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of
WISCONSIN
MADISON

COLLEGE OF ENGINEERING
DEPARTMENT OF
ENGINEERING PROFESSIONAL
DEVELOPMENT



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Or visit our Web site

Wind Turbine Foundation and Tower System Design

A practice-oriented, design course describing and analyzing wind turbine foundation and tower systems

- Tower manufacture, design and transportation logistics
- Turbine foundation design criteria and load documents
- Wind power site geotechnical investigation and reporting
- Step-by-step design examples
- Tensionless pier, ground anchor, and micropile design
- Foundation and tower construction case studies

February 22–23, 2011
Santa Clara, California

Wind Turbine Foundation and Tower System Design

February 22–23, 2011, Santa Clara, California

Why You Should Attend (Four Key Reasons)

In this course, you will learn about the critical factors of wind power plant foundation/tower evaluation, design and logistics from a diverse, highly experienced, and expert course faculty. By attending this course, you will:

- Develop design know-how in this rapidly developing area
- Gain an in-depth understanding of the mechanics and principles of structural tower loads on foundations
- Become a valuable, contributing member of your company's design team
- Gain a working knowledge of the design of shallow through deep foundation systems for wind turbines, including ground improvement

Who Should Attend

- Utility Engineers and Managers
- EPC Contractors
- Geotechnical and Geological Engineers
- Electrical Engineers
- Structural Engineers
- Soil Investigation Contractors
- Material Suppliers and Vendors
- Developers
- Principal Engineers
- Engineering Consultants
- Regulators/Inspectors
- Academicians
- State and Federal Officials

You'll benefit from interactive learning that maximizes group discussions and in-course networking. **Enroll early, previous Wind Energy courses have filled.**

Your Instructors

Josef Karl Alter, BS, MEPP, is an engineering manager with Con Tech Systems Ltd. He has more than 33 years of heavy civil engineering construction experiences and is actively involved in the design of alternative deep foundation systems for wind turbines.

Bo Rohde Jensen, MSc, ME, is a Senior Specialist with Vestas Technology R&D in Århus, Denmark. Mr. Jensen is a structural engineer and has been working within technology research and development for wind turbines for more than 10 years. Mr. Jensen specializes in structural system design and integration of new technology. He is currently heading a new team focused on demonstration and maturing of emerging technologies as well being responsible for research in tower and foundation technology on/offshore.

Mohamed Nofal, PE, is a Senior Civil Design Engineer with Renewable Energy Systems Americas Inc. in Broomfield, Colorado. Mr. Nofal is a licensed civil engineer with a BS degree in civil engineering and an M. Eng. degree in geotechnical engineering from the University of Louisville and an MS degree in environmental engineering from the University of Tennessee-Knoxville. For the past five years, he has worked on the design and layout of wind farm projects across the United States.

Shelton Stringer, PE, is President of Earth Systems Global, Inc., an international geotechnical consulting and civil design company focusing on renewable energy in the United States, Canada, and China. Mr. Stringer is a licensed geotechnical engineer, professional geologist, and engineering geologist in the state of California and professional civil engineer licensed in many states. He has 25 years of professional practice. Mr. Stringer has a specialty practice in the design of several thousand wind turbine foundations over the last 10 years. He also excels in seismic hazard evaluations and has developed spreadsheet programs for geotechnical, foundation, site-specific seismic ground motion, cone penetrometer (CPT) applications, and liquefaction hazard analyses.

James Tinjum, PhD, PE, is an Assistant Professor and Program Director with the Department of Engineering Professional Development at the University of Wisconsin-Madison, where he is responsible for programming continuing education short courses in geotechnical and foundation engineering. Prior to joining academia, he worked for six years with CH2M HILL in Denver and Philadelphia and for five years with RMT in Madison.

Earn Continuing Education Credit

By participating in this course, you will earn 15 Professional Development Hours (PDH), 1.5 Continuing Education Units (CEU), or 15 AIA Learning Units (LU) (if applicable). Our courses meet the requirements for Engineering Professional Development Hours (PDH) in all states.

A Sampling of Companies Whose Employees Have Recently Benefited From This Course

Aero Solutions LLC
Bay Shore Systems, Inc.
Bechtel Corporation
Blattner Energy
Capital Power Corporation
Conagra Foods
CTL/Thompson, Inc.
Flodesign Wind Turbine
GDF Suez North America
HDR Engineering, Inc.
Kleinschmidt Associates
McKinney Drilling Company
Paul J Ford & Company
Tradewinds Steel Group, Inc.
Ulteig Engineers
Valmont Newmark Inc.
Vestas Wind Systems
Western Technologies, Inc.
W-T Civil Engineering, LLC

Course Outline inside...

