GeoMotions, LLC

training@geomotions.com
http://www.geomotions.com

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

training@geomotions.com
http://www.geomotions.com

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

GeoMotions, LLC

training@geomotions.com
http://www.geomotions.com

Introduction to Nonlinear and Effective-Stress Site Response Analyses

St. Louis, Missouri
August 23, 2008

Agenda

Registration – Continental Breakfast **7:30 – 8:00**

1. Introduction and Objectives **8:00 – 8:30**
- 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)**
- 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)**
- Total-Stress Analysis
  - 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)**
- 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