

STRATEGIES FOR ADOPTING NEW TRENDS IN WIND LOAD EVALUATION ON STRUCTURES

by

A. U. Weerasuriya

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by

Prof. M. T. R. Jayasinghe

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY OF MORATUWA

MORATUWA

SRI LANKA

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I declare that this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any University or other institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

Signature:

Date:

Asiri Umenga Weerasuriya
Department of Civil Engineering,
University of Moratuwa.



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DECLARATION OF THE SUPERVISOR

I have supervised and accepted this thesis for the submission of the degree.

Signature of the supervisor:

Date

Professor M.T.R. Jayasinghe
Department of Civil Engineering,
University of Moratuwa.



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DEDICATION

I would like to dedicate this dissertation to professional Engineers in Sri Lanka, who will make future buildings safer, benefiting the general public of Sri Lanka.



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ABSTRACT

With respect to the other disciplines of Engineering, Wind Engineering is at its premature state in Sri Lanka. The only mandatory document available in Sri Lanka is the design manual, named as “Design buildings for high winds-Sri Lanka”, which generally covers the construction methods and techniques that can be used to improve the wind resistance ability of low-rise buildings. Since Sri Lanka does not possess its own wind loading standards, the common practice is to utilize various international wind loading standards and the most widely used is CP 3 Chapter V Part 2:1972.

As many countries in the world, Sri Lanka also has a trend to construct high-rise building at its city centres, especially in the city of Colombo. In this context, the designers as well as regulating bodies face many problems, such as non-uniformity among wind load calculations, lack of verification for the methods and factors that are given in different standards, when utilize in Sri Lankan context, uncertainty of the achieved risk levels for load combinations with load factors, etc. Therefore, it is worthwhile to produce at least a document, which can guide the practice engineers to properly select and subsidize a utilize standard for design.

CP3 Chapter V-Part 2:1972, AS 1170.2:1989, AS/NZS 1170.2:2002, BS 6399.2:1997 and BS EN 1991-1-4:2005 are the codes and standards that have been used in this particular study. These codes are selected, by considering many factors such as previous practice in Sri Lanka, available data, new technologies, method and factors proposed in the recent times in the wind engineering etc. Wind loads derived from above five standards were applied in two buildings with different heights, which are 48 m and 183 m in height to cover both static and dynamic analysis methods given in wind loading standards. Computational Fluid Dynamic (CFD) Techniques have been used to evaluate the various strategies adopting by different standards such as division – by – parts rule given in British and Euro codes.

From the studies carried out in this research, it can be noted that the two types of wind speed values as defined in wind loading manual can be used to design low rise and high rise buildings within certain accepted risk levels. Further, it is recommended to apply windward and leeward pressures separately to evaluate wind induce forces in structural members of a building. The discrepancies among CP3 Chapter V – Part 2:1972 and other selected standards have been evaluated by the means of structural

forces in columns, beams, concrete shells and base reactions and results are shown as normalised forces with respect to load obtained from CP3 Chapter V – Part 2:1972. The behaviour of the two buildings at serviceability limit condition was evaluated by using both acceleration and drift index values according to selected standards.

Final observations and recommendations would lead practise engineers to select one of these wind loading standards for making a building with more wind resistant capabilities and higher satisfaction in comfort levels to its occupants.



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TABLE OF CONTENT

1	Introduction.....	1
1.1	General	1
1.2	Main Objectives	4
1.3	Methodology	5
1.4	Arrangement of report.....	6
2	Literature Review.....	7
2.1	General	7
2.2	Nature of the wind.....	7
2.3	Extreme wind conditions in Sri Lanka.....	8
2.3.1	Tropical cyclones.....	8
2.3.2	Gales	11
2.3.3	Monsoon	12
2.4	Wind effects on structures.....	13
2.4.1	Wind drift design	14
2.4.2	Comfort criteria; Human response to building motion.....	15
2.5	Basics of wind loading standards.....	16
2.5.1	Basic wind speed	18
2.5.2	Terrain category.....	20
2.5.3	The Power Law wind profile	21
2.5.4	The Log Law wind profile.....	22
2.5.5	Topography effect.....	22
2.5.6	Return period	23
2.6	Wind loading design methods	25
2.6.1	Static method	25
2.6.2	Dynamic method.....	26
2.6.3	Gust factor method	28
2.7	Wind engineering practices in Sri Lanka	30
2.8	Computational fluid dynamics (CFD) techniques.....	33
3	Wind Loading Codes and Standards.....	35
3.1	General	35
3.2	Suitable wind loading codes and standards for Sri Lankan context.....	35

