Geotechnical Aspects of Earthquake Engineering
San Jose, CA
February 20-22, 2007
Schedule

Day 1

1. Introductions and Objective **8:00 - 8:30 (Ted)**

- Registration
- Personnel Introduction: Ted S. Vinson (Ted); Gustavo Ordonez (Gus)
- Course Participant Introductions
- Philosophy – Objectives – Limitations
- Overview of Site Specific Seismic Hazard Analysis

2. Earthquakes **8:30 - 10:00 (Ted)**

- 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 Motions During Earthquakes **10:15 - 12:00 (Ted)**

- 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, NEHRP)
- Attenuation Relations
    - PGA, Spectral Acceleration
    - Free Field, Base Rock, Outcrop
    - Development

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

4. Ground Response Analysis – Overview **1:00 - 2:00 (Ted)**

- 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

5. Software - SHAKE2000 Hands-on Training **2:00 - 3:00 (Gus)**

- SHAKE & SHAKE2000 Features
  - SHAKE Options
  - Validation Studies, Recommendations.
  - Program Installation & Registration

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

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

- Site Specific Response Analysis with SHAKE
  - Problem Definition
  - Selection of Input Ground Motions
  - Dynamic Soil Properties
  - Soil Column
  - Assignment of Input Motion

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

Day 2

7. Site Characterization **8:00 - 8:30 (Ted)**

- Soil Profile
- Soil Parameters for Analyses

8. Determination of Soil Properties for Ground Response Analysis **8:30 - 10:00 (Ted)**

- 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. Influence of Base Rock Characteristics on Ground Response **10: 15 - 11:00 (Ted)**

- Homogeneous Rock Formations with Different Stiffness Characteristics
- Influence of Intermediate Rock Layers
- Influence of Sloping Rock Boundaries

10. Liquefaction **11:00 - 12:00 (Ted)**

- 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

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

11. Site Specific Response - SHAKE2000 Hands-on Training (cont.) **1:00 - 3:00 (Gus)**

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

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

- Processing of Output Data from SHAKE **3: 15 - 4:45 (Gus)**
- Sequential SHAKE Analyses

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

Day 3

12. Evaluation of Liquefaction Potential **8:00 - 9:00 (Ted)**

- 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 **10:00 - 10: 15**

13. Seismic Slope Stability **10: 15 - 12:00 (Ted)**

- Analysis Procedures
  - Pseudostatic
  - Deformation
- Peak Acceleration, Yield Acceleration
- Shear Strength for Pseudostatic Analysis
- Post-earthquake Slope Stability Analysis

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

14. Liquefaction and Settlement - SHAKE2000 Hands-on Training **1:00 - 3:00 (Gus)**

- Liquefaction Evaluation Potential - SPT
- Liquefaction Evaluation Potential - CPT
- Settlement Analysis
- Liquefaction-Induced Lateral Displacement

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

15. Displacement Analysis - SHAKE2000 Hands-on Training **3:15 - 4:45 (Gus)**

- Newmark Method of Displacement Analysis
- Makdisi-Seed Simplified Method of Displacement Analysis

16. Closure **4:45 - 5:00**

- Questions/Answers
- PHDs

Nonlinear Effective-Stress Site Response Analysis
San Jose, CA
February 23, 2007
Schedule

1. Introductions and Objective **8:00 - 8:30 (Ted)**

- Registration
- Personnel Introduction: Neven Matasovic (Neven); Gustavo Ordonez (Gus)
- Course Participant Introductions
- Philosophy – Objectives – Limitations

2. Role of Advanced Analyses in Geotechnical Earthquake Engineering **8:30 - 10:00 (Neven)**

- Why and When is Nonlinear Analysis Needed?
- Why and When is Effective Stress Analysis Needed?
- When to use the Nonlinear and Effective Stress Analyses, When are 2-D and 3-D Analyses Required, and When Soil-Structure Interaction Effects Should Not be Ignored

Break **10:00 - 10:15**

3. Nonlinear and Effective Stress Analyses **10:15 - 12:00 (Neven)**

- Theoretical Background
- Modeling
  - Layer Thickness, Transmitting versus Rigid Boundary
  - Evaluation of Rayleigh (Viscous Damping) Parameters
  - Porewater Pressure and Cyclic Degradation of Clay Models
  - Use of Generic Input Parameters
  - Generation of Input Parameters from Published Data and And Laboratory Testing
- Interpretation of Results
  - Calculation of Soil Liquefaction
  - Calculation of Seismically-Induced Settlement
  - Quasi 2-D Effects and Slip Elements
- Validation of D-MOD2000
  - Response to Sinusoidal Loading and Handling of Reversals
  - Case Histories
  - Comparison with Other Programs

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

4. Nonlinear Analysis - D-MOD2000 Hands-on Training **1:00 - 3:00 (Gus)**

- Program Download and Installation
- Site Specific Response Analysis with D-MOD2000
  - Problem Definition
  - Selection of Input Ground Motions
  - Dynamic Soil Properties
  - Soil Column

- Assignment of Input Motion

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

5. Nonlinear Analysis - D-MOD2000 Hands-on Training (cont.) **3:15 - 4:45 (Gus)**

- Site Specific Response Analysis with D-MOD2000
  - Acceleration & Shear Stress Time Histories
  - Porewater Pressure and Degradation Index Time Histories
  - Response Spectrum
- Processing of Output Data from D-MOD2000

6. Closure **4:45 - 5:00**

- Questions/Answers
- PHDs