

Geotechnical Aspects of Earthquake Engineering: Practical Applications

**St. Louis, Missouri
August 21-22, 2008**

Agenda

Day 1

- Registration – Continental Breakfast** **7:30 – 8:00**
- 1. Introductions and Objective** **8:00 - 8:30**
- Registration
 - Introduction: Dr. Ronaldo Luna, Gustavo Ordonez
 - Course Participant Introductions
 - Philosophy – Objectives – Limitations
 - Overview of Site Specific Seismic Hazard Analysis
- 2. Earthquakes** **8:30 - 10:00 (Ronaldo)**
- Causes, Distribution and Stress Waves Generated by Earthquakes
 - Definitions (fault types, distance, magnitude, PGA)
 - Earthquake Magnitude and Intensity
 - Characterization of the Seismic Environment
 - Maximum Credible Earthquake, Design Earthquake, Maximum Considered Earthquake
 - Sources – Zones
 - Estimating Rock Motions for Design Purposes
 - Amount of Energy Release
 - Attenuation Relations: Development, PGA
- Break** **10:00 - 10:15**
- 3. Ground Response Analysis – Overview** **10:15 - 11:00 (Ronaldo)**
- Seismic Hazard Analysis
 - Deterministic SHA
 - Identification and Characterization of Sources
 - Selection of Source-Distance Parameter
 - Selection of Controlling Earthquake
 - Definition of Hazard Using Controlling Earthquake
 - Development of Ground Motion Histories
 - Site Response Analysis

4. Site Response – Approximate Analyses **11:00 - 12:00 (Gus)**

- Site Specific Response Analysis using 1-D Equivalent-Linear Analysis
- SHAKE & SHAKE2000 Software
- Validation Studies, Recommendation

Lunch **12:00 - 1:00**

5. Ground Motions During Earthquakes **1:00 - 2:00 (Ronaldo)**

- Ground Motions and Response Spectra
- Influence of Soil Conditions on Ground Motion and Response Spectra
- Methods for Predicting the Influence of Soil Conditions on Level Ground Response
- Building Codes (IBC and NEHRP)
- Attenuation Relations
 - PGA, Spectral Acceleration
 - Free Field, Base Rock, Outcrop
 - Development

6. Site Specific Response - SHAKE2000 Hands-on Training **2:00 - 3:00 (Gus)**

- Site Specific Response Analysis with SHAKE
 - Problem Definition
 - Selection of Input Ground Motions

Break **3:00 - 3:15**

Site Specific Response - SHAKE2000 Hands-on Training (cont) **3:15 - 4:45 (Gus)**

- Dynamic Soil Properties
- Soil Column
- Assignment of Input Motion

Questions/Answers **4:45 - 5:00**

Day 2

Continental Breakfast **7:30 – 8:00**

7. Regional Seismicity of CEUS **8:00 - 9:00 (Ronaldo)**

- Principal Source Zones
- East vs. West
- Attenuation Relations applicable to CEUS
- Acceleration Time Histories appropriate to CEUS

8. Determination of Soil Properties for Ground Response Analysis **9:00 - 10:00 (Ronaldo)**

- Site Characterization

- Soil Profile
- Soil Parameters for Analysis
- Introduction to Soil Properties and Test Procedures
- Field Wave Velocity Measurements
- Laboratory Tests
 - Forced Vibration Tests
 - Free Vibration Tests
 - Repeated Cyclic Loading Tests
- Dynamic Soil Properties for analyses

Break

10:00 - 10:15

9. Site Specific Response - SHAKE2000 Hands-on Training (cont.)

10:15 - 12:00 (Gus)

- Site Specific Response Analysis with SHAKE
 - Acceleration & Shear Stress Time Histories
 - Response Spectrum
 - Multiple Analyses

Lunch

12:00 - 1:00

10. Liquefaction

1:00 - 2:30 (Ronaldo)

