NATIONAL ANNEX

UK National Annex to Eurocode 1 – Actions on structures

Part 1-4: General actions – Wind actions

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National Annex (informative) to BS EN 1991-1-4:2005, Eurocode 1 – Actions on structures – Part 1-4: General actions – Wind actions

Introduction

This National Annex has been prepared by BSI Subcommittee B/525/1, *Actions (loadings) and basis of design.* In the UK it is to be used in conjunction with BS EN 1991-1-4:2005.

NA.1 Scope

This National Annex gives:

a) the UK decisions for the Nationally Determined Parameters or alternative procedures in the following clauses of BS EN 1991-1-4:2005:

– **1.1** (11) Note 1
– **1.5** (2)
– **4.1** (1)
– **4.2** (1)P Note 2
– **4.2** (2)P Notes 1, 2, 3 and 5
– **4.3.1** (1) Notes 1 and 2
– **4.3.2** (1)
– **4.3.2** (2)
– **4.3.3** (1)
– **4.3.4** (1)
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– **4.4** (1) Note 2
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– **5.3** (5)
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– **7.6** (1) Note 1
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– **7.11** (1) Note 2
– **7.13** (1)
– **7.13** (2)
– **8.1** (1) Notes 1 and 2
– **8.1** (4)
– **8.1** (5)
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– **8.3.3** (1) Note 1
– **8.3.4** (1)
– **8.4.2** (1) Note 1
– **A.2** (1)
– **E.1.3.3** (1)
– **E.1.5.1** (1) Notes 1 and 2
– **E.1.5.1** (3)
– **E.1.5.2.6** (1) Note 1
– **E.1.5.3** (2) Note 1
– **E.1.5.3** (4)
– **E.1.5.3** (6)
– **E.3** (2)

b) the UK decision on the status of BS EN 1991-1-4:2005, informative Annexes A, B, C, D, E and F; and

c) references to non-contradictory complementary information.

NOTE The advisory note at the end of this National Annex provides valuable additional information related to the determination of wind pressures.

In calibration carried out in the UK, BS EN 1991-1-4, ***7.2.3*** *to* ***7.2.6*** *have been found sometimes to give significantly different pressures than are obtained when using BS 6399-2; the advisory note to this National Annex has been drafted in order to advise users on how to maintain the current levels of safety and economy of construction.*

NA.2 Nationally Determined Parameters

NA.2.1 Guidance for design of torsional vibrations, bridge deck vibrations, cable supported bridges, higher order modes of vibration [BS EN 1991-1-4:2005, 1.1 (11) Note 1]

No additional guidance is given for torsional vibrations, e.g. for tall buildings with relatively low torsional frequencies and/or a significantly offset shear centre.

For bridge deck vibrations from transverse wind turbulence, the procedures given in background paper PD 6688-1-4[1)] should be used.

For cable supported bridges, no additional guidance on wind actions and response is given in this National Annex.

For buildings and bridges where more than the fundamental transverse or lateral modes need to be considered, specialist advice should be sought.

NA.2.2 Guidance on design assisted by testing and measurements [BS EN 1991-1-4:2005, 1.5 (2)]

NA.2.2.1 Static building structures

Tests for the determination of wind loads on static structures should not be considered to have been properly conducted unless:

a) the natural wind has been modelled to account for:

- the variation of mean wind speed with height above ground appropriate to the terrain of the site; and
- the intensity and scale of the turbulence appropriate to the terrain of the site at a determined geometric scale;

b) the building has been modelled at a geometric scale not more than the following multiples of the geometric scale of the simulated natural wind, with appropriate corrections applied to account for any geometric scale discrepancies within this range:

- 3 for overall loads; and
- 2 for cladding loads;

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1) In preparation.

c) the response characteristics of the wind tunnel instrumentation are consistent with the measurements to be made;

d) the tests enable the peak wind loads with the required annual risk of being exceeded to be predicted.

Further guidance on wind tunnel testing can be obtained from *The designer's guide to wind loading of building structures – Part 2: Static structures* [1], *Wind tunnel studies of buildings and structures* [2] and PD 6688-1-4[2)].

NA.2.2.2 Dynamic building structures

Tests for the determination of the response of dynamic structures should not be considered to have been properly conducted unless the provisions for static structures in items a) to d) are satisfied, together with the additional provision that the structural model is represented (physically or mathematically) in mass distribution, stiffness and damping in accordance with the established law of dimensional scaling.

Further guidance on wind tunnel testing can be obtained from references: *The designer's guide to wind loading of building structures – Part 2: Static structures* [1], *Wind tunnel studies of buildings and structures* [2] and PD 6688-1-4[2)].

NA.2.3 National climatic information from which the mean wind velocity and peak velocity pressure may be directly obtained for the terrain categories considered [BS EN 1991-1-4:2005, 4.1 (1) – Note]

See ***NA.2.17***.

NA.2.4 The fundamental value of the basic wind velocity $v_{b,0}$ [BS EN 1991-1-4:2005, 4.2 (1)P Note 2]

The fundamental value of the basic wind velocity $v_{b,0}$ should be determined from Equation NA.1.

$$v_{b,0} = v_{b,map} c_{alt} \qquad \text{(NA.1)}$$

where

$v_{b,map}$ is the value of the fundamental basic wind velocity before the altitude correction is applied. $v_{b,map}$ is given in Figure NA.1;

c_{alt} is the altitude factor given in **NA.2.5**.

2) In preparation.

NA.2.5 Procedure for determining the influence of altitude [BS EN 1991-1-4:2005, 4.2 (2)P Note 1]

The altitude factor c_{alt} should be determined from Equations NA.2a) or NA.2b).

(NA.2a)) $c_{alt} = 1 + 0{,}001 \cdot A$ for $z \leqslant 10$ m)

(NA.2b)) $c_{alt} = 1 + 0{,}001 \cdot A \cdot (10/z)^{0.2}$ for $z > 10$ m

where

A is the altitude of the site in metres above mean sea level;

z is either z_s as defined in BS EN 1991-1-4:2005 Figure 6.1 or z_e the height of the part above ground as defined in BS EN 1991-1-4:2005 Figure 7.4.

NOTE Equation NA.2a) may be used conservatively for any building height.

Where there is significant orography, as defined by the shaded zones in Figure NA.2, A should be taken as the altitude of the upwind base of the orographic feature for each wind direction considered.

NA.2.6 Directional factor, c_{dir} [BS EN 1991-1-4:2005, 4.2 (2)P Note 2]

The directional factor c_{dir} is given in Table NA.1.

Table NA.1 **Directional factor c_{dir}**

Direction	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
c_{dir}	0,78	0,73	0,73	0,74	0,73	0,80	0,85	0,93	1,00	0,99	0,91	0,82

NOTE 1 Interpolation may be used within Table NA.1.

NOTE 2 The directions are defined by angles from due North in a clockwise direction.

NOTE 3 Where the wind loading on a building is assessed only for orthogonal load cases, the maximum value of the factor for the directions that lie ± 45° either side of the normal to the face of the building is to be used.

NOTE 4 Conservatively, c_{dir} may be taken as 1,0 for all directions.

