

# TRANSMISSION & COMMUNICATION TOWERS DESIGN WORKSHOP

(Including Power Poles)

NEW  
COURSE



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

- Over 45 years of design and construction experience within Australia.
- Previously Structural Tower Design Engineer with Transfield as well as Structural Engineer with Australian Institute of Steel Construction (now ASI).
- Former Part-Time Senior Lecturer – UNSW, UTS and University of Sydney.

## WORKSHOP SUMMARY **16 hours of CPD**

This two (2) day design and construction workshop will address key aspects of Transmission Towers and Cables, Communication Lattice Towers and Power Poles (inc Steel, Concrete, Composite and Timber). Foundation Design will be covered for all tower types.

The Australian Standards covered include AS4100, AS3995, AS/NZS7000, AS/NZS1170.2, AS2159, AS3600, AS1720, AS1559, AS1163, AS3679, AS3607. Overseas Standards such as ASCE10-97 (2000), ASCE48.5, ASCE48.11, ASCE48.19, IEC 60826 and IS 802 will also be referenced. Similarly, reference will be made to documents by Australian authorities such as Transgrid, Ausgrid, Ausnet, Powerlink, Western Power, Gateway, Horizon, Western Renewables and various other State Electricity Commission Authorities.

The course will primarily be aimed at structural and civil engineers (including mechanical engineers). Electrical engineers who wish to gain knowledge into the structural analysis of these types of structures are welcome to attend.

The presenter for this two-day course worked as a structural tower design engineer for Transfield and was involved in many line designs including 132 kV tower designs for Wellington-Dubbo NSW, Dapto-Tallawarra NSW, Tuggerah-Ourimbah NSW and Nebo-Ross QLD. In addition to transmission tower design, he designed communication towers eg Mt Annan NSW. He also worked for the Australian Institute of Steel Construction providing guidance to engineers designing steel structures.

## DAY 1 (8.30am Registrations at Venue)

### 9.00 - 11.00 Session 1 - TOWER BASICS

- Power Distribution basics (eg Voltage vs Current vs Resistance vs Power, Substations, three phase AC vs DC)
- Typical Tower types and Circuits (Suspension, Tension, Termination, Single Circuit, Double Circuit, Multi Circuit)
- Tower Terminology (eg Cross Arms, Earth-wires, Corner Legs, Conductors, Insulators, Vibration Dampers)
- Typical Voltages required (eg 33 kV, 66 kV, 132 kV, 220 kV, 275 kV, 330 kV, 400 kV, 500 kV, 700 kV)
- Cable types (ACSR, AAC, AAAC, OPGW, GWIRE)
- Conductor Types and Spacing (eg Onion, Mango, Orange)
- Arcing and Earth-wire Shielding Angle
- Ground Clearances, Easement Guidelines and Widths
- Spans (eg Basic or Normal Span, Average Span, Ruling or Equivalent Span, Wind Span, Weight Span)
- Cable Sag and Tension calculations (Parabolic vs Catenary-hyperbolic, Temperature effects, Drag, Max Tension)
- Tutorial Questions and Solved Answers

### 11.00 - 11.15 Morning Break

### 11.15 - 1.00 Session 2

#### - TRANSMISSION TOWER: STRUCTURAL DESIGN (using hand calculations)

- Tower Base Width -Rules of Thumb
- Tower Weight – Rules of Thumb
- Weather Effects (eg Downdraft vs Synoptic Winds, Wind Induced Vibration)
- Drag on Cables (typical Cd values)
- Typical Loads on Conductors (eg Vertical, Longitudinal, Transverse, Torsional, Broken Cables)
- Load Combination Trees for Towers (unbroken vs broken cables)
- Design of Tower Body Corner Legs (Slenderness effects, Local Buckling, Radius of Gyration)
- Tutorial Questions and Solved Answers

