



MALAYSIAN STANDARD

MS 1553 : 2002

CODE OF PRACTICE ON WIND LOADING FOR BUILDING STRUCTURE

ICS : 91.090

Descriptors : building structure, wind loading, wind action, wind speed, wind pressure, site exposure multipliers, shape factor

© Copyright

DEPARTMENT OF STANDARDS MALAYSIA

DEVELOPMENT OF MALAYSIAN STANDARDS

The **Department of Standards Malaysia (DSM)** is the national standardisation and accreditation body.

The main function of the Department is to foster and promote standards, standardisation and accreditation as a means of advancing the national economy, promoting industrial efficiency and development, benefiting the health and safety of the public, protecting the consumers, facilitating domestic and international trade and furthering international cooperation in relation to standards and standardisation.

Malaysian Standards are developed through consensus by committees which comprise of balanced representation of producers, users, consumers and others with relevant interests, as may be appropriate to the subject in hand. To the greatest extent possible, Malaysian Standards are aligned to or are adoption of international standards. Approval of a standard as a Malaysian Standard is governed by the Standards of Malaysia Act 1996 (Act 549). Malaysian Standards are reviewed periodically. The use of Malaysian Standards is voluntary except in so far as they are made mandatory by regulatory authorities by means of regulations, local by-laws or any other similar ways.

The Department of Standards appoints **SIRIM Berhad** as the agent to develop Malaysian Standards. The Department also appoints SIRIM Berhad as the agent for distribution and sale of Malaysian Standards.

For further information on Malaysian Standards, please contact:

Department of Standards Malaysia
Level 1 & 2, Block C4, Parcel C
Federal Government Administrative Centre
62502 Putrajaya
MALAYSIA

Tel: 60 3 88858000
Fax: 60 3 88885060

<http://www.dsm.gov.my>

E-mail: central@dsm.gov.my

OR **SIRIM Berhad**
(Company No. 367474 - V)
1, Persiaran Dato' Menteri
P.O. Box 7035, Section 2
40911 Shah Alam
Selangor D.E.

Tel: 60 3 5544 6000
Fax: 60 3 4410 8095

<http://www.sirim.my>

CONTENTS

	Page
Committee representation.....	v
Foreword.....	vi

SECTION 1 : GENERAL

1.1	Scope.....	1
1.2	Application.....	1
1.3	Referenced documents.....	1
1.4	Determination of wind actions.....	1
1.5	Units.....	2
1.6	Definitions.....	2
1.7	Notation.....	6

SECTION 2 : CALCULATION OF WIND ACTIONS

2.1	General.....	14
2.2	Site wind speed.....	14
2.3	Design wind speed.....	15
2.4	Design wind pressure.....	15
2.5	Wind actions.....	16
2.6	Wind tunnel procedure.....	17
2.7	Wind induced vibrations.....	18

SECTION 3 : WIND SPEEDS

3.1	General.....	19
3.2	Station wind speeds.....	19

SECTION 4 : SITE EXPOSURE MULTIPLIERS

4.1	General.....	22
4.2	Terrain/height multiplier, $m_{z,cat}$	22
4.3	Shielding multiplier, m_s	25
4.4	Hill shape multiplier, m_h	26

SECTION 5 : AERODYNAMIC SHAPE FACTOR

5.1	General.....	29
5.2	Evaluation of aerodynamic shape factor.....	30
5.3	Internal pressure for enclosed buildings.....	31
5.4	External pressures for enclosed buildings.....	33
5.5	Frictional drag forces for enclosed buildings.....	41

CONTENTS (continued)

Page

SECTION 6 : DYNAMIC RESPONSE FACTOR

6.1	Evaluation of dynamic response factor.....	43
6.2	Along-wind response of tall buildings and towers.....	43
6.3	Cross wind response.....	47
6.4	Combination of along wind and crosswind response.....	53