Figure NA.1 **Value of fundamental basic wind velocity $v_{b,map}$ (m/s) before the altitude correction is applied**

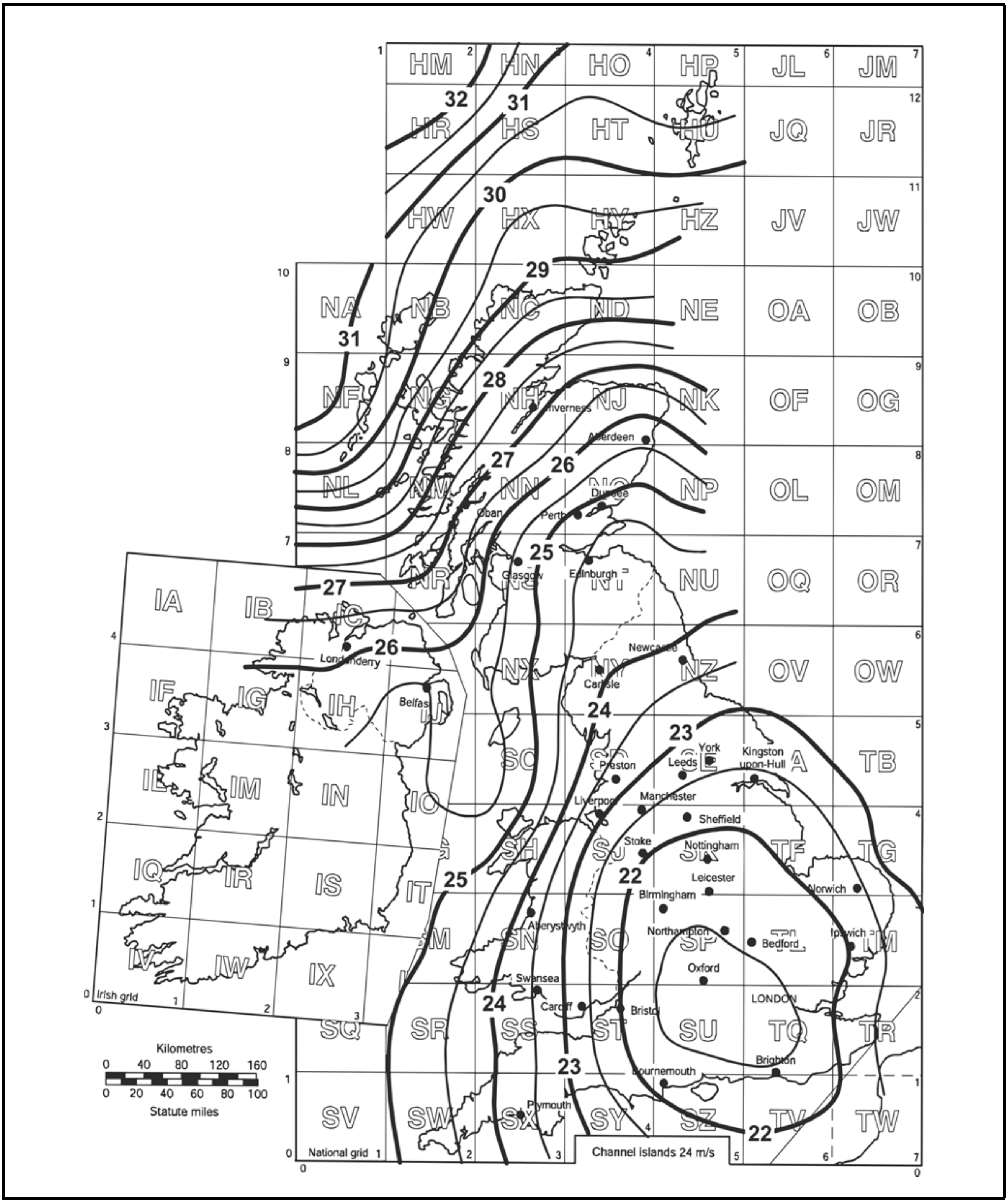
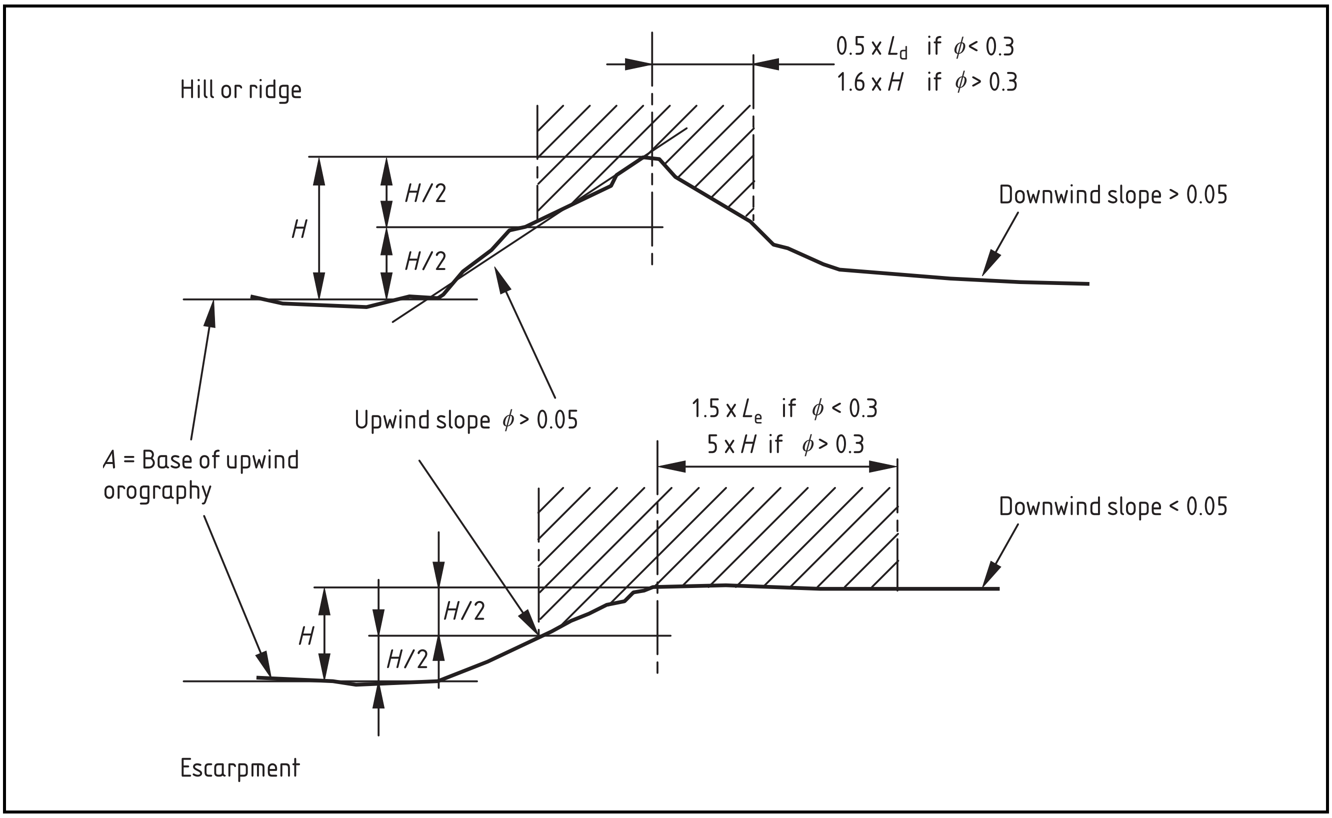


Figure NA.2 **Definition of significant orography (definition of symbols given in A.3(3))**



NA.2.7 Season factor, c_{season} [BS EN 1991-1-4:2005, 4.2 (2)P Note 3]

The season factor c_{season} is given in Table NA.2.