Wind Turbine Foundation and Tower System Design

February 22–23, 2011 in Santa Clara, California

Course Outline

Note: The course outline and schedule are somewhat flexible and will be adjusted to best fit the needs of the participants. You will be asked for your specific interests, needs, and questions. We will do our very best to tailor our presentations to address all your concerns.

Course Topics

Tuesday, February 22

8:00 Introduction and Perspective

- CARD: Clean, Abundant, Renewable, Domestic
- Status of foundation/tower design approaches and standards in the U.S.

Professor James M. Tinjum, PE, Program Director
University of Wisconsin–Madison

8:25 Tower/Turbine Structural Load Documents and Forces

- Wind turbine basics
- Tower design loads
- Codes and regulations
- Example of wind turbine and load document

Bo Rohde Jensen, MSc, ME, Senior Specialist
Vestas Technology, Århus, Denmark

9:40 Morning Break and Discussions

10:00 Geotechnical Design Considerations for Turbine Foundations, Access Roads, and Collector Systems

- Moduli and soil properties pertinent to wind energy sites
- Thermal resistivity basics, measurements, and applications
- Implications of soil conditions to collector system design
- Electrical resistivity measurements and grounding
- Foundation effective area
- Modulus reduction factors

Professor James M. Tinjum, PE

11:15 The Geotechnical Report for Wind Energy Site Design

- Scoping the field investigation and laboratory testing program
- Geophysical techniques and standard investigation methods
- Components of a complete geotechnical report
- Introduction of geotechnical data for course calculations

Professor James M. Tinjum, PE

12:00 Lunch

1:00 Shallow Turbine Foundation Design Considerations

- Shallow turbine gravity foundation design criteria '101'
- Introduction to the octagonal gravity foundation
 - why chosen?
 - role of the octagonal base
 - typical dimensions

Mohamed Nofal, PE, Senior Civil Design Engineer
Renewable Energy Systems Americas Inc.,
Broomfield, CO

1:30 Reinforced Concrete Design for Turbine Foundations

- Turbine foundation concrete design
- Tower flange bolting
- Embedment plates
- Grout selection and bolt tensioning

Mohamed Nofal, PE

2:00 Gravity Foundation Design

- Foundation stiffness
- Bearing capacity
- Overturning
- Embedment effects
- Sliding

Mohamed Nofal, PE

2:45 Afternoon Break

3:10 Reinforced Concrete Gravity Design Calculations

- Example calculations based on hypothetical load document and geotechnical report
- Concrete and foundation design, step-by-step

Mohamed Nofal, PE

4:10 Tower Systems

- Tower types and selection
- Manufacturing
- Tower internals
- Transportation logistics
- Turbine and tower erection

Bo Rohde Jensen, MSc, ME

Wednesday, February 23

7:50 Announcements

8:00 Wind Turbine Tower Design

- Tower system design
- Design criteria and methods according to DIN 18800
- Tower design example, step-by-step

Bo Rohde Jensen, MSc, ME

9:30 Morning Break and Discussion

9:50 Deep Turbine Foundation Options for Wind Turbines (Part 1)

- Options: Caissons, driven piles, auger cast piles, rammed aggregate piers, specialty foundation systems
- Feasibility assessment
- Design, analysis, and construction methods

Josef Alter, MEPP, Engineering Manager

Con Tech Systems Ltd., Descano, CA

10:50 Stretch Break

11:00 Introduction to Deep Turbine Foundations (Part 2)

- Micropile behavior and analysis
- Ground anchor testing procedures and guidelines
 - groutable void form concept and applications to wind turbine foundations
 - micropile deep foundation design calculation based on hypothetical site conditions and load conditions

Josef Alter, MEPP

12:00 Lunch



1:00 The P&H Tensionless Pier and Anchor Foundations

- Introduction to the P&H pier and anchor-type foundations
- Site conditions warranting consideration of the P&H options
- Lateral capacity, rotational stiffness, capacity, and design procedures
- Structural analysis design calculation example

Shelton Stringer, PE, Vice President

Earth Systems Global Inc., Bermuda Dunes, CA

2:15 Afternoon Break and Discussions

2:40 Deep Foundation Design and Construction Case Studies

- The Patrick and Henderson Tensionless Pier
 - Snyder, TX Vestas V90 on 105m tower
 - Rock site, Wildhorse, WA

