Seminar on MS1553 Code of Practice on Wind Loading for Building Structures

CIVIL & STRUCTURAL ENGINEERING TECHNICAL DIVISION

by Ir. Prof. Dr Jeffrey Chiang Choong Luin

LAST year, the IEM Civil & Structural Engineering Technical Division hosted a seminar on MS1553 Code Of Practice On Wind Loading For Building Structures on 7 and 9 November 2012 at Hotel Armada, Petaling Jaya and Blue Wave Hotel, Johor Baru respectively.

The events at both venues were partially sponsored by the Department of Standards Malaysia (Standards Malaysia), and were well attended (136 participants in Petaling Jaya and 34 in Johor Baru), comprising more than 50% practicing engineers as well as 5% academics and 5% students. The rest were non-practicing engineers in contracting, material or equipment suppliers or project development.

In his opening address, the guest of honour, Encik Shaharul Sadri Alwi, Director of Accreditation, Standards Malaysia encouraged members of the audience to look up to Standards Malaysia website to view all the standards in progress, especially the completed standards available for public comments. Input from the industry and end users would give invaluable suggestions to improve or to correct some of the draft standards before publication as referenced standards.

The two invited speakers for both events were Dr John Holmes and Ir. Prof. Dr Jeffrey Chiang. Dr Holmes is Director of JDH Consulting, Australia and previously was a senior academic and researcher at James Cook University and Monash University, Australia. Other than being a regular visiting professor in USA, he has been engaged in research, testing and consulting in wind loads and wind effects for more than 35 years. He is currently Chair of the wind loads subcommittee of Australia and New Zealand, and was actively involved in the writing of Australian Standards AS1170.2-1989, AS/NZS1170.2:2002 and now the 2011 version (Wind loads) and AS3995-1994 (Design of steel lattice towers and masts). He is the author or co-author of some 300 journal papers, conference presentations, and research and consulting reports. He is the author of "Wind Loading Of Structures", published in 2001, with the second edition published in 2007, and co-author of "A Guide to AS/NZS1170.2:2002 – Wind Actions" published by Warreen Publishing in 2005. He is Editor-in-Chief of the journal Wind And Structures.

Ir. Prof. Dr Jeffrey Chiang is currently the Head of Civil Engineering at the Faculty of Engineering & IT, INTI International University at Nilai Campus. He is actively involved in drafting the Malaysian Standards on design of concrete structures (as TC Secretary) and is now serving as Chairman of both IEM-TC on Wind Loading and IEM-TC on Earthquake. He was a Past Chairman of IEM Civil & Structural Engineering Technical Division, and had served as IEM Honorary Secretary and Treasurer. He has recently been re-elected to serve as the Honorary Secretary of IEM.

Dr John Holmes started the seminar by presenting slides on the main features of MS1553 which is essentially an adoption of AS/NZS1170.2:2202 version. The current Australian Standard version is AS/NZS1170.2:2011 version. Interestingly, he pointed out that the format of MS1553 is based on ISO 4354:1997. This indicated that Malaysian Standards' format follows the ISO format wherever possible. The key items to work on are the various comprehensive set of shape factors, relating to different types of structures such as:

- Gable roofs
- Curved roofs
- Multi-span buildings
- Free-standing walls and hoardings
- Pitched-free roofs
- Lattice towers
- Tower ancillaries
- Flags
- etc

Comparison was made with between MS1553 and AS/NZS1170, whereby some key differences were identified in terrain-height multipliers below 10 metres in terrain categories 2 and 3, as well as in averaging distance for change of terrain category. Other differences include, a more complex topographic multiplier in AS/NZS1170, which also specifies a minimum design wind speed (30 m/s) while MS1553 specifies a minimum net wind load of 0.65 kN/m^2. Some minor differences were mentioned in calculating the dynamic response factor, and MS1553 has appendices outlining a simplified procedure with a guided flow charts.

Participants were also given a list of amendments to MS1553:2002 which was sent for public comments by SIRIM. Some of these included basic information like changing air density from 1.225 kg/m^3 to 1.20 kg/m^3, and

Photographs of the seminar at Petaling Jaya as shown above and on page 34

amending some formulas and diagrams. Readers may get hold of the amendments from SIRIM as addendums to be inserted into MS1553:2002.