Table NA.2 **Season factor c_{season}**

<table>
<tr><th>Months</th><th>1 month</th><th colspan="2">2 months</th><th colspan="4">4 months</th></tr>
<tr><td>January</td><td>0,98</td><td rowspan="2">0,98</td><td></td><td rowspan="4">0,98</td><td></td><td rowspan="2"></td><td rowspan="3"></td></tr>
<tr><td>February</td><td>0,83</td><td rowspan="2">0,86</td><td rowspan="4">0,87</td></tr>
<tr><td>March</td><td>0,82</td><td rowspan="2">0,83</td><td rowspan="4">0,83</td></tr>
<tr><td>April</td><td>0,75</td><td rowspan="2">0,75</td><td rowspan="4">0,76</td></tr>
<tr><td>May</td><td>0,69</td><td rowspan="2">0,71</td><td rowspan="4">0,73</td></tr>
<tr><td>June</td><td>0,66</td><td rowspan="2">0,67</td><td rowspan="4">0,83</td></tr>
<tr><td>July</td><td>0,62</td><td rowspan="2">0,71</td><td rowspan="4">0,86</td></tr>
<tr><td>August</td><td>0,71</td><td rowspan="2">0,82</td><td rowspan="4">0,90</td></tr>
<tr><td>September</td><td>0,82</td><td rowspan="2">0,85</td><td rowspan="4">0,96</td></tr>
<tr><td>October</td><td>0,82</td><td rowspan="2">0,89</td><td rowspan="4">1,00</td></tr>
<tr><td>November</td><td>0,88</td><td rowspan="2">0,95</td><td rowspan="4">1,00</td></tr>
<tr><td>December</td><td>0,94</td><td rowspan="2">1,00</td><td rowspan="4">1,00</td></tr>
<tr><td>January</td><td>0,98</td><td rowspan="2">0,98</td><td rowspan="3"></td></tr>
<tr><td>February</td><td>0,83</td><td rowspan="2">0,86</td><td rowspan="2"></td></tr>
<tr><td>March</td><td>0,82</td><td></td><td></td></tr>
</table>

NOTE 1 The factor for the six month winter period October to March inclusive is 1,00 and for the six month summer period April to September inclusive is 0,84.

NOTE 2 These factors provide the 0,02 probability of exceedence for the period given (see ***3.4****).*

NA.2.8 Values of *K* and *n* used to determine the probability factor [BS EN 1991-1-4:2005, 4.2 (2)P Note 5]

The recommended values of shape factor $K = 0{,}2$ and exponent $n = 0{,}5$ are to be used.

NA.2.9 Orography factor $c_o(z)$ [BS EN 1991-1-4:2005, 4.3.1(1) Note 1]

The recommended procedure given in BS EN 1991-1-4:2005 **A.3** should be used.

NA.2.10 Design charts for $v_m(z)$ [BS EN 1991-1-4:2005, 4.3.1(1) Note 2]

Design charts for $v_m(z)$ are not provided.

NA.2.11 Procedure for determining the roughness factor $c_r(z)$ [BS EN 1991-1-4:2005, 4.3.2 (1)]

BS EN 1991-1-4:2005 Expressions (4.4) and (4.5) do not apply.

The classification of roughness categories has been simplified to give the following three terrain categories:

- Terrain category 0 is referred to as Sea;
- Terrain categories I and II have been considered together to give a single terrain category referred to as Country terrain;
- Terrain categories III and IV have been considered together to give a single terrain category referred to as Town terrain.

All inland lakes extending more than 1 km in the direction of wind and closer than 1 km upwind of the site should be treated as Sea.

The roughness factor $c_r(z)$ depends on upwind distance to sea and additionally on the distance upwind to the edge of the urban area for sites in Town terrain.

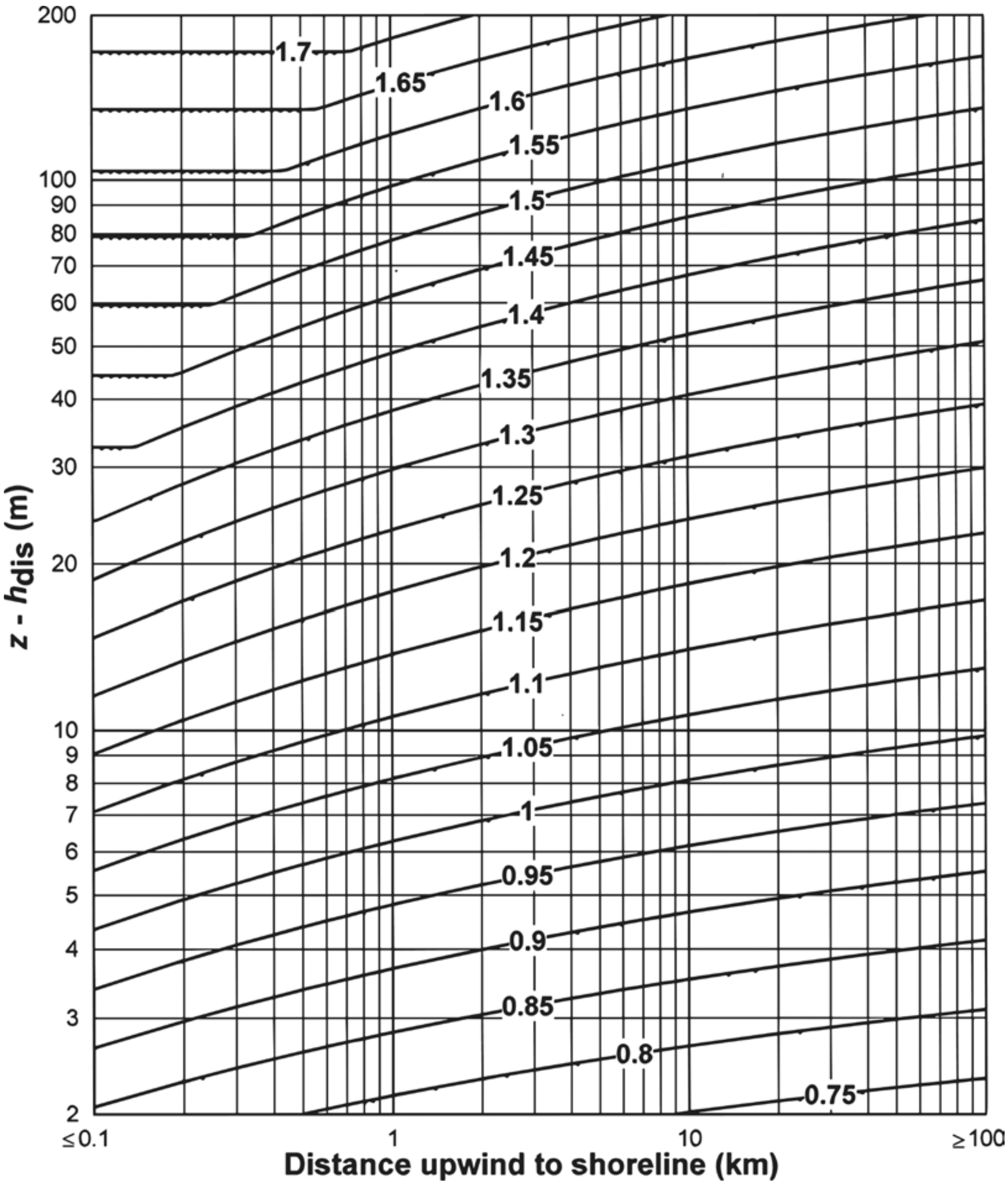
For sites in Country terrain, the roughness factor $c_r(z)$ given in Figure NA.3 should be used.

For sites adjacent to Sea terrain (sea or large inland lakes), the distance upwind from the shoreline should be taken as 0,1 km.

For sites in Town terrain, the roughness factor $c_r(z)$ given in Figure NA.3 should be multiplied by the roughness correction factor $c_{r,T}$ for Town terrain given in Figure NA.4.