Shelton Stringer, PE

3:40 Stretch Break

3:50 Shallow Foundation Design and Construction Case Studies

- Ground improvement sites
- Shallow foundation examples
- Joint RES/NREL research project: Main parameters affecting the design of wind turbine foundations

Mohamed Nofal, PE

4:45 Closing: Industry News and Discussion

- State of practice
- Final question-and-answer session
- Course evaluations

Daily Schedule

Registration will be at 7:30 a.m. on the first day at the course location. Class will begin at 8:00 a.m. on the first day and 7:50 a.m. on the second and continue until 5:15 p.m. on the first day, with final adjournment at 5:00 p.m. on the final day of the course. The daily schedule will include refreshments prior to the start of the course, morning and afternoon breaks, and lunch served at noon. There will be plenty of scheduled time for question-and-answer sessions and for breaks.

Four Easy Ways to Enroll

**Internet:**

<http://epd.engr.wisc.edu/webL771>

**Phone:**

800-462-0876 or
608-262-1299 (TDD 265-2370)

**Mail to:**

Engineering Registration
The Pyle Center, Dept. 107
702 Langdon Street
Madison, Wisconsin 53706

**Fax:**

800-442-4214 or
608-265-3448

**ENROLL ONLINE
TODAY!**

Course Information

- Please enroll me in **Wind Turbine Foundation and Tower System Design Course #L771** February 22–23, 2011 in Santa Clara, California Fee: \$1195
Team Discount: \$1045 each when two or more enroll from the same organization.
- I cannot attend at this time. Please send me brochures on future courses.

Limited Enrollment

Personal Information (Please print clearly.)

Name _____

Title _____

Company _____

Address _____

City/State/Zip _____

Phone (____) _____ Fax (____) _____

E-mail _____

Additional Enrollees

Name _____

Title _____

E-mail _____

Name _____

Title _____

E-mail _____

Billing Information

Bill my company P.O. or check enclosed (Payable in U.S. funds to UW – Madison)

  

Cardholder's Name _____

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UW#
From mailer panel.

Please check the box if you are a person with a disability and desire special accommodations. A customer service representative will contact you. Requests will be kept confidential.

"GREAT OVERVIEW OF TOWER SYSTEMS AND HOW IT AFFECTS FOUNDATION DESIGN. SOME REAL INNOVATIVE METHODS USED IN THESE SYSTEMS THAT MAY HAVE OTHER APPLICATIONS."

"I WILL BE REPROGRAMMING OUR DESIGN SOFTWARE BASED ON THIS SEMINAR."

Related Courses

For information on the following courses please call 800-462-0876, e-mail custserv@epd.engr.wisc.edu, or visit <http://epd.engr.wisc.edu>

Wind Energy Resource Assessment and Project Planning
December 7–9, 2010
Madison, WI
Course #L886

Foundation Engineering and Design
January 31–February 2, 2011
Madison, WI
Course #L700

Wind Energy Electrical Balance-of-Plant Design
May 18–20, 2011
Orange County, CA
Course #L889

Contact Us

Call toll free 800-462-0876 and ask for

Program Director:

James M. Tinjum
tinjum@epd.engr.wisc.edu

Program Associate:

Theresa Rodger
rodger@epd.engr.wisc.edu

General Information

Fee Covers

Two days of instruction, comprehensive course notes (please leave room in your luggage for a 2" course notebook), references for further study, continental breakfasts, break refreshments, lunches, and a University of Wisconsin Certificate of Participation recognizing achievement (15 PDH). Fee does not include lodging or other meals.

Enrollment and Confirmation

We recommend enrollment in advance by fax, phone, online, or mail. Be certain you receive our enrollment confirmation before the course or call 608-262-1299.

Cancellation

If you cannot attend, please notify us by February 15, and we will refund your fee. Cancellations received after this date and no-shows are subject to a \$150 administrative fee. You may enroll a substitute at any time before the course starts.

Location and Accommodations

The course will be held at University of California Extension, 2505 Augustine Drive, Santa Clara, California. We have reserved a block of sleeping rooms for course participants at the Embassy Suites Santa Clara, 2885 Lakeside Drive, Santa Clara, California. To reserve a room, call 408-845-7231 and indicate that you will be attending this course under group code UOW. Room requests made later than January 19 will be subject to availability.

**Act Now,
Limited Enrollment!**

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