Tables

3.1	Wind speed for various return period.....	19
3.2	Importance factor, I	21
4.1	Terrain/height multipliers for gust wind speeds in fully developed terrain. Serviceability limit state design and ultimate limit state.....	23
4.2	Roughness lengths for terrain categories.....	24
4.3	Shielding multiplier, M_s	25
4.4	Hill-shape multiplier at crest ($ x = 0$), $z = 0$ (for gust wind speeds).....	28
5.1	Internal pressure, coefficients, $C_{p,i}$, for buildings with open interior plan.....	32
5.2	Wall : External pressure coefficients, $C_{p,e}$ for rectangular enclosed buildings ...	35
5.3	Roofs : External pressure coefficients, $C_{p,e}$ for rectangular enclosed buildings ...	36
5.4	Area reduction factor, K_a	37
5.5	Action combination factors for wind pressure contributing from two or more building surfaces to effects on major structural elements.....	37
5.6	Local pressure factor, K_l	39
5.7	Reduction factor, K_r , due to parapets.....	40
5.8	Porous cladding reduction factor, K_p	41
5.9	Frictional drag coefficient for $d/h > 4$ or $d/b > 4$	43
6.1	Turbulence intensity (I_z) ultimate limit state design and serviceability limit state design – all regions	45
6.2	Values of fraction critical damping of structures (ζ)	46
A1	Terrain height multiplier, $M_{z,cat}$	55
A2	External pressure coefficients $C_{p,e}$ for leeward wall	57
A3	External pressure coefficients $C_{p,e}$ for side walls	57
A4	For up-wind slope, u and down-wind slope, d for $\alpha < 10^\circ$ and R for gable roofs ..	57
A5	Up-wind slope, U , $\alpha \geq 10^\circ$	58
A6	Down-wind slope, D , $\alpha \geq 10^\circ$ and R for hip roofs	58
A7	Local pressure factor, K_l for claddings	58
C1	External pressure coefficients ($C_{p,e}$) for multi-span buildings: pitch roofs	64
C2	External pressure coefficients ($C_{p,e}$) for multi-span buildings: saw-tooth roofs...	64
C3	External pressure coefficients ($C_{p,e}$): curved roofs $h/r \leq 2$	65
C4	External pressure for roofs of circular bins, silos and tanks	69
D1	Local net pressure factors, K_l , for open structures	71
D2	Net pressure coefficients for hoardings and free standing walls	72
D3	Frictional drag coefficient	73
D4(a)	Net pressure coefficients, $C_{p,n}$ for monoslope free roofs($0.25 \leq h/d \leq 1$)	74
D4(b)	Net pressure coefficients, $C_{p,n}$ for monoslope free roofs with $\alpha \leq 5^\circ$ ($0.05 \leq h/d \leq 0.25$) or for all α and $\theta = 90^\circ$ and for long roofs	75
D5	Net pressures coefficients, $C_{p,n}$ for pitched free roofs($0.25 \leq h/d \leq 1$)	75

CONTENTS (continued)

	Page
D6 Net pressure coefficients, $C_{p,n}$ for troughed free roofs ($0.25 \leq h/d \leq 1$)	76
D7 Net pressure coefficients, $C_{p,n}$ for hypar free roofs (Empty under)	77
D8 Net pressure coefficients, $C_{p,n}$, for canopies and awnings attached to buildings (refer to Figure D6(a)) for $\theta = 0^\circ$	79
D9 Net pressure coefficients, $C_{p,n}$, for partially enclosed carports ($h_c/w_c \leq 0.5$)	80
E1 Aspect ratio correction factors, K_{ar}	82
E2 Shielding factors, K_{sh} , for multiple frames	84
E3 Drag force coefficient (C_d) for rounded circular shapes	85
E4 Drag force coefficient (C_d) for sharp-edge-prisms	86
E5 Force coefficients ($C_{F,x}$) and ($C_{F,y}$) for structural sections	87
E6 Drag force coefficients (C_d) for lattice towers	90
E7 Drag force coefficient (C_d) for UHF-antenna sections	91
F1 Aerodynamic shape factor for circular shapes	96