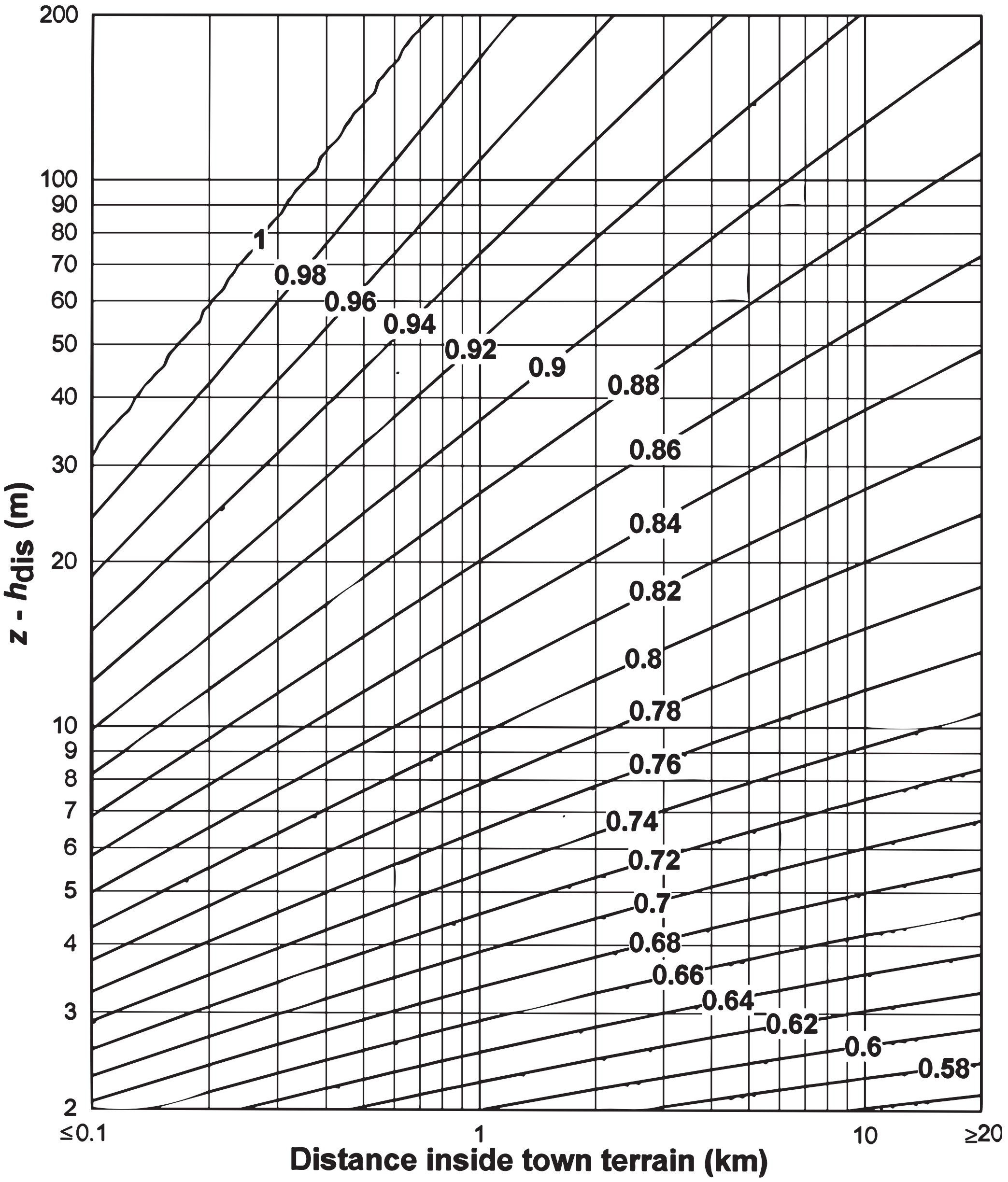
*NOTE The appropriate value of h_{dis} is to be used in Figure NA.3 and Figure NA.4. For sites in Country terrain, $h_{dis} = 0$. For sites in Town terrain, h_{dis} is given by BS EN 1991-1-4:2005 **A.5**.*

Figure NA.3 **Values of $c_r(z)$**



NOTE The height z is the height at which v_m is sought.

Figure NA.4 **Values of correction factor $c_{r,T}$ for sites in Town terrain**



NOTE The height z is the height at which v_m is sought.

NA.2.12 Procedure for determining the angular sector and upstream distance for the assessment of terrain roughness [BS EN 1991-1-4:2005, 4.3.2 (2) Note]

The recommended value of the angular sector should be used.

The recommended value of upstream distance in BS EN 1991-1-4:2005 **A.2** should not be used. Procedures given in this National Annex implicitly take into account the upstream distances of terrain and terrain changes.

NA.2.13 Procedure for determining the orography factor [BS EN 1991-1-4:2005, 4.3.3 (1)]

The recommended procedure in BS EN 1991-1-4:2005 **A.3** should be used for sites that lie in the shaded zones shown in Figure NA.2. Outside of these zones, the orography factor may be taken as 1,0 or can be calculated. When the orography factor is taken as 1,0, the altitude A should be taken as the site altitude.

NA.2.14 Effect of large and considerably taller neighbouring structures [BS EN 1991-1-4:2005, 4.3.4 (1)]

The recommended procedure in BS EN 1991-1-4:2005 **A.4** may be used.

NA.2.15 Effect of closely spaced buildings and obstacles [BS EN 1991-1-4:2005, 4.3.5 (1)]

The recommended procedure in BS EN 1991-1-4:2005 **A.5** may be used.

NA.2.16 Determination of the turbulence factor k_I [BS EN 1991-1-4:2005, 4.4 (1) Note 2]

Values for turbulence factor k_I on its own are not given. It is incorporated in a new term $I_v(z)_{flat}$.

$I_v(z)_{flat} = k_I/\ln((z - h_{dis})/z_0)$, values of which are given in Figure NA.5.

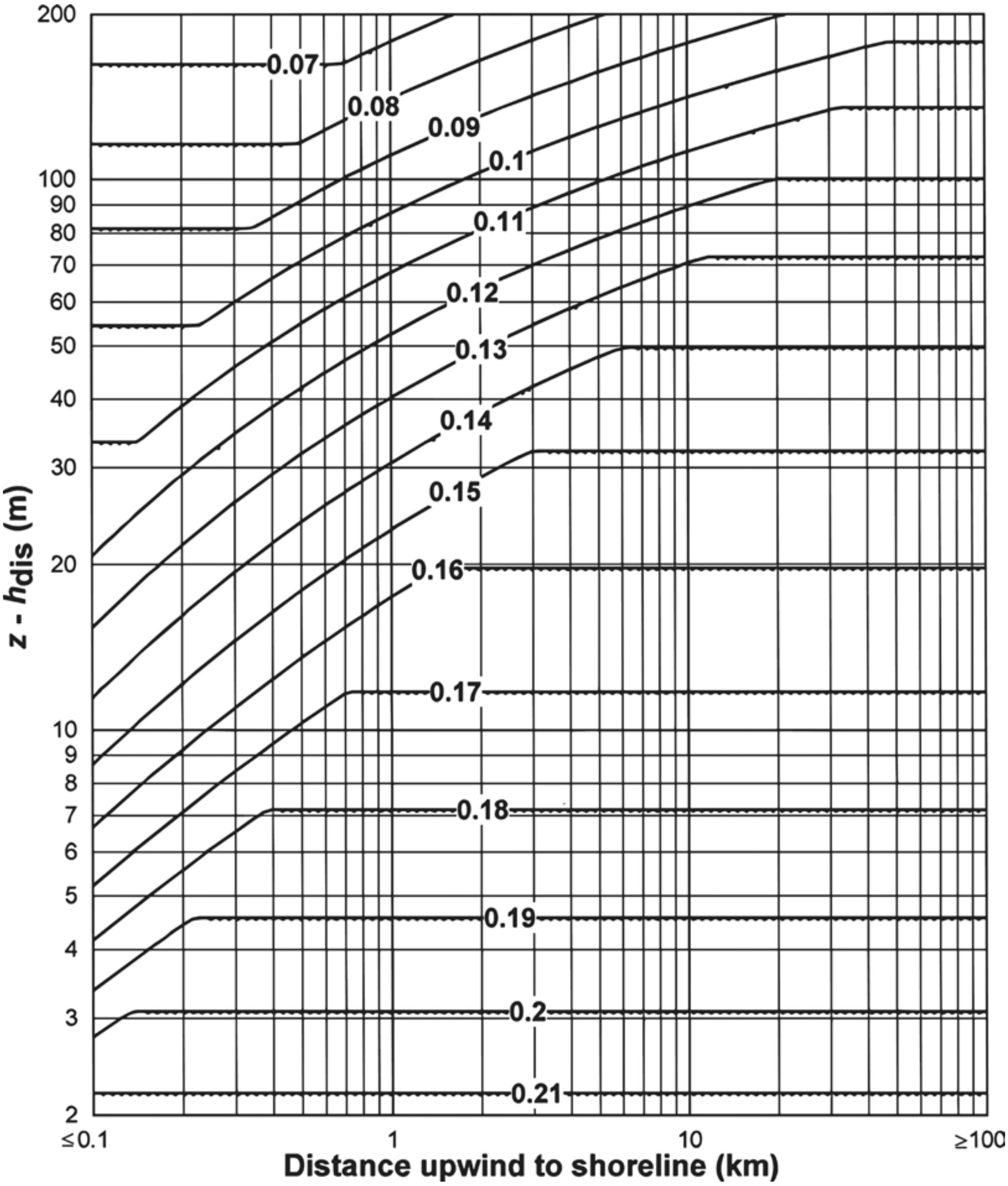
Where orography is not significant as defined by Figure NA.2: $I_v(z) = I_v(z)_{flat}$ for sites in Country terrain; and