3.3 Codes of Basic data for the design of buildings Chapter V, Loading, Part 2, Wind loads (CP 3: Chapter V: Part 2: 1972).....	36
3.4 British Standard: Loading for building- Part 2: Code of Practice for wind loads; BS 6399- 2:1997.....	38
3.4.1 Standard method.....	40
3.4.2 Directional Method.....	42
3.5 Australian Standard: Minimum design loads on structures: Part 2: Wind Loads; AS 1170.2-1989	42
3.6 Australian/ New Zealand Standard: Structural design actions: Part 2: Wind Loads; AS/NZS 1170.2:2002	48
3.7 Euro code 1: Actions on structures – Part 1-4: General actions – Wind Actions, BS EN 1991-1-4:2005	52
4 Finite Element 3-D Modelling of High-Rise Buildings.....	57
4.1. General	57
4.2. Applicability of finite element modelling	58
4.2.1 Case studies	59
4.2.2. Loadings	62
4.2.3. Load combinations	63
4.3 Results and comparison.....	64
4.3.1 Basic wind speeds with different averaging time	65
4.3.2 Return period vs load factors.....	65
4.3.3. Terrain Height multiplier.....	70
4.3.4. Wind pressure calculations.....	72
4.3.5. Wind induced forces.....	81
4.3.6 Base reactions	91
4.3.7. Maximum shell stress in shear walls	93
4.3.8. Drift limit.....	94
4.3.9. Along wind and cross wind acceleration of the building.	95
5 Computational Fluid Dynamic (CFD) Simulation of a Building within Boundary Layer	97
5.1 General	97
5.2 Main components of CFD simulation	98
5.2.1. Fluid domain.....	98
5.2.2 Meshing	100
5.2.3 Boundary conditions.....	102

5.2.4 Wind velocity profiles	102
5.3 Results of CFD simulation	105
5.3.1 Wind profiles	106
5.3.2. Kinetic energy and energy dissipation rate.....	107
5.4 Result of the CFD simulation.....	111
6 Conclusion, Recommendations and Future works.....	113
6.1.General conclusion.....	113
6.2.Recommendation.....	117
6.3. Future Work	118
Reference	119
APPENDIX A.....	125
APPENDIX B	141
APPENDIX C	160
APPENDIX D.....	194
APPENDIX E	206



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LIST OF FIGURES

Figure 2.1: Characteristic of global atmospheric circulation due to earth rotation (Sachs, 1978)	8
Figure 2.2 Tropical cyclone paths in the world (Cook,1985)	9
Figure 2.3: Cyclones paths in period of 1877 -2004 (After Professor Alan Davenport,2004)	10
Figure 2.4 (a): Wind flow pattern in South-West monsoon season (www.nrlmry.navy.mil)	12
Figure 2.4 (b): Wind flow pattern in North-East monsoon season (www.nrlmry.navy.mil)	13
Figure 2.5: Wind Response Directions (Mendis et al, 2007)	14
Figure 2.6: Analysis steps for wind loading standards (Kolousek, 1984)	17
Figure 2.7: wind power spectrum (After Van der Hoven, 1957)	19
Figure 2.8: Mean wind speed dependence on speed of average time t (Simu and Scanlan 1976)	20
Figure 2.9: Mean wind profiles with roughness lengths for different terrain types (Mendis et al, 2007)	21
Figure 2.10: Probability factor Vs mean recurrence interval (Cook, 1999)	24
Figure 2.11: Vortices formation on side of a building (Mendis et al, 2007)	28
Figure 2.12: Wind Zones in Sri Lanka (Design manual “Design building for high winds”, 1978)	31
Figure 2.13: Schematic sketch of the flow field around a three dimensional rectangular obstacle (Becker et al, 2002)	34
Figure 2.14: Suction pressures on leeward faces of the building (Cook, 1999)	34
Figure 3.1: Dynamic Augmentation factor C_r given in BS 6399.2:1997	39
Figure 3.2: Division of buildings by parts for lateral loads (BS 6399.2:1997)	41
Figure 4.1: (a) global coordinate system (b) local coordinate system used for frame in SAP 2000, finite element analysis software.	58
Figure 4.2: Finite element model of 48 m height building (a) 3 –D view, (b) Plan view at 1 st floor level, (c) a sectional view	60
Figure 4.3: finite element model of 183 m height building (a) 3 –D view, (b) Plan view at 1 st floor level, (c) a sectional view	61
Figure 4.4: Wind loads applied in two orthogonal directions of 48 m building	63

