"> <li>• Lateral resistance of deep foundations</li> <li>• Load-deflection of laterally loaded piles</li> <li>• Midterm Exam Review</li> </ul>	HW #6
	3/20/2014	No Class – Spring Break	
9	3/27/2014	<ul style="list-style-type: none"> <li>• Midterm – Expanded Format</li> </ul>	
10	4/3/2014	<ul style="list-style-type: none"> <li>• Axial capacity determination using field tests - static, STATNOMIC, and drop weight dynamic load testing</li> </ul>	HW #7
11	4/10/2014	<ul style="list-style-type: none"> <li>• Integrity testing</li> <li>• Quality control and quality assurance</li> <li>• <b>Project submittal: Final Paper 2 copies</b></li> </ul>	HW #8
12	4/17/2014	<ul style="list-style-type: none"> <li>• Guest Lecture – Tony Kiefer, P.E., Principal AECOM, <i>“Slurry Caisson Problems and Correction in Chicago”</i></li> <li>• <b>Project review submittal</b></li> </ul>	
13	4/24/2014	<ul style="list-style-type: none"> <li>• <b>Student Seminars</b></li> </ul>	
14	5/1/2014	<ul style="list-style-type: none"> <li>• Final Exam</li> </ul>	

## **14.528 DRILLED DEEP FOUNDATIONS Spring 2014**

### **Term Project**

As part of the Drilled Deep Foundations class you are required to prepare, submit 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.

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. Attached please find a guide to technical writing. Please follow its instructions. It will be worthwhile for you to review it.

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

1/23 & 1/30/2014	Choose a topic and discuss its acceptability with the instructor.
2/6/2014	Submit a title for your project with a short description of the subject and the intended extent of your work.
2/20/2014	Submit a rough abstract, headings for the subjects and a list of references.
4/10/2014	Completed term projects are due. Each student will be assigned someone else's project for review. Please provide two copies of your project.
4/17/2014	Typed, one page discussion with marked comments of the reviewed projects are due.
4/24/2014	Project presentation.

### **General Ideas for Possible Projects:**

1. Dynamic analysis of piles using the one-dimensional wave equation
2. Mitro/Mini pile construction
3. Settlement analysis of single piles
4. Settlement analysis of a pile group
5. Load test procedures
6. Interpretation of pile load tests
7. Dynamic measurements for drilled foundations
8. Bearing capacity of piles in sand and/or clay
9. Negative skin friction and downdrag
10. Rock socketed shafts
11. Specific pile types, CFA, etc.
12. Single shaft and/or a shaft group subjected to lateral load

13. Shafts under vertical and/or horizontal dynamic loading
14. The plugging phenomenon in pipe piles
15. The application of LRFD to drilled shafts
16. Pile integrity testing
17. Drilled Shafts projects (Seismic Design, Group analysis, Innovative Testing)
18. New pile testing methods (e.g. Statnatics, Osterberg cell, Drop Weight, Smart Pile/Coil).
19. Capacity of rock sockets.
20. Construction methods of drilled shafts.
21. FEM of pile group response (to lateral, vertical loading, etc.).

### **Project Grading:**

- Preparation / Timely submission of subject 15%
- Project Manuscript 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.



## **PREPARING YOUR PRESENTATION:**

When you organize your presentation, it may be helpful to begin by considering the following:

- 1. What is the topic of my presentation?**  
Of course, you know this, but be sure your audience is fully aware of your goals.
- 2. Who is my audience?**  
How would you like the information presented if you were a member of the audience.
- 3. What is the objective of my presentation?**  
Choose main points and elaborate on them.

Once you have answered these questions, you may then begin to outline your presentation. A speech may be divided into three parts:

### **1. Introduction/Opening**

- State your goal or ideas in general terms.
- Share a relevant story, anecdote, or quote.
- Startle them with a statistic.
- Use a metaphor or comparison to your topic.
- Use humor very carefully; it can be powerful and engaging, but jokes, as a particular form of humor are risky and difficult to use successfully.
- Any one or a combination of these introductory methods may be used in your opening to draw your audience into the presentation.

### **2. Body**

- Discuss your main idea(s) in detail.
- Use supporting examples
- Use visual aids to reinforce.
- Reiterate your points.
- Develop a theme.

### **3. Closing**

- Summarize your main points.
- Restate your goal, in a memorable way.
- Explain the value of your discussion.
- Reiterate the plan of action or any future plans.
- Return to the opening theme or story.
- Share another relevant story, anecdote, or quote.

## **GUIDELINES FOR PREPARING YOUR VISUAL AIDS:**

Once you have prepared your presentation, you may then decide to incorporate visual aids. Remember, "A picture is worth a thousand words." A Harvard University study reveals that individuals comprehend about 7% of information they obtain verbally. They comprehend 87% when information is delivered both verbally and visually.

- There are many different types of visual aids available to you including 35mm slides, videos, computer driven, or exhibits\*.
- No matter what types of visual aids you choose, remember the acronym KISS (Keep it Short & Simple) and the old saying “Less is More”.
- Choose your visual aids carefully and make each one count.
- Determine if the information really needs visual representation – will it really help to explain your point? Too much information may overwhelm an audience.
- It is also important to prepare your visual aids so that everyone in the audience will be able to see the information. There is nothing worse than telling an audience, “Those in the back of the room won’t be able to see some of the information on this slide, so I’ll explain...”

### **Slides...**

- Use only one (1) idea per slide.
- Keep it bold, simple, uncluttered and colorful.
- With color copy, never use black type on a dark-colored background or whit letters on a light colored background.
- Use large, (18+ point size) simple block letters; the best type font is a bold sans serif (e.g. Arial).
- Use upper and lower case letters.
- Use only vertical, not slanted (italic) letters
- For graphs and charts, use heavy lines for curves and use a minimum of lightweight grid lines. No more than two curves or bars on a graph.
- Space between lines should equal the height of the letters.
- Use only horizontal lettering unless absolutely necessary (such as on graphs); other lettering is difficult for the audience to read, especially at longer distances.

If you choose to use **slides** you may want to note the following suggestions:

- The life expectancy of an average slide is 30sec or fewer.
- Begin and end the presentation with a thematic logo slide.
- IF you anticipate the need to stop for discussion during the slide presentation, insert a black slide so that you won’t have a slide up that has outlived the interaction.
- If you refer to a particular slide twice during your presentation, make two copies of the slide and place them in the appropriate sequence, this will allow your presentation to flow smoothly.
- Check and double-check your carousel.
- The speaker preparation room will be available for your use during the conference.

### **Video...**

- Video can be used effectively to show examples.
- Show only top quality tapes, never those that have been copied over and over.
- Review your tape ahead of time, make sure the video and sound quality are good from the beginning to end.

### **Computer-driven...**

- The technology now exists that will allow presentations to be driven from a notebook computer; the same rules of thumb for slides (e.g. type face, color, size, etc.) apply for computer-driven presentations.
- Computer-based presentations increase the capabilities of the presenter; however, a speaker does not want to be upstaged by his/her visual aides.

### **The Final Step:**

- Practice, Practice, Practice!
- The presentation should be well rehearsed, as papers should not be read, but rather a presentation prepared.
- As you practice, be extra conscious of such things as elocution and time constraints.
- If you have practiced your presentation and are comfortable with your material and visual aids, then you will be a more relaxed, effective speaker.

**BEST OF LUCK ON YOUR PRESENTATION!**