$I_v(z) = I_v(z)_{flat}\ k_{I,T}$, for sites in Town terrain. $k_{I,T}$ is the turbulence correction factor for Town terrain, values of which are given in Figure NA.6.

Where orography is significant, the value obtained from Figure NA.5 should be divided by the orography factor c_o.

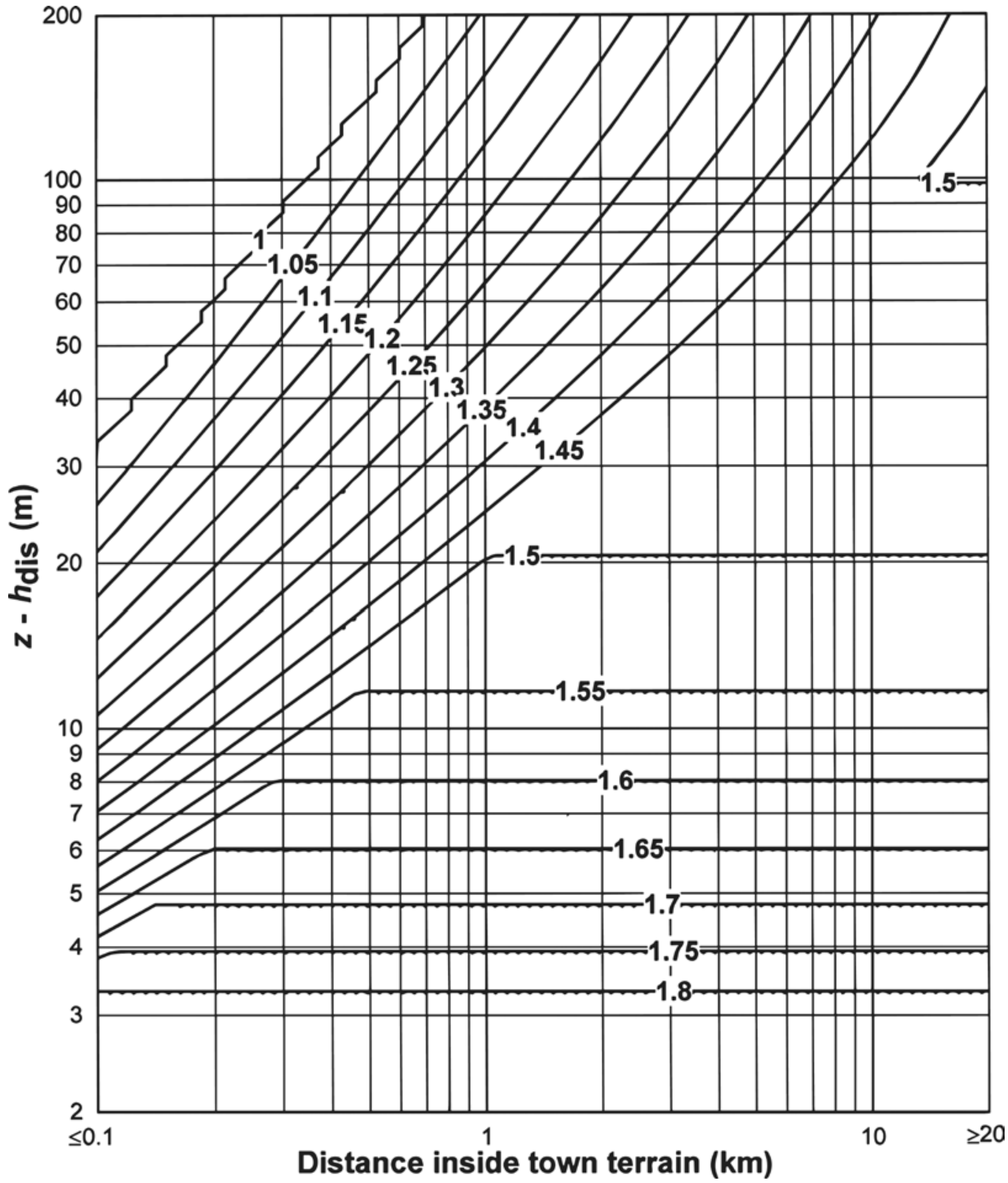
*NOTE The appropriate value of h_{dis} to be used in Figure NA.5 and Figure NA.6. h_{dis} is defined in BS EN 1991-1-4:2005 **A.5**.*

Figure NA.5 **Values of $I_v(z)_{flat}$**



NOTE The height z is the height at which q_p is sought using Expression NA.4b).

Figure NA.6 **Values of turbulence correction factor $k_{I,T}$ for sites in Town terrain**



*NOTE The height z is the height at which q_p is sought using Expression **NA.4**b).*

NA.2.17 Determination of peak velocity pressure, $q_p(z)$ [BS EN 1991-1-4:2005, 4.5 (1) Note 1]

BS EN 1991-1-4:2005 Expression (4.8) does not apply.

When orography is not significant as defined by Figure NA.2 (c_o = 1,0):

(NA.3a) $q_p(z) = c_e(z)q_b$ for sites in Country terrain; and

(NA.3b) $q_p(z) = c_e(z) \cdot c_{e,T} \cdot q_b$ for sites in Town terrain.

The values of exposure factor $c_e(z)$ are given in Figure NA.7 and the values of exposure correction factor for Town terrain $c_{e,T}$ are given in Figure NA.8.

When orography is significant:

