Report on Design of Slender Tall Buildings for Wind & Earthquake

by Ir. Low Kai Wah

Ir. Low Kai Wah is currently a committee member in Civil and Structural Engineering Technical Division (CSETD).

The Civil and Structural Engineering Technical Division (CSETD) had successfully organized an evening talk on 5th September 2017 titled "Design of Slender Tall Buildings for Wind & Earthquake". The talk was held at Auditorium of Tan Sri Prof Ching Fung Kee, Wisma IEM and the invited distinguished speaker was Dr. Juneid Qureshi, who has over 28 years of experience in planning, design and construction of tall and complex buildings.

The talk was chaired by Ms Wong Ai Ming and was attended by 138 participants. The participants consist a pool of professionals from different industries background ranging from practising consultants, contracting firm, Authorities, academician and students.

Dr Juneid outlined 6 main topics in his presentation mainly:-

1) Structural Design Challenges for Tall Buildings.
2) Structural Systems for Tall Buildings.
3) Key Considerations for Seismic Design.
4) Case Studies.
5) Comparison of Wind & Seismic Effects.
6) Cost Comparison of Using Reinforced Concrete versus Composite for Tall Building.

Dr Juneid highlighted that as the building goes higher, there will be a premium for it as the buildings need to be designed for wind force, occupant comfort, drift, differential shortening, robustness, construction sequence and buildability.

The speaker suggested that to minimise cross-wind effect, designer may adopt the following approach such as re-oriented building orientation, introducing set-back and varying cross-sections, softened corners, tapering and increased porosity in the buildings. Dr Juneid also presented few types of structural framing used for his projects and the advantages of the framing systems.

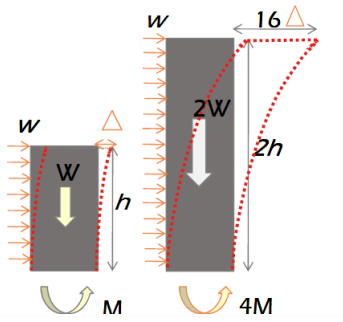

Figure 1: Simple illustration of increase in building height resulting increase in base moment and deflection.

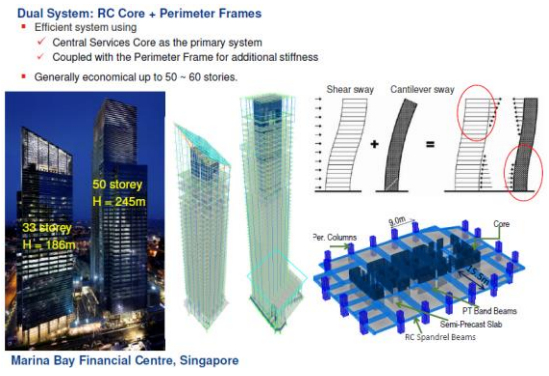

Figure 2: Simple illustration of RC core + perimeter frames

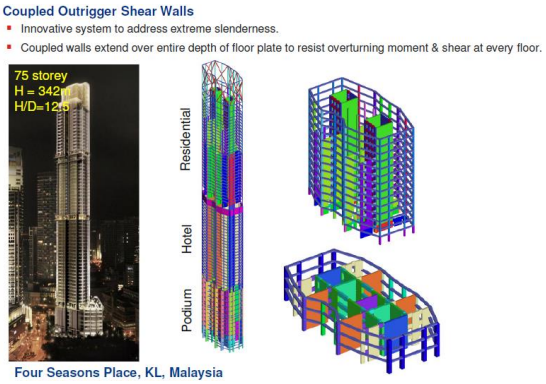

Figure 3: Simple illustration of coupled outrigger shear wall systems

Dr. Juneid stressed that for seismic design, there are few key considerations that the designer shall be aware such as torsional irregularity, re-entrant corners, diaphragm eccentricity, out-of-plane offsets, stiffness irregularity (soft story), mass irregularity, geometric irregularity, and weak story.

The speaker later presented few case studies to the audience.

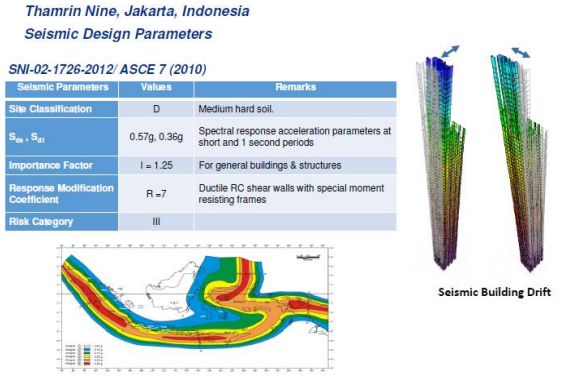

Figure 4: Seismic Design Parameters for Thamrin Nine, Jakarta, Indonesia

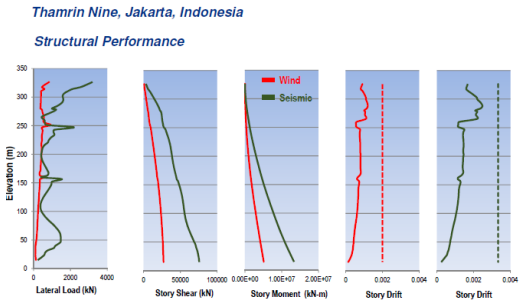

Figure 5: Structural performance of the building

Dr. Juneid also presented comparison of lateral load in tall building design using BC3:2013 (Guidebook for Design of Buildings in Singapore to requirements in SS EN 1998-1) for seismic action. The speaker presented the seismic force acting on building using two sets of different buildings behaviour factor, q.

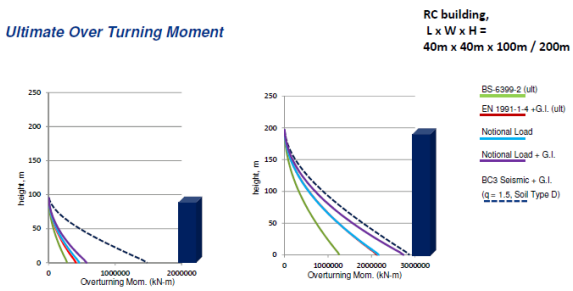

Figure 6: Ultimate Over Turning Moment with behaviour factor, q = 1.5

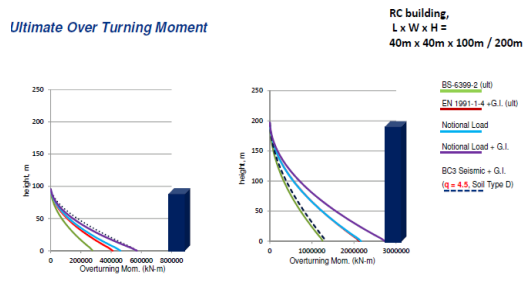

Figure 7: Ultimate Over Turning Moment with behaviour factor, q = 4.5

Lastly, the speaker presented a cost comparison of structural framing using reinforced concrete (RC) frame with post tensioned (PT) band beams versus composite framing. Dr. Juneid concluded that the choice of the structural framing lies within the designer preference. At the end of the session, the Q&A session was lively as enthusiastic audience poured in quality questionnaires to the speaker and were answered by Dr. Juneid. The talk ended with CSETD Chairman presented a token of appreciation to Dr Juneid.

Figure 8: CSETD Chairman, Dr. Ng presenting a token of appreciation to Dr. Juneid