Figure 4.5: comparison of results obtained for 1.2G+1.2Q+1.2W load combination with and without load factor	68
Figure 4.6: Comparison of results obtained for 1.0G+1.4W load combination with and without load factor	68
Figure 4.7: Comparison of results obtained for 1.0G+1.4W load combination with and without load factor	68
Figure 4.8: Comparison of results obtained for W and W_U wind load cases with and without load factor	69
Figure 4.9: Terrain height multipliers for town terrain	71
Figure 4.10: Terrain height multipliers for country terrain	71
Figure 4.11: Total pressure on 48m building (wind flow perpendicular to 60m long side)	74
Figure 4.12: Total pressure on 48m building (wind flow perpendicular to 30 m side)	74
Figure 4.13: Total pressure on 183 m building (wind flow perpendicular to 46 m long side)	75
Figure 4.14: Total pressure on 183 m building (wind flow perpendicular to 30 m long side)	75
Figure 4.15: Windward pressure on 48m building (wind flow perpendicular to 60m long side)	78
Figure 4.16: Windward pressure on 48m building (wind flow perpendicular to 30m long side)	78
Figure 4.17: Leeward pressure on 48m building (wind flow perpendicular to 60m long side)	78
Figure 4.18: Leeward pressure on 48m building (wind flow perpendicular to 30m long side)	79
Figure 4.19: Windward pressure on 183m building (wind flow perpendicular to 46m long wall)	80
Figure 4.20: Windward pressure on 183m building (wind flow perpendicular to 30m long wall)	80
Figure 4.21: Leeward pressure on 183m building (wind flow perpendicular to 60m long side)	80
Figure 4.22: Leeward pressure on 183m building (wind flow perpendicular to 30m long side)	81

Figure 4.23: (a) Column loads (b) beam loads for load combination 1.2G+1.2Q+1.2W (wind flow perpendicular to 60m side)	82
Figure 4.24: (a) Column loads (b) beam loads for load combination 1.0G+1.4W (wind flow perpendicular to 60m side)	83
Figure 4.25: (a) Column loads (b) beam loads for load combination 1.4G+1.4W (wind flow perpendicular to 60m side)	83
Figure 4.26: (a) Column loads (b) beam loads for wind load only (wind flow perpendicular to 60m side)	84
Figure 4.27: (a) Column loads (b) beam loads for load combination 1.2G+1.2Q+1.2W (wind flow perpendicular to 30m side)	84
Figure 4.28: (a) Column loads (b) beam loads for load combination 1.0G+1.4W (wind flow perpendicular to 30m side)	85
Figure 4.29: (a) Column loads (b) beam loads for load combination 1.4G+1.4W (wind flow perpendicular to 30m long side)	85
Figure 4.30: (a) Column loads (b) beam loads for wind loads only (wind flow perpendicular to 30m long side)	86
Figure 4.31: (a) column loads (b) beam loads for load combination 1.2G+1.2Q+1.2W (wind flow perpendicular to 46m long side)	87
Figure 4.32: (a) column loads (b) beam loads for load combination 1.0G+1.4W (wind flow perpendicular to 46m long side)	87
Figure 4.33: (a) column loads (b) beam loads for load combination 1.4G+1.4W (wind flow perpendicular to 46m long side)	88
Figure 4.34: (a) column loads (b) beam loads for wind load only (wind flow perpendicular to 46m long side)	88
Figure 4.35: (a) column loads (b) beam loads for load combination 1.2G+1.2Q+1.2W (wind flow perpendicular to 30m long side)	89
Figure 4.36: (a) column loads (b) beam loads for load combination 1.0G+1.4W (wind flow perpendicular to 30m long side)	89
Figure 4.37: (a) column loads (b) beam loads for load combination 1.4G+1.4W (wind flow perpendicular to 30m long side)	90
Figure 4.38: (a) column loads (b) beam loads for wind load only (wind flow perpendicular to 30m long side)	90
Figure 4.39: Base moment and base shear of the 48m building (a) wind flow perpendicular to 60 m wall (b) wind flow perpendicular to 30 m wall	91