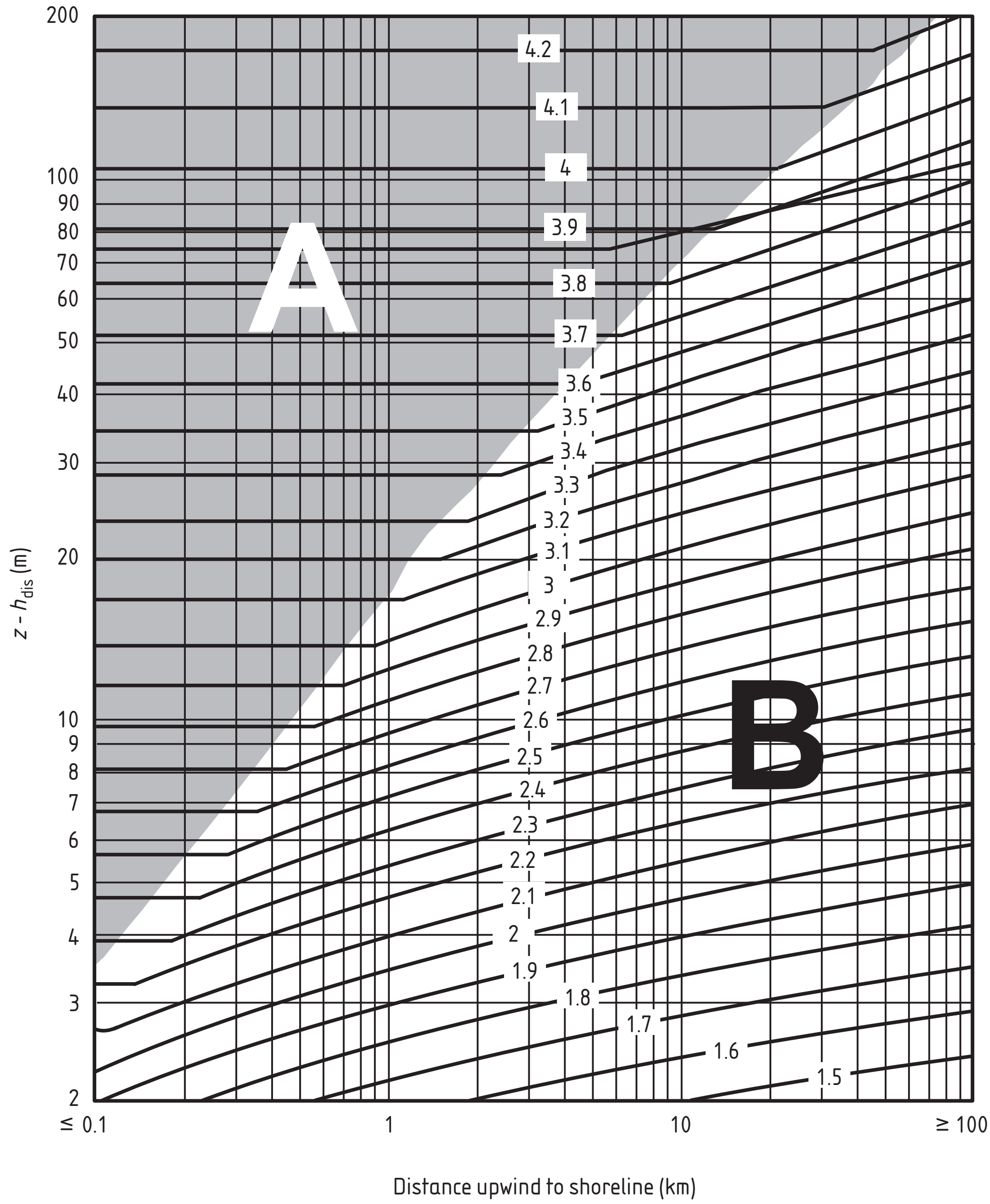
(NA.4a)) $q_p(z) = [\ q_p(z)$ from Equation NA.3a or NA.3b$] \cdot [(c_o(z) + 0.6)/1.6]^2$ for $z \leqslant 50$ m;

or

(NA.4b)) $q_p(z) = [1 + 3{,}0 \cdot I_v(z)]^2 \cdot 0.5 \cdot \rho \cdot v_m{}^2$ for $z > 50$ m.

Annex A to this National Annex shows flow diagrams for the determination of $q_p(z)$.

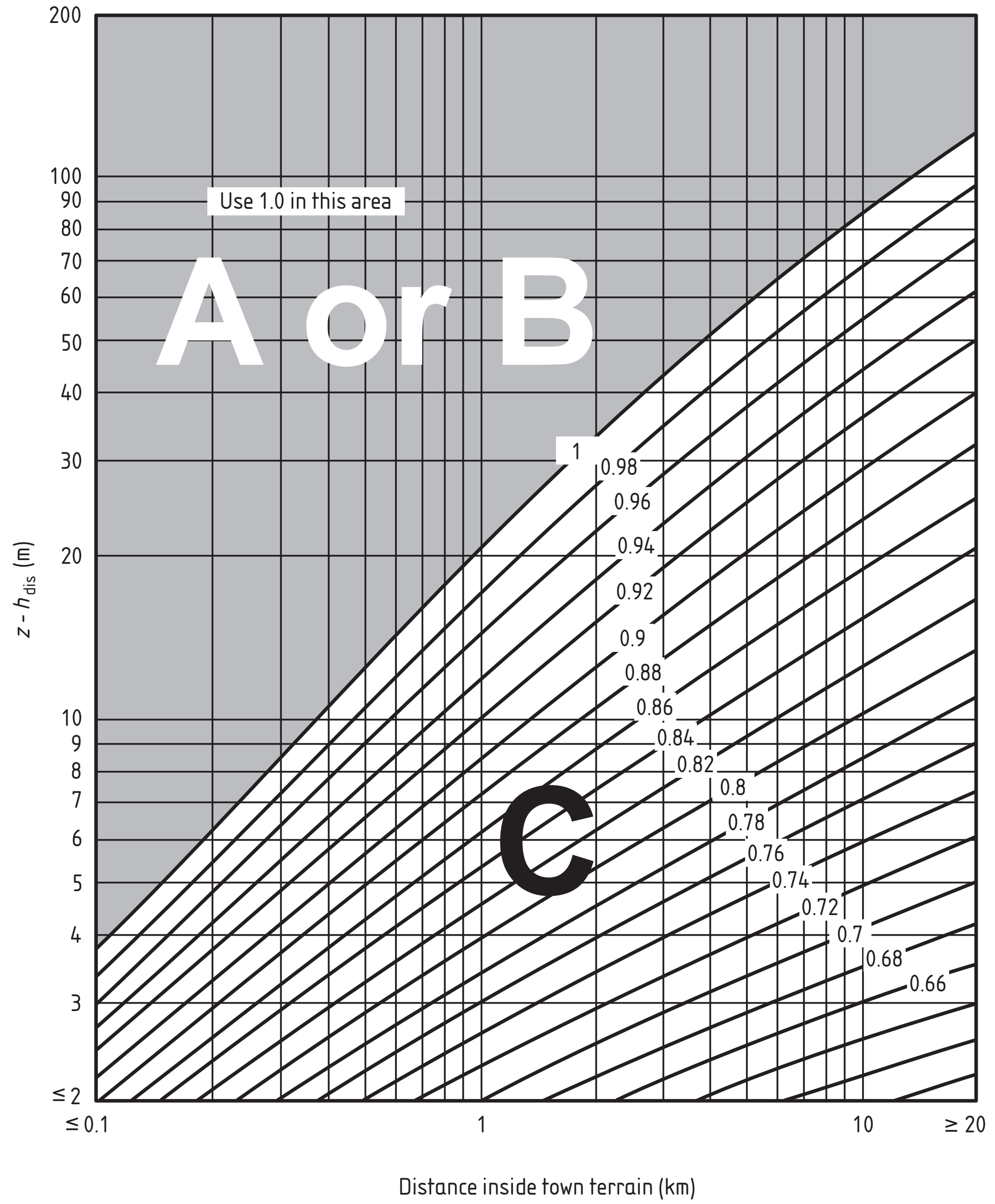
Figure NA.7 **Values of $c_e(z)$**



NOTE 1 The height z is the height at which q_p is sought using Equations NA.3a) or NA.3b).

NOTE 2 Zones A and B are indicated for use in Table NA.3.

Figure NA.8 **Values of exposure correction factor $c_{e,T}$ for sites in Town terrain**



NOTE 1 The height z is the height at which q_p is sought using Equation NA.3a) or NA.3b).

NOTE 2 Zones A, B and C are indicated for use in Table NA.3.

