ENGINEERING TRAINING INSTITUTE AUSTRALIA

GLASS & ALUMINIUM FAÇADE DESIGN WORKSHOP

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

- Master's degree (University of Sydney) on the acoustic topic of '*Transmission Loss of Building Façades*'
- Provided structural design testing for many high-rise glazing curtain wall systems in Sydney including:
  - 20 Elizabeth St Martin Place (originally called The State Bank)
  - ABC Radio and Orchestra building at Ultimo
  - 338 Pitt St Sydney; 66 Clarence St, Sydney
  - 88-90 Arthur St North Sydney
  - 127-141 Walker St North Sydney
  - 32 Phillip St Parramatta
  - 875 Pacific Hwy Pymble
  - IBM Headquarters Frenchs Forest
  - Designed the steel rafter support system for the Triangular Glass Skylight (Area 6) Parliament House, Canberra.
- Previous employment: H.H. Robertson (taken over by Pilkington) as an Engineering Services Manager (Architectural Walls Division) and NATA approved laboratory signatory for a 9m x 11m x 2m x 6kPa test rig; Engineering Manager at Australco (curtain wall company).
- Since 2015, he has lectured on the topic of 'inferior aluminium cladding and its proven fire hazard to high-rise buildings' at UNSW and the ETIA Risk Management Workshop (e.g The Al Tayer Tower, Dubai 2013, and The Torch, Dubai 2015).

WORKSHOP SUMMARY 16 hours of CPD

This two-day course will cover the topic of glass and aluminium façades (also known as Curtain Walls) for medium to high rise buildings. The Standards that will be highlighted include the Glass Standards AS1288 and AS4666, the Aluminium Standard AS1664 and the façade testing Standard AS4284 and AS 2047.

The structural design of glass panes in window frames as well as the structural design of the aluminium that contains the glazing will be addressed. There will be a primary focus on the design of these façades to wind loads (as per AS/NZS 1170.2-2021) and AS1288. The testing procedure for such façades according to Australian Standard AS4284 (Sirowet test) and AS2047 will be explained, along with real life examples.

All sessions provide worked examples, tutorial exercises and solutions.

DAY 1 *(8.30am Zoom invite link will be emailed)*

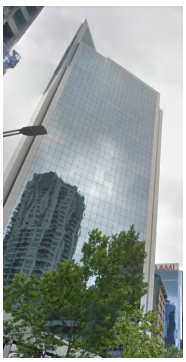
9.00 - 11.00 Session 1
- GLASS PROPERTIES (incl. THERMAL)

Glass Types

- Annealed
- Laminated
- Heat Strengthened
- Toughened
- Double Glazing or Insulated Glazed Units (DGU or IGU)
- Pigments used to produce coloured glass
- Detrimental Nickel Sulphide inclusions in glass
- TUTORIAL

Thermal & Energy rating systems

- U value vs R value vs Low 'e' coatings
- SHGC formula and values
- T_{vw} value
- Air Infiltration value
- Thermal Cracking of Glass
- BASIX rating system
- TUTORIAL



11.00 - 11.15 Morning Break

11.15 – 1.00 Session 2
- GLASS ACOUSTICS

Sound Insulation

- Acoustic terminology: STL vs (R_w+ C_{tr}) vs STC and L_A or L_{eq}
- Double Glazing – Acoustics vs Condensation vs Heat Flow
- BCA (NCC) & Aust Standards eg AS1276, AS1191, AS2253
- TUTORIAL

1.00 - 1.30 Lunch Break

1.30 - 3.00 Session 3
- HIGH RISE WIND DESIGN TO AS/NZS 1170.2-2021

Medium to Tall Structure Wind Design to AS/NZS 1170.2-2021

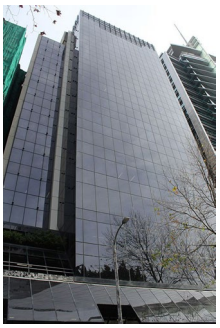
- Terrain Categories
- Wind pressure derivations for medium to tall structures
- Direction Multipliers
- Local Pressure factors for Glazing and Cladding
- K factors for wind design in high rise
- Effects of Shielding from other buildings
- Shear loads on buildings from wind and earthquakes
- Drift and Façade Displacement
- TUTORIAL

3.00 - 3.15 Afternoon Break

3.15 - 5.00 Session 4
- GLASS PANEL WIND DESIGN TO AS1288

Wind Design for Glazing

- Wind Pressures vs Span Tables
- Two (2) edge vs Four (4) edge support
- Glass Aspect Ratio
- Glass Tensile Strength vs Membrane Action
- Linear vs Non Linear Analysis
- 'Edge' pressure vs 'Away from Edge' pressures
- Glass Fin Design
- Localised glass cracking (Butterfly effect)
- Safety Glass requirements
- Stress Concentrations
- TUTORIAL



Sealants, Gaskets and Tapes

- Silicone Sealants -Silicones vs Polyurethanes
- Other types of sealants
- Acetic vs Neutral cured sealants
- Bite Calculations
- Failure causes in Sealants
- Gaskets – Neoprene vs EPDM
- Shore A Hardness of Spacer blocks
- TUTORIAL

Livestreamed via zoom

Cancellations made more than 5 working days prior to a course will incur a 50% processing fee of the full registration amount.
Cancellations made 5 working days or less will incur forfeiture of the full registration fee.