- Phenomenological Explanation
- Laboratory Investigation of Soil Liquefaction
 - Representation of Stress Conditions During an Earthquake in the Laboratory to Evaluate Liquefaction
 - Typical Test Results for Loose and Dense Sands
 - Major Factors Influencing Liquefaction
 - Minor Factors Influencing Liquefaction
- Analysis of Soil Liquefaction
 - Historical Development
 - General Procedure
 - Simplified Procedure for Evaluating Soil Liquefaction Potential
- Liquefaction Hazard Assessment
 - Use of Field Data to Evaluate Soil Liquefaction
 - Mitigation of Liquefaction Hazard

Break

2:30 - 2:45

11. Liquefaction & Displacement - SHAKE2000 Hands-on Training

2:45 - 4:45 (Gus)

- Liquefaction Analysis
- Newmark Displacement Analysis

Closure

4:45 - 5:00

- Questions/Answers
- Evaluation

Introduction to Nonlinear and Effective-Stress Site Response Analyses

St. Louis, Missouri
August 23, 2008

Agenda

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|--|------------------------------|
| Registration – Continental Breakfast | 7:30 – 8:00 |
| 1. Introduction and Objectives | 8:00 – 8:30 |
| <ul style="list-style-type: none">• Introduction: Dr. Neven Matasovic,• Course Participants Introductions• Course Philosophy – Objectives – Limitations | |
| 2. Role of Advanced Analyses in Geotechnical Earthquake Engineering | 8:30 - 10:00 (Neven) |
| <ul style="list-style-type: none">• Basic Definitions – A Refresher• Why and when is Nonlinear Analysis needed?• Why and when is Effective-Stress Analysis needed?• What are the limitations of 1-D Nonlinear (and Effective-Stress) Models?• When are 2-D and 3-D analyses required?• When Soil-Structure Interaction Effects should not be ignored?• Discussion and Recapitulation | |
| Break | 10:00 - 10:15 |
| 3. Nonlinear and Effective-Stress Analysis – Theoretical Background | 10:00 - 12:00 (Neven) |
| <ul style="list-style-type: none">• Total-Stress Analysis<ul style="list-style-type: none">○ Dynamic Response Model○ Viscous Damping Model○ Stress-Strain Model○ Irregular Stress-Strain Behavior Rules• Pore Water Pressure (PWP) Generation Models (Sand and Clay)• Degradation Models (Sand and Clay)• Redistribution Model for PWP (Sand) and Degradation Index (Clay)• PWP Dissipation Model (Sand, Clay, and Composite Soil Deposits) | |
| Lunch | 12:00 - 1:00 |
| 4. Hands-On Modeling | 1:00 - 2:00 (Neven) |
| <ul style="list-style-type: none">• Layer Thickness, Transmitting versus Rigid Boundary | |

- Evaluation of the Rayleigh Damping Model Parameters
- Use of Generic Material (Model) Parameters
- Generation of Input Parameters from Published Data
- Generation of Input Parameters from Laboratory Testing Results
- Interpretation of the Results
- “Independent” Validation of D-MOD2000

5. Example Problems

2:00 -2:30 (Neven)

- Total-Stress Analysis (Comparison with SHAKE2000)
- Effective-Stress Analysis (Soil Liquefaction Case History)
- Composite Soil Deposit with PWP Dissipation in Sand and Clay

Break

2:30 - 2:45

6. D-MOD2000 Hands-on Training

2:45 - 4:45 (Gus)

- Program Installation
- Site Response Analysis with D-MOD2000
 - Problem Definition
 - Selection (download) of Input Ground Motions
 - Dynamic Soil Properties
 - Soil Column
 - Assignment of Input Motion
- Site Specific Response Analysis with D-MOD2000
 - Acceleration and Shear Stress Time Histories
 - Tracing of Stress-Strain Time History
 - PWP Time Histories
 - Response Spectra
- Processing of Output Data from D-MOD2000

Closure

4:45 - 5:00

- Questions/Answers
- Evaluation