Figure 4.40: Base moment and base shear of the 183m building (a) wind flow perpendicular to 46 m wall (b) wind flow perpendicular to 30 m wall	92
Figure 4.41: Maximum shell stress in shear walls of the 48m building (a) wind flow perpendicular to 60 m wall (b) wind flow perpendicular to 30 m wall	93
Figure 4.42: Maximum shell stress in shear wall of the 183m building (a) wind flow perpendicular to 46 m wall (b) wind flow perpendicular to 30 m wall	93
Figure 5.1: Dimensions of the domain used in CFD simulation.	99
Figure 5.2: Sub regions in the turbulent boundary layer (www.fluentusers.com)	100
Figure 5.3: Mesh adopted in fluid domain for simulations	102
Figure 5.4: wind speed variation with height for different wind profiles.	107
Figure 5.5: Kinetic energy for different wind profiles	108
Figure 5.6: Energy dissipation rate for different wind profiles	109
Figure 5.7: C_p values on different sides of the building obtained from wind tunnel test	109
Figure 5.8: C_p values on different sides of the building obtained from simulating actual wind tunnel test data	110
Figure 5.9: C_p values on different sides of the building obtained from simulating power law wind profile data	110
Figure 5.10: C_p values on different sides of the building obtained from simulating log- law wind profile data	111

LIST OF TABLES

Table 2.1: Time, situation and origin of cyclone in 1900 – 2000(Cyclone event 1900-2000)	10
Table 2.2: Cyclone damages in 1978 – 2008 period(www.desinventar.com)	11
Table 2.3: Damages due to Strong winds and gale forces www.desinventar.lk)	12
Table 2.4: Drift limits for non – structure elements (Cooney and King ,1988)	15
Table 2.5: Human perception levels (Irwin, 1978)	16
Table 2.6: Annual risk exceedence for structures (Kaspersky, 2009)	23
Table 2.8: Three second gust velocities used for different areas of Sri Lanka (Design manual “Design building for high winds”, 1978)	31
Table 3.1: Values of ‘k’ for Sri Lanka (Design manual design building for high winds Sri Lanka, 1978)	37
Table 3.2: Building type factor K_b (BS 6399.2:1997)	39
Table 3.3: Structural Importance Multiplier (M_i) (AS 1170.2:1989)	44
Table 3.4: Values of fraction of critical damping of structures (ζ) (AS 1170.2:1989)	46
Table 3.5: Mode shape exponent values (AS 1170.2:1989)	47
Table 4.1: Basic wind speeds with different averaging time	65
Table 4.2: 3 second gust wind speeds for different return periods, obtained from probability curve for BS 6399.2:1997	66
Table 4.3: S_p and S_p^2 values for wind speeds with different return periods for zone 1,2 and 3	67
Table 4.4: Importance level of buildings and structures (Building Code of Australia, 2007)	70
Table 4.5: Comparison of wind pressure at 183m height in zone 3	73
Table 4.6: External and internal pressure coefficient	77
Table 4.7: Drift index for 48m and 183 m height buildings in zone 1, 2 and 3	94
Table 4.8: Wind speeds used for acceleration calculations	95
Table 4.9: Acceleration values at 183 m height in zone 1, 2 and 3	96
Table 5.1: Wall functions and location of the first cell (www.fluentusers.com)	101
Table 5.2: wind speed data for different wind profiles	106
Table 5.3: Turbulence kinetic energy, energy dissipation rate	108