– Curtain Walls in Medium to High Rise Structures

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DAY 2

9.00 - 11.00 Session 5
- ALUMINIUM PROPERTIES AND STRUCTURAL DESIGN

Aluminium design to AS1664

- Anodized Surfaces vs Coatings
- 6061 vs 6063 vs 6060
- Tempers eg T4 vs T5
- Hardenability Treatments
- Structural requirements and applications of AS1664
- Yield vs Tensile Strength
- Allowable vs Ultimate Stresses
- Bending vs Buckling
- High thermal expansion issues of aluminium
- Slotted holes in members and brackets
- Welding aluminium issues
- Corrosion – Stainless vs Aluminium vs Galvanised Steel
- Stainless Steel (to AS4673) vs Galv. Steel (to AS4680)
- TUTORIAL

Fire and Aluminium Panels

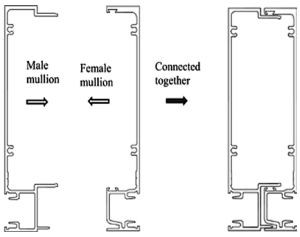
- Composite Panels Manufacture
- Fire Issues with Polyethylene Core
- Testing for fire in composite aluminium panels
- Real life examples around the World
- Issues in Australia (e.g. Lacrosse Building)
- TUTORIAL

11.00 - 11.15 Morning Break

11.15 - 1.00 Session 6
- CURTAIN WALL DESIGN

Systems and Terminology

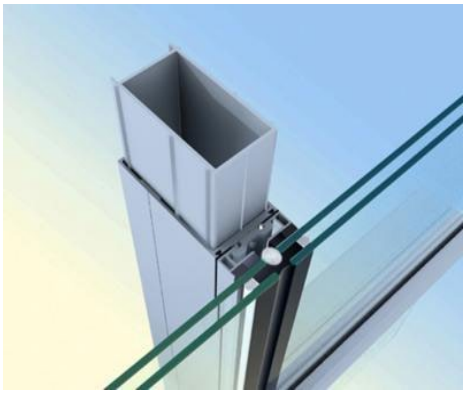
- Stick System
- Panelised (or Unit) System
- Mullions, Transoms, Sills
- Design calculations using I_{xx} vs I_{yy} values
- TUTORIAL

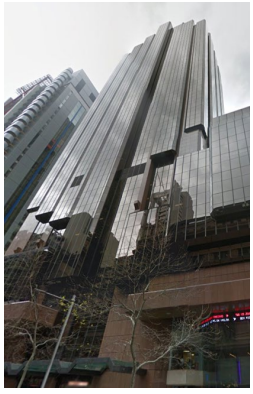


Serviceability

- Serviceability deflection limits
- Support conditions (Edge vs Central)
- Vertical Differential Deflection limits
- Member tolerances
- Column member shortening
- Building sway and inter-storey drift
- Steel cast-in insert anchorage capacity in concrete
- TUTORIAL

1.00 - 1.30 Lunch Break





1.30 - 3.00 Session 7
- CONNECTIONS, DEFLECTIONS, MOVEMENT, TOLERANCES AND ERECTION

Steel Connections

- Steel to Concrete connections e.g. uni-struts
- Steel to Aluminium Member connections
- Connection pull-out capacity in concrete
- Allowance for connection expansion and contraction
- Slotted Hole patterns
- Common Errors
- TUTORIAL

Deflections, Movement, Tolerances

- Panel differential movement
- Inter-storey Drift
- Edge beam deflection
- Thermal movement effects
- Column shortening due to creep and shrinkage
- Allowable Movement Limits and Tolerances
- TUTORIAL

Erection Processes

- Panel installation
- Panel placement - From inside or from outside building
- TUTORIAL

3.00 - 3.15 Afternoon Break

3.15 - 5.00 Session 8
- CURTAIN WALL FAÇADE TESTING

Façade Testing (Mock Ups) to AS2047 and AS4284

- Positive and Negative Wind pressure tests
- Air infiltration
- Proof Testing
- Water penetration testing requirements
- Real life case studies of façade testing
- Pendulum Lead Shot test vs Twin Tyre test
- TUTORIAL

Certificate of Attendance will be emailed

CALCULATORS REQUIRED

- Two day course – **$1,560**

FURTHER INFORMATION

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

- *To register, visit our website* www.etia.net.au ***OR*** *scan the QR Code.*

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