DIN EN 1991-1-4:2010-12 (E)

Eurocode 1: Actions on structures – Part 1-4: General actions – Wind actions (includes Amendment A1:2010 + Corrigendum AC:2010) English translation of DIN EN 1991-1-4:2010-12

Content	S	Page
Foreword to	D EN 1991-1-4:2005	5
A) Forewor	d to EN 1991-1-4:2005/A1:2010	5
Section 1	General	10
1.1 Scop		10
	ative references	11
1.3 Assu		11
	iction between Principles and Application Rules	11
	in assisted by testing and measurements	11
1.6 Defin		11
1.7 Symb		12
-		17
	Design situations	
	Modelling of wind actions	18
3.1 Natur	-	18
	esentations of wind actions	18
	ification of wind actions	18
	acteristic values	18
3.5 Mode	ls	18
Section 4	Wind velocity and velocity pressure	19
4.1 Basis	for calculation	19
4.2 Basic	values	19
4.3 Mean	wind	20
4.3.1	Variation with height	20
4.3.2	Terrain roughness	20
4.3.3	Terrain orography	22
	Large and considerably higher neighbouring structures	22
	Closely spaced buildings and obstacles	23
-	turbulence	23
4.5 Peak	velocity pressure	23
Section 5	Wind actions	25
5.1 Gene	ral	25
5.2 Wind	pressure on surfaces	25
5.3 Wind	forces	26
Section 6	Structural factor c _S cd	29
6.1 Gene	ral	29
	mination of c _s c _d	29
	led procedure	29
	Structural factor $c_s c_d$	29
	Serviceability assessments	31
	Wake buffeting	31
Section 7	Pressure and force coefficients	32
7.1 Gene		32
	Choice of aerodynamic coefficient	32
	Asymmetric and counteracting pressures and forces	33
7.1.2	Effects of ice and snow	33
	sure coefficients for buildings	34
7.2.1 General		34
	Vertical walls of rectangular plan buildings	34
	Flat roofs	38
	Monopitch roofs	41
	Duopitch roofs	44
	Hipped roofs	48
	Multispan roofs	40
	Vaulted roofs and domes	43 51

7.2.9 Internal pressure 7.2.10 Pressure on walls or roofs with more than one skin 7.3 Canopy roofs	52 54 55
7.4 Free-standing walls, parapets, fences and signboards	62
7.4.1 Free-standing walls and parapets	62
7.4.2 Shelter factors for walls and fences	64
7.4.3 Signboards 7.5 Friction coefficients	64 65
7.6 Structural elements with rectangular sections	66
7.7 Structural elements with sharp edged section	68
7.8 Structural elements with regular polygonal section	68
7.9 Circular cylinders	70
7.9.1 External pressure coefficients	70
7.9.2 Force coefficients	72
7.9.3 Force coefficients for vertical cylinders in a row arrangement	75
7.10 Spheres	75
7.11 Lattice structures and scaffoldings 7.12 Flags	77
7.12 Flags 7.13 Effective slenderness λ and end-effect factor ψ_{λ}	79 81
Section 8 Wind actions on bridges	83
8.1 General	83
8.2 Choice of the response calculation procedure 8.3 Force coefficients	86 86
8.3.1 Force coefficients in x-direction (general method)	86
8.3.2 Force in <i>x</i> -direction – Simplified Method	89
8.3.3 Wind forces on bridge decks in z-direction	90
8.3.4 Wind forces on bridge decks in y-direction	91
8.4 Bridge piers	92
8.4.1 Wind directions and design situations	92
8.4.2 Wind effects on piers	92
Annex A (informative) Terrain effects A.1 Illustrations of the upper roughness of each terrain category A.2 Transition between roughness categories 0, I, II, III and IV A.3 Numerical calculation of orography coefficients A.4 Neighbouring structures A.5 Displacement height	93 93 94 96 101 102
Annex B (informative) Procedure 1 for determining the structural factor c _s c _d B.1 Wind turbulence	103 103
B.2 Structural factor	104
B.3 Number of loads for dynamic response	106
B.4 Service displacement and accelerations for serviceability assessments of a vertical structure	106
Annex C (informative) Procedure 2 for determining the structural factor $c_s c_d$	109
C.1 Wind turbulence	109
C.2 Structural factor	109
C.3 Number of loads for dynamic response C.4 Service displacement and accelerations for serviceability assessments	110 110
Annex D (informative) $c_s c_d$ values for different types of structures	112
Annex E (informative) Vortex shedding and aeroelastic instabilities E.1 Vortex shedding	115 115
E.1.1 General	115
E.1.2 Criteria for vortex shedding	115
E.1.3 Basic parameters for vortex shedding	116
E.1.4 Vortex shedding action	119
E.1.5 Calculation of the cross wind amplitude	119
E.1.6 Measures against vortex induced vibrations	129
E.2 Galloping	130
E.2.1 General	130

E.2.2 Onset wind velocity	130
E.2.3 Classical galloping of coupled cylinders	132
E.3 Interference galloping of two or more free standing cylinders	134
E.4 Divergence and Flutter	135
E.4.1 General	135
E.4.2 Criteria for plate-like structures	135
E.4.3 Divergency velocity	135
Annex F (informative) Dynamic characteristics of structures	137
F.1 General	137
F.2 Fundamental frequency	137
F.3 Fundamental mode shape	142
F.4 Equivalent mass	144
F.5 Logarithmic decrement of damping	144
Bibliography	147