### 1.00 - 1.30 Lunch Break

### 1.30 - 3.00 Session 3

#### - TRANSMISSION TOWER: STRUCTURAL DESIGN (cont.)

- Design of Tower Body Cross Bracing Diagonals (X Bracing vs K Bracing, No of Bolts vs Restraint)
- Design of Cross Arms (Simple Truss Analysis/Method of Joints for Suspension and Tension towers)
- Design of Tension Members (Yield vs Ultimate Capacity)
- Design of Redundant members (2.5% rule)
- Combined Bending, Compression, Tension and Shear
- Connections and their Structural Design (eg Splice plates, Gussets, Bolts -single vs double shear, Brittleness effects)
- Tower Member Detailing Basics
- Reference to Computer printouts eg STAAD-PRO
- Tutorial Questions and Solved Answers

### 3.00 - 3.30 Afternoon Break

### 3.30 - 5.00 Session 4

#### - FOUNDATION DESIGN FOR TRANSMISSION TOWERS: STRUCTURAL DESIGN (using hand calculations)

- Soil Properties
- Pile Foundation Design to AS2159 Requirements
- Pile Foundation Design to AS7000 Requirements
- Downthrust Bearing Capacity
- Uplift Pull out Capacity of Tower Leg Foundations
- Straight vs Bell Shaped Piles
- Assumed Frustum Angles
- Assumed Skin Friction values
- Lateral Capacity
- Tutorial Questions and Solved Answers

**FACE-TO-FACE (BRISBANE)**

**VOCO Brisbane City Centre**

(85/87 N Quay, Brisbane City QLD 4000)



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## DAY 2

### 9.00 - 11.00 Session 5 - COMMUNICATION LATTICE TOWER BASICS

- Wind Pressures on Communication Towers
- AS1170.2 - Terrain Categories (TC 1 to TC4) and Multipliers ( $M_{z cat}$ ,  $M_d$ ,  $M_s$ ,  $M_t$ )
- Wind Velocity  $V_{sit, \beta}$  and  $V_{des, \theta}$  calculations
- Drag Force Coefficients -Members (circular vs angle members) and Cross Sections (square vs triangular base)
- Drag Force Effects from Dish Antennas
- Solidity Ratios
- Aerodynamic Shape Factors
- Interference Correction Factors
- Wind on Face vs Wind on Corner
- Tutorial Questions and Solved Answers

### 11.00 - 11.15 Morning Break

• Two day course – **\$1670**

#### 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.



### 11.15 - 1.00 Session 6 - POWER POLES: STRUCTURAL DESIGN (using hand calculations)

- Power Pole Types (Steel, Concrete, Timber)
- Wind Pressures on Poles
- Steel Pole Design to AS4100 and AS1163
- Circular vs Hexagon vs Dodecagon vs Rectangular shapes and properties
- Concrete Pole Design to AS3600 and AS7000
- Timber Pole Design to AS1720 and AS4676
- Composite Poles
- Wind Effects on Circular Poles to AS1170.2
- Torsion Effects on Poles
- Vibration Issues
- Tutorial Questions and Solved Answers

### 1.00 - 1.30 Lunch Break

### 1.30 - 3.00 Session 7 - POWER POLES: FOUNDATION DESIGN (using hand calculations)

- Steel Base Plate to Foundation Design
- Soil Properties
- Pile Foundation Design to AS2159 Requirements
- Pile Foundation Design to AS7000 Requirements
- Downthrust Bearing Capacity (simple method)
- Lateral Load Capacity ( $p$ - $y$  method vs Broms vs Brinch-Hansen)
- Pole Tip Deflection
- Tutorial Questions and Solved Answers

### 3.00 - 3.30 Afternoon Break

### 3.30 - 5.00 Session 8 - POWER POLES (Miscellaneous)

- Guyed Towers
- Stay Wire Properties
- Stay Wire Sizing Calculations
- Pole Corrosion (Steel)
- Reinforcing Cover Requirements (Concrete)
- Pole Maturity (Timber)
- Pole Durability and Degradation (Timber)
- Shaving Factors (Timber)
- Fibre Strength vs Time (Timber)
- Risk Factors and Hazards per year
- Tutorial Questions and Solved Answers

### 5.00 - 5.15 Certificate of Attendance will be emailed