Figures

2.1 Reference to height of structure	16
3.1 Peninsular Malaysia	20
4.1 Changes in terrain	25
4.2 Hills and ridges	27
4.3 Escarpments	28
4.4 Separation zone for slopes greater than 0.44	28
5.1 Sign conventions for C_{fig}	30
5.2 Parameters for rectangular enclosed buildings	34
5.3 Local pressure factor, (K_l)	40
5.4 Notation for permeable surfaces	41
6.1 Notation for heights	43
6.2 Cross wind force spectrum coefficient for 3:1:1 square section	49
6.3 Cross wind force spectrum coefficient for 6:1:1 square section	50
6.4 Cross wind force spectrum coefficient for 6:2:1 rectangular section	50
6.5 Cross wind force spectrum coefficient for 6:1:2 rectangular section	51
A1 Peninsula Malaysia	56
A2 Local pressure factors (K_l)	59
B1 Information in using this standard	60
B2 Determination of design wind speed	61
B3 Determination of design wind pressure using simplified procedure	62
C1. External pressure coefficients ($C_{p,e}$) for mult	63
C2 External pressure coefficient ($C_{p,e}$) for multi-span building : saw-tooth roofs	64
C3 External pressure coefficients ($C_{p,e}$) : curved roofs	65
C4 External pressure coefficients ($C_{p,e}$) for mansard roofs	66
C5 External pressure coefficients ($C_{p,b}$) on walls of circular bins, silos and tanks ($0.25 \leq c/b \leq 4.0$)	67
C6 Plot of external pressure coefficient ($C_{p,i}$) on walls of circular bins, silos and tanks ($c/b = 1$)	68
C7 External pressure coefficients ($C_{p,e}$) on walls of circular bins, silos and tanks ($0.25 < c/b < 4.0$)	69
D1 Free standing hoardings and walls	72

CONTENTS *(continued)*

		Page
D2	Monoslope free roofs	75
D3	Pitched free roofs	76
D4	Troughed free roofs	76
D5	Hyperbolic paraboloid (hypar) roofs	77
D6	Net pressure coefficients, $C_{p,n}$, for canopies, awnings and carports attached to buildings	79
D7	Cantilevered roof and canopy	80
E1	Notation for frame dimensions	83
E1(a)	Along-wind coefficients for rectangular prisms	88
E1(b)	Cross-wind coefficients for rectangular prisms	89
E2	Drag force coefficients (C_d) for sections of UHF antenna	92
E3	Tower sections with ancillaries	94
F1	Reference area for flags	95
Appendices		
A	Simplified procedure.....	54
B	Flow chart.....	60
C	Additional pressure coefficients for enclosed buildings.....	63
D	Free standing walls, hoardings and canopies.....	70
E	Aerodynamic shape factors for exposed structural members.....	81
F	Flags and circular shapes.....	95

Committee representation

The Building and Civil Engineering Industry Standards Committee (ISC D) under whose supervision this Malaysian Standard was developed, comprises representatives from the following organisations:

Association of Consulting Engineers Malaysia
Chartered Institute of Buildings Malaysia
Construction Industry Development Board Malaysia
Department of Standards Malaysia
Jabatan Bomba dan Penyelamat Malaysia
Malaysian Timber Industry Board
Master Builders Association Malaysia
National Housing Department
Public Works Department
Pertubuhan Aritek Malaysia
Suruhanjaya Tenaga
The Institution of Engineers, Malaysia
Universiti Teknologi Malaysia

The Technical Committee on Structure Loading which supervised the development of this standard was managed by the Construction Industry Development Board Malaysia (CIDB) in its capacity as an authorised Standard-Writing Organisation and comprises the following organisations:

Association of Consulting Engineers Malaysia
Construction Industry Development Board Malaysia
Jabatan Kerja Raya
Jabatan Perkhidmatan Kajiucua Malaysia
Pertubuhan Aritek Malaysia
SIRIM Berhad
The Institution of Engineers Malaysia
Universiti Kebangsaan Malaysia
Universiti Malaya
Universiti Sains Malaysia
Universiti Teknologi MARA

MS 1553 : 2002

Committee representation

The Working Group (CIDB/SWO-TC2/WG1) on Academic and Research of **Code Of Practice On Wind Loading For Building Structure** which developed this Malaysian Standard consists of representative from the following organisations:

Association of Consulting Engineers Malaysia
Construction Industry Development Board Malaysia
GR Associates
Jabatan Perkhidmatan Kajiucua Malaysia
Monash University Malaysia
Universiti Kebangsaan Malaysia
Universiti Malaya
Universiti Sains Malaysia
Universiti Teknologi MARA

The Working Group (CIDB/SWO-TC2/WG2) on Development of **Code of Practice on Wind Loading for Building Structure** that developed this Malaysian Standard consists of representative from the following organisations:

Association of Consulting Engineers Malaysia
GR Associates
Jabatan Perkhidmatan Kajiucua Malaysia
Construction Industry Development Board Malaysia
Monash University Malaysia
Universiti Kebangsaan Malaysia
Universiti Malaya
Universiti Sains Malaysia
Universiti Teknologi MARA