Dr John Holmes then gave a detailed lecture on the procedures of calculating the wind pressure, firstly referring to zonal map of Peninsular Malaysia for the basic wind speed, after which various site exposure multipliers (terrain/height, shielding, and hill shape or slope) and importance factor would be incorporated to yield the design wind speed.

The design wind pressure would include this design wind speed, together with parameters relating to aerodynamic shape factor which is covered in Chapter 6 of MS1553. Other analyzing for rectangular enclosed buildings for external and internal pressure coefficients and other factors such as local pressure factor and frictional drag coefficients, Dr Holmes also presented provisions unique to structures (as found in MS1553) as follow:

- Appendix C — Curved roofs, multi-span buildings, bins, silos and tanks
- Appendix D — Free-standing hoardings and walls; monoslope, pitched and troughed free roofs; and hypar free roofs
- Appendix E — Various cross sections in rectangular, circular and structural angles; lattice towers, ancillaries
- Appendix F — Flags, circular discs, hemispheres, spheres

Once the dynamic response factor, C_{dyn} is determined, there may be need to also analyse the effect of cross-wind dynamic response, for both rectangular and circular cross-sections.

After the lunch break, Dr Holmes gave tips on how to determine the wind pressures for three types of structures:

- Multispan industrial building, located in Kedah near Alor Setar on a 100m hill with terrain categories 1 and 4 with station wind speed of 32.5 m/s,
- 180m high tall building, located in Kuala Lumpur (Zone I), with suburban terrain for all directions with station wind speed of 33.5 m/s,
- Reinforced concrete chimney 50m high, located in Subang, Selangor, with open rural terrain for all directions with station wind speed of 32.5 m/s

Photographs of the seminar at Johor Baru as shown above

After the mid-afternoon break, Ir Dr Jeffrey Chiang presented a tutorial session for participants in which a structural steel lattice tower was selected for detailed step-by-step analysis, performed with inputs from the audience. The details of the lattice tower were as follow:

- 50m high located on a hill 65m from ground level in Melaka, under Zone I category with station wind speed 33.5 m/s,
- Exposed open terrain category I, and
- 6m x 6m sectional configuration

Participants were guided through a series of procedural steps to determine all the basic parameters, such as:

- Exposure multipliers (terrain/height, shielding, and hill shape or slope) and importance factor
- Calculation of design wind speed, V_{des}
- Calculation of aerodynamic shape factor, C_{fig}
- Calculation of dynamic response factor, C_{dyn} (which involved additional calculations for background factor, size reduction factor, spectrum of turbulence, peak factor for resonance.

The last part of the tutorial session involved the filling up of tabulated calculated values of along-wind base bending moments, for a series of stepped heights of the structure at 5m intervals, as shown as Table 1.

Table 1

Height of section (m)	b (m)	$C_d = C_{fig}$	$M_{z,cat\ 1}$	M_h	V_{des} (m/s)	q_z	qz.Cfig (kPa)	$q_z.C_{fig}.C_{dyn}.\delta A$ (kN)	Moment contribution (kN.m)
47.5	6.0	3.5	1.2475	1.0970					
42.5	6.0	3.5	1.2425	1.0996					
37.5	6.0	3.5	1.2350	1.1023					
32.5	6.0	3.5	1.2250	1.1052					
27.5	6.0	3.5	1.2125	1.1083					
22.5	6.0	3.5	1.1975	1.1115					
17.5	6.0	3.5	1.1750	1.1150					
12.5	6.0	3.5	1.1400	1.1187					
7.5	6.0	3.5	1.1300	1.1226					
2.5	6.0	3.5	0.825	1.1268					

In between the sessions in the morning and afternoon, participants raised queries during the Q&A session as well as during coffee breaks. Both Dr Holmes and Dr Chiang had a field day answering questions from the floor, making the seminar lively, enjoyable and a good learning and awareness session. The seminar ended at 5.30 p.m., with the organiser presenting souvenirs to both speakers. ■

Ir. Prof. Dr Jeffrey Chiang Choong Luin holds several posts in IEM, namely Honorary Secretary of IEM, Past Chairman and current committee member of Civil & Structural Engineering Technical Division and Chairman of Technical Committee on Earthquake. He is currently the Head of Civil Engineering at INTI International University.