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2010 - Fifth International Conference on Recent  
Advances in Geotechnical Earthquake  
Engineering and Soil Dynamics

24 May 2010, 8:00 am - 6:00 pm

## Soil Dynamics Short Course

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# Soil Dynamics Short Course

## Instructors

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## Schedule

### Monday, May 24, 2010

#### **8:00 AM – 10AM – SOIL DYNAMICS AND MODELING (Prakash)**

Problems of dynamic loading of soils, seismic loading, other sources of dynamic load, ground motion associated with earthquakes, effects of earthquakes on structures; damage during earthquakes, engineering vibrations, sensitivity of humans to vibrations. Single and Multiple Degrees of System. Natural Frequencies, Springs and Dashpot, Material and Radiation Damping, and Idealization of structure for analysis. Free and forced vibrations. Source and magnitude of damping in structures.

#### **10:00 AM – 12:00 PM – DYNAMIC SOIL PROPERTIES AND COMPUTATIONAL MODELING (Elgamal)**

Measures of dynamic soil properties at low and high strain. Cyclic strength. Use of wave propagation techniques. Non-linear soil behavior. Ground response to earthquakes. Data Bank, problems; selection of design parameters computational modeling including site amplification and 2D finite element modeling, Shake 91: typical results.

#### **12:00 PM – 1:00 PM – Lunch Break**

#### **1:00 PM – 3:00 PM – LIQUEFACTION AND CASE HISTORIES (Elgamal)**

Liquefaction of soils. Settlement and spreading. Methods of analysis. Cyclic: A nonlinear finite-element code <http://cyclic.ucsd.edu>. Remedial measure against liquefaction, lateral loads on piles, OpenSeesPL a 3D ground modification FE user-friendly interface (<http://cyclic.ucsd.edu/openseespl>), Case Histories.

#### **3:00 PM – 5:00 PM – PERFORMANCE BASED DESIGN OF RIGID RETAINING WALL UNDER SEISMIC LOADING (Prakash)**

Static and dynamic earth pressure. Codal recommendations for design of retaining walls. Displacement analysis of rigid retaining walls and abutments. Design procedure. Design problems. Performance based design and design charts.

#### **5:00 PM 6:00 PM – Discussion**

## **Tuesday, May 25, 2010**

### **8:00 AM – 10:00 AM – PILE FOUNDATION UNDER SEISMIC LOADING (Prakash)**

Piled foundations under static, dynamic and seismic loadings: Overview of models and methods of analysis. Simplified models. Pile response and dynamic impedance of single piles in vertical, horizontal and rocking loading. Dynamic response of pile groups to seismic loading. Interaction between piled foundation and superstructures. Design consideration. Prediction and performance of piles under dynamic loads. Piles in liquefied soils, case studies.

### **10:00 AM – 12:00 PM – RESPONSE SPECTRA AND APPLICATION (Elgamal)**

Response spectra for force-excited systems. Design approaches for dynamic loads. Experimental determination of dynamic system properties. Euro-code and uniform building code recommendations.

### **12:00 PM – 1:00 PM – Lunch Break**

### **1:00 PM – 3:00 PM – EVALUATION OF STABILITY OF TWO BRIDGES AGAINST FUTURE CREDIBLE EARTHQUAKES (Prakash)**

Southeast Missouri experienced the largest magnitude (estimated 8.0-8.3) earthquakes in recorded history (1811-1812). In a future major earthquake, the reopening of critical emergency vehicle access routes into St. Louis, Sikeston and Cape Girardeau would be a top priority. On the basis of a study on detailed assessments at two bridge sites along the designated vehicle access route, it was found that under an event with probability of exceedence (PE) of 2% in 50 years, these routes will be rendered unserviceable. A detailed study of the displacements on top of the abutment due to sliding and rotation and considering non-linear soil properties has been estimated. This sets procedural guidelines for similar studies.