



**PAUL UNO** BE MBdgSc MIE(Aust) CPEng NER RPEQ APEC Engineer IntPE(Aus)

- Over 40 years of experience in the design and construction industry.
- Former Senior Part-Time Lecturer – UNSW, UTS and University of Sydney.
- Masters Degree thesis on vibration titled 'Sound Transmission Loss of Building Facades'.

Livestreamed via



## WORKSHOP SUMMARY 8 hours of CPD

This design workshop will primarily cover vibrations and dynamics that relate to earthquake analysis. It will reference AS1170.4-2007 (R2018) and the relevant earthquake clauses from AS3600-2018. This course is for engineers who understand basic earthquake actions & wish to apply this knowledge to the design of reinforced concrete, structural steel & unreinforced masonry structures. This course will follow on from the *Earthquake Design Workshop: Module 1* presented by Prof. John Wilson.

The course will highlight the importance of the 0.08 change to the earthquake hazard design factor 'Z' from AS1170.4 Table 3.2 via Amendment No.2 Feb 2018, for areas such as Cairns, Townsville, Mackay, Toowoomba, Brisbane, Gold Coast, Tweed Heads, Port Macquarie, Coffs Harbour, Tamworth, Lismore, Hobart, & Launceston.

Attendees will be shown how to determine building natural frequencies from first principles without the need for a computer. This will include modal analysis using eigen values and basic matrix manipulation.

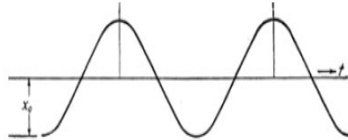
All sessions provide worked examples, tutorial exercises and solutions. Paul Uno has been privileged to have presented Earthquake courses alongside Prof. John Wilson for many years.

## PROGRAMME (8.30am Zoom invite will be emailed)

### 9.00 - 11.00 Session 1

#### - BASIC SEISMOLOGY & EARTHQUAKE FUNDAMENTALS

- Richter Scale vs Modified Mercalli Scale vs Moment Magnitude Scale
- Fault Types ie Strike Slip vs Normal vs Reverse Fault
- Plate tectonics
  - Seismicity
- Damping
  - Pounding
- Liquefaction
  - Soft Storey Concept
- Natural frequencies
  - Damage from past earthquakes
- Epicentre location methods
  - EQ vs Tsunami
- Return Periods - Australia vs Overseas
- Base Isolation, Elastomeric Bearings and Viscous Dampers
- California USA, El Centro Accelerogram 1940
- Famous EQ's: Mexico 1985, Kobe 1995, Sumatra 2004, Chile 2010, Japan 2011
- Newcastle Aust -1989
- Christchurch NZ -2010 & 2011
- Tutorial Exercise & Solutions



### 11.00 - 11.15 Morning Break

### 11.15 - 1.00 Session 2

#### - EARTHQUAKE DESIGN USING STATIC (FORCE BASED) METHODS TO AS1170.4

- Explanation of the EQ Shear Distribution Formula V
- Ductility  $\mu$  vs non-ductile parameters in design
- Distribution of Shear Force up the building
- Soil vs Site Classifications A to E
- Over Strength explanation
- Over-strength  $S_p$
- Importance Level  $I.L$
- EQ Hazard Maps
- Site Hazard Factor Z
- Probability Factor  $k_p$



- Soil Periods
- Building Height
- Calculation of Shear Forces
- Building Height vs Building Period vs No. Storeys
- Earthquake Design Categories: EDC I (10%W), II (Static), III (Dynamic)
- Structures designed for gravity & wind; checked for seismic performance
- Tutorial Exercise & Solutions
- Spectral Shape Factor
- Building Floor Natural Frequency
- Calculation of Bending Moments

### 1.00 - 1.30 Lunch Break

CALCULATORS REQUIRED

### 1.30 - 3.00 Session 3

#### - EARTHQUAKE DESIGN USING DYNAMIC METHODS

- Basic principles of simple harmonic motion and vibration theory.
- Maximum Response Method: SRSS vs CQC vs Absolute
- Elastic vs Inelastic Design Response Spectrum
- Acceleration vs Velocity vs Displacement
- Calculation of Eigenvectors & Eigenvalues
- Mode Shapes
  - Torsional Effects
- Participation Factors
  - Equivalent Mass concepts
- Calculation of Shear Forces
  - Fourier response relationship
- Mass vs Stiffness relationships
  - Modal analysis of tall structures
- Calculation of Bending Moments
- Tutorial Exercise & Solutions

### 3.00 - 3.15 Afternoon Break

### 3.15 - 5.00 Session 4


#### - DYNAMIC METHODS (CONTINUED) – INCLUDING REFERENCE TO EARTHQUAKE SOFTWARE PROGRAMS

- Modal analysis of simple 2 storey building
- Modal analysis of simple 3 storey structures
- Centre of Mass vs Centre of Rotation (Shear Centre)
- ETABS vs FINE vs other programs
- Tutorial Exercise & Solutions.

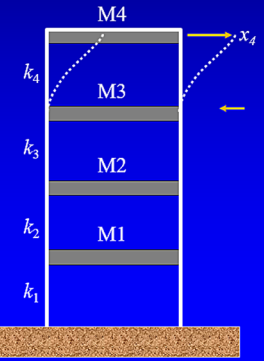
Certificate of Attendance will be emailed

### Stiffness for Unit Displacement at Level 4

Level 1	Level 2	Level 3	Level 4
$k_1 + k_2$	$-k_2$	0	0
$-k_2$	$k_2 + k_3$	$-k_3$	0
0	$-k_3$	$k_3 + k_4$	$-k_4$
0	0	$-k_4$	$k_4$



$\frac{12E(I_1 + I_2)}{h^3}$



• One day course – **\$740 pp**

#### FURTHER INFORMATION

- (02) 9899 7447
- +61 413 998 031
- [registrations@etia.net.au](mailto:registrations@etia.net.au)

• To register, visit our website [www.etia.net.au](http://www.etia.net.au) OR scan the QR Code.