Table NA.3 **Size factor c_s for zones A, B and C indicated in Figure NA.7 and Figure NA.8**

$b + h$	$z - h_{dis}$ = 6 m			$z - h_{dis}$ = 10 m			$z - h_{dis}$ = 30 m			$z - h_{dis}$ = 50 m			$z - h_{dis}$ = 200 m		
m	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
1	0.99	0.98	0.97	0.99	0.99	0.97	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.99
5	0.96	0.96	0.92	0.97	0.96	0.93	0.98	0.97	0.95	0.98	0.98	0.96	0.98	0.98	0.98
10	0.95	0.94	0.88	0.95	0.95	0.90	0.96	0.96	0.93	0.97	0.96	0.94	0.98	0.97	0.97
20	0.93	0.91	0.84	0.93	0.92	0.87	0.95	0.94	0.90	0.95	0.95	0.92	0.96	0.96	0.95
30	0.91	0.89	0.81	0.92	0.91	0.84	0.94	0.93	0.88	0.94	0.93	0.90	0.96	0.95	0.93
40	0.90	0.88	0.79	0.91	0.89	0.82	0.93	0.91	0.86	0.93	0.92	0.88	0.95	0.94	0.92
50	0.89	0.86	0.77	0.90	0.88	0.80	0.92	0.90	0.85	0.92	0.91	0.87	0.94	0.94	0.91
70	0.87	0.84	0.74	0.88	0.86	0.77	0.90	0.89	0.83	0.91	0.90	0.85	0.93	0.92	0.90
100	0.85	0.82	0.71	0.86	0.84	0.74	0.89	0.87	0.80	0.90	0.88	0.82	0.92	0.91	0.88
150	0.83	0.80	0.67	0.84	0.82	0.71	0.87	0.85	0.77	0.88	0.86	0.79	0.90	0.89	0.85
200	0.81	0.78	0.65	0.83	0.80	0.69	0.85	0.83	0.74	0.86	0.84	0.77	0.89	0.88	0.83
300	0.79	0.75	0.62	0.80	0.77	0.65	0.83	0.80	0.71	0.84	0.82	0.73	0.87	0.85	0.80

b = cross wind breadth of building or building part or width of element

h = height of building or building part or length of element

z = height of building or height to top of element (or height of building part, subject to BS EN 1991-1-4:2005 **7.2.2** (1))
interpolation may be used

The zone A, B or C to be used for a building can be determined as follows:

For sites in country, it is determined with respect to distance from shore and ($z - h_{dis}$) using Figure NA.7.

For sites in town, using the distance into town and ($z - h_{dis}$) in Figure NA.8 it is first determined whether zone C applies. If not, zone A or B will apply depending on the distance of the site from shore and ($z - h_{dis}$) as shown in Figure NA.7.

NA.2.18 Value to be used for air density ρ [BS EN 1991-1-4:2005, 4.5 (1) Note 2]

The air density ρ should be taken as 1,226 kg/m^3.

NA.2.19 Procedure for determining lack of correlation between windward and leeward faces [BS EN 1991-1-4:2005, 5.3 (5)]

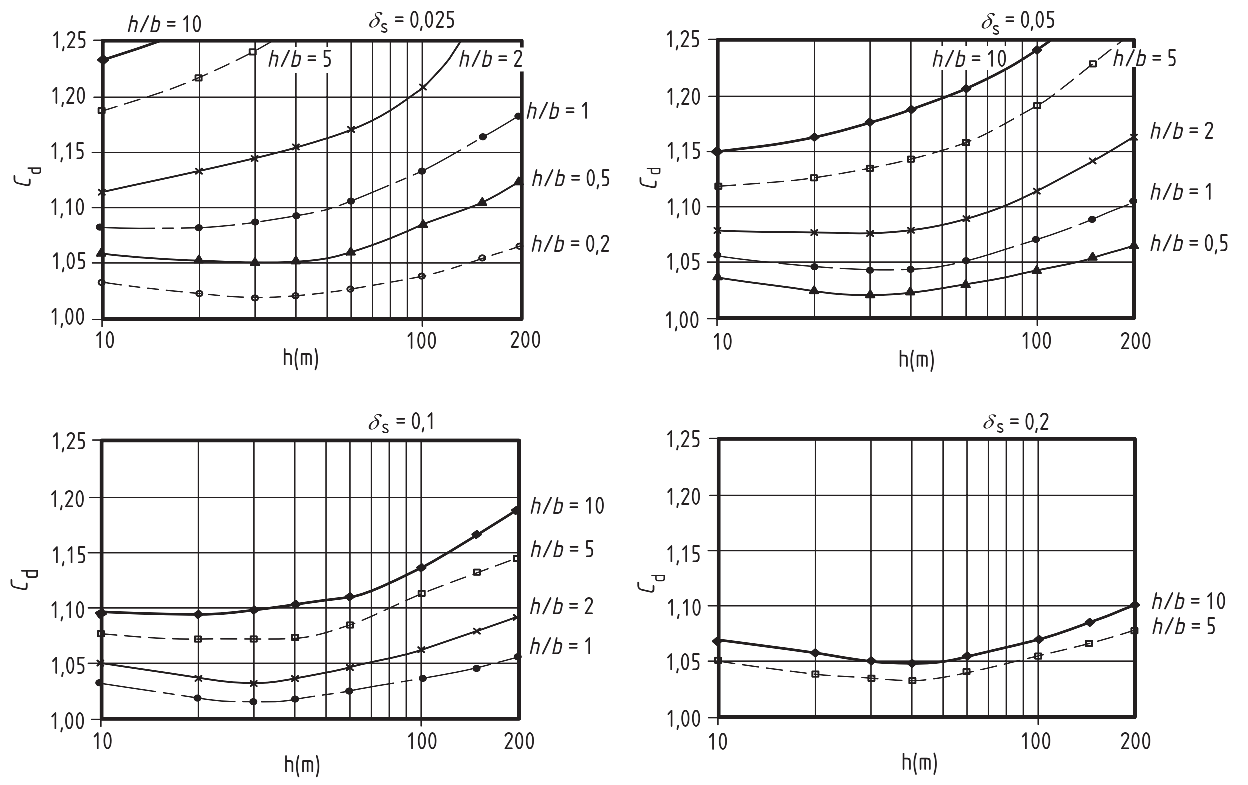
When determining overall loads on a structure from the vectorial summation of external pressure coefficients using BS EN 1991-1-4:2005 Expression (5.5), the rule given in BS EN 1991-1-4:2005 **7.2.2** (3) may be applied to the summation of the loads on all windward and leeward surfaces, i.e. the reduction factor may be applied to the horizontal force component from both the walls and the roof.

NA.2.20 Separation of the structural factor $c_s c_d$ into a separate size factor c_s and dynamic factor c_d [BS EN 1991-1-4:2005, 6.1 (1)]

The structural factor $c_s c_d$ may be separated in to a size factor c_s and a dynamic factor c_d. The size factor c_s may be determined from Table NA.3 or BS EN 1991-1-4:2005 Expression (6.2). The dynamic factor c_d may be determined from Figure NA.9 or BS EN 1991-1-4:2005 Expression (6.3).

NOTE Table NA.3 and Figure NA.9 have been derived using BS EN 1991-1-4:2005 Expressions (6.2) and (6.3).

Figure NA.9 **Dynamic factor c_d for various values of logarithmic decrement of structural damping, δ_s**



NOTE 1 Figure NA.9 is based on v_b = 26 m/s, n_1h = 46, z_e = 0,6h. (Value of c_d does not change significantly for other wind speeds.)

NOTE 2 The size effect factor c_s accounts for the non-simultaneous action of gusts over external surfaces. It may be applied to individual structural components and cladding units and to the overall structure.

NOTE 3 The dynamic factor c_d accounts for the effect of fluctuating wind loads in combination with the resonance of the structure. The simplified approach given in Figure NA.9 has been derived for typical buildings with typical damping and natural frequency characteristics. More accurate values will be given using the procedure in BS EN 1991-1-4:2005 ***6.3****.*

NOTE 4 The dynamic factor c_d may be taken as 1,0 for framed buildings with structural walls and masonry internal walls and for cladding panels and elements.

NOTE 5 Values of δ_s for typical classes of structure are given in Annex F.5 of BS EN 1991-1-4:2005.

NA.2.21 Procedure to determine peak, background and resonance response factors [BS EN 1991-1-4:2005, 6.3.1 (1) Note 3]

The recommended procedure given in BS EN 1991-1-4:2005 Annex B should be used.

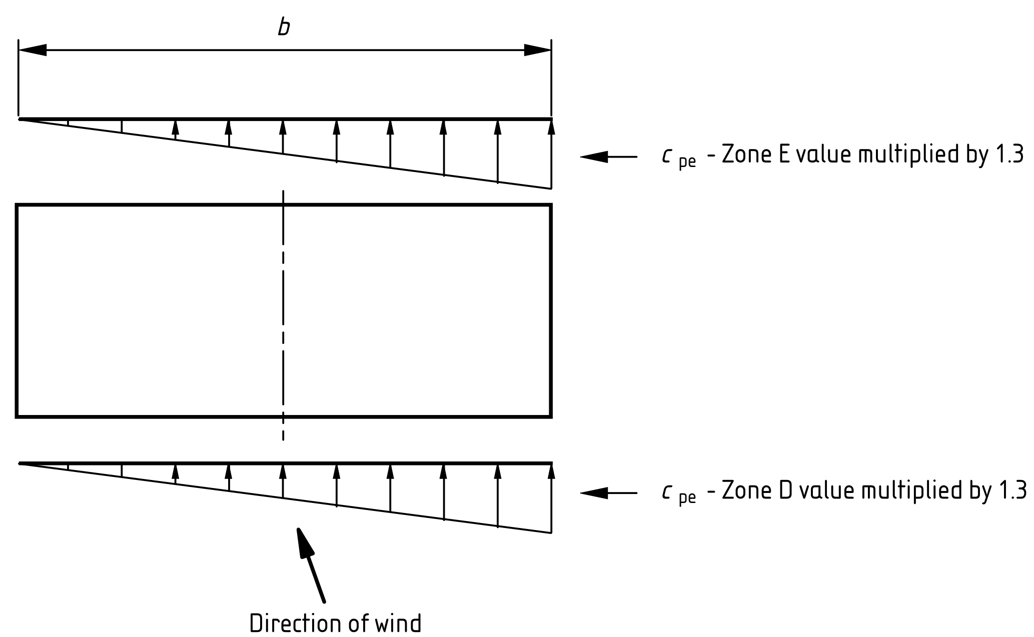
NA.2.22 Method for determining the along-wind displacement and the standard deviation of the along-wind acceleration [BS EN 1991-1-4:2005, 6.3.2 (1) Note]

The recommended method in BS EN 1991-1-4:2005 Annex B should be used.

NA.2.23 Asymmetric and counteracting pressures and forces – the representation of torsional effects due to an inclined wind or lack of correlation [BS EN 1991-1-4:2005, 7.1.2 (2) Note]

The recommended procedures in BS EN 1991-1-4:2005 **7.1.2** (2) Note a) and b) apply but BS EN 1991-1-4:2005 Figure 7.1 is replaced with Figure NA.10.

Figure NA.10 **Pressure distribution used to take torsional effects into account. The zones and c_{pe} values are given in BS EN 1991-1-4:2005 Table 7.1 and BS EN 1991-1-4:2005 Figure 7.5**



NOTE The pressure distribution shown in the figure is for producing counter-clockwise torsion.

NA.2.24 Effects of ice and snow [BS EN 1991-1-4:2005, 7.1.3 (1)]

No additional guidance is given in this National Annex.
BS EN 1993-3-1[3)] gives guidance for lattice structures; for other structures, specialist advice should be sought.

NA.2.25 Procedure for determining the external pressure coefficient for loaded areas between 1 m^2 and 10 m^2 [BS EN 1991-1-4:2005, 7.2.1 (1) Note 2]

BS EN 1991-1-4:2005 Figure 7.2 should not be used.

$c_{pe,1}$ values should be used for loaded areas 1 m^2 and $c_{pe,10}$ values should be used for loaded areas >1 m^2.

NA.2.26 Rules for velocity pressure distribution on leeward and side walls [BS EN 1991-1-4:2005, 7.2.2 (1)]

The recommended rule should be used and the pressure distribution should be assumed to be uniform over the whole height.

NA.2.27 Values of external pressure coefficients for vertical walls of rectangular-plan buildings [BS EN 1991-1-4:2005, 7.2.2 (2) Note 1]

BS EN 1991-1-4:2005 Table 7.1 may be used. For the determination of overall loads on buildings, the net pressure coefficients in Table NA.4 may be used instead of the sum of the pressure coefficients for zones D and E. Factor for accounting for lack of correlation between the front and rear faces may also be applied to the net pressure coefficients.

Table NA.4 **Net pressure coefficients for vertical walls of rectangular buildings**

h/d	**Net pressure coefficient $c_{pe,10}$**
5	1.3
1.0	1.1
≥0.25	0.8

The following should be noted:

a) *In BS EN 1991-1-4:2005 Table 7.1, linear interpolation may be used for intermediate values of h/d.*

b) *The coefficients may be applied to non-vertical walls within ±15° of vertical.*

c) *For bridge piers, see **NA.2.52** relating to BS EN 1991-1-4:2005 **8.4.2**.*

3) In preparation.

d) *Where the walls of two buildings face each other and the gap between them is less than e (smaller value of e in case of buildings with different e values), "funnelling" will accelerate the flow and make the pressure coefficients in zones A, B and C more negative than in the case where the building is "isolated", according to the following:*

1) *where the gap between the buildings is < e/4 or > e, the coefficient for isolated case should be used;*

2) *where the gap between the buildings is > e/4 and < e:*

- *either use the funnelling values, conservatively, or*
- *interpolate linearly according to the actual gap between the following values: the funnelling values to apply for a gap of e/2 and the isolated values to apply for a gap of e/4 and a gap of e;*

3) *where the two buildings are sheltered by upwind buildings such that ($h_r - h_{dis}$) < 0.4h_r for the lower of the two buildings, then funneling can be disregarded.*

e) *The external pressure coefficients for side faces affected by funneling should be taken as −1.6 for Zone A, − 0.9 for Zone B and − 0.9 for Zone C.*

NA.2.28 Pressure coefficients

*The pressure coefficients given in BS EN 1991-1-4:2005, **7.2.3** to **7.2.6** are not given in a form that allows a National Choice; however, users of BS EN 1991-1-4 are recommended to follow the advisory note to this National Annex drafted in order to advise users on how to maintain the current levels of safety and economy of construction.*

NA.2.29 Values of $c_{pe,1}$ and $c_{pe,10}$ for vaulted roofs and domes [BS EN 1991-1-4:2005, 7.2.8 (1) Note]

BS EN 1991-1-4:2005 Figure 7.11 should not be used.

External pressure coefficients for vaulted roofs are given in Figure NA.11 and Figure NA.12 for windward zone A and central zone B respectively. External pressure coefficients for leeward zone C should be taken as 0,5 for $h/d \leqslant 5{,}0$ and $f/d \leqslant 0{,}5$.

For dome roofs, the recommended values given in BS EN 1991-1-4:2005 Figure 7.12 should be used.

The following should be noted:

a) *Zones A and B are defined in BS EN 1991-1-4:2005 Figure 7.11.*

b) *For h/d 0,5 there will be alternative cases of positive and negative pressures on zone A; both need to be considered.*

c) *For local ridge and edge zones the $c_{pe,1}$ values for zones G, F and J from Table 7.4a) from BS EN 1991-1-4:2005 are to be used. The equivalent roof pitch is to be taken as the tangent of the area of the part of the barrel vault under consideration.*

d) *The values of $c_{pe,10}$ and $c_{pe,1}$ for duopitch roofs given in BS EN 1991-1-4:2005 Table 7.4b) may be used for wind blowing on to the gable end of cylindrical roofs (θ = 90°).*

Figure NA.11 **External pressure coefficients $c_{pe,10}$ for zone A of vaulted roofs for $\theta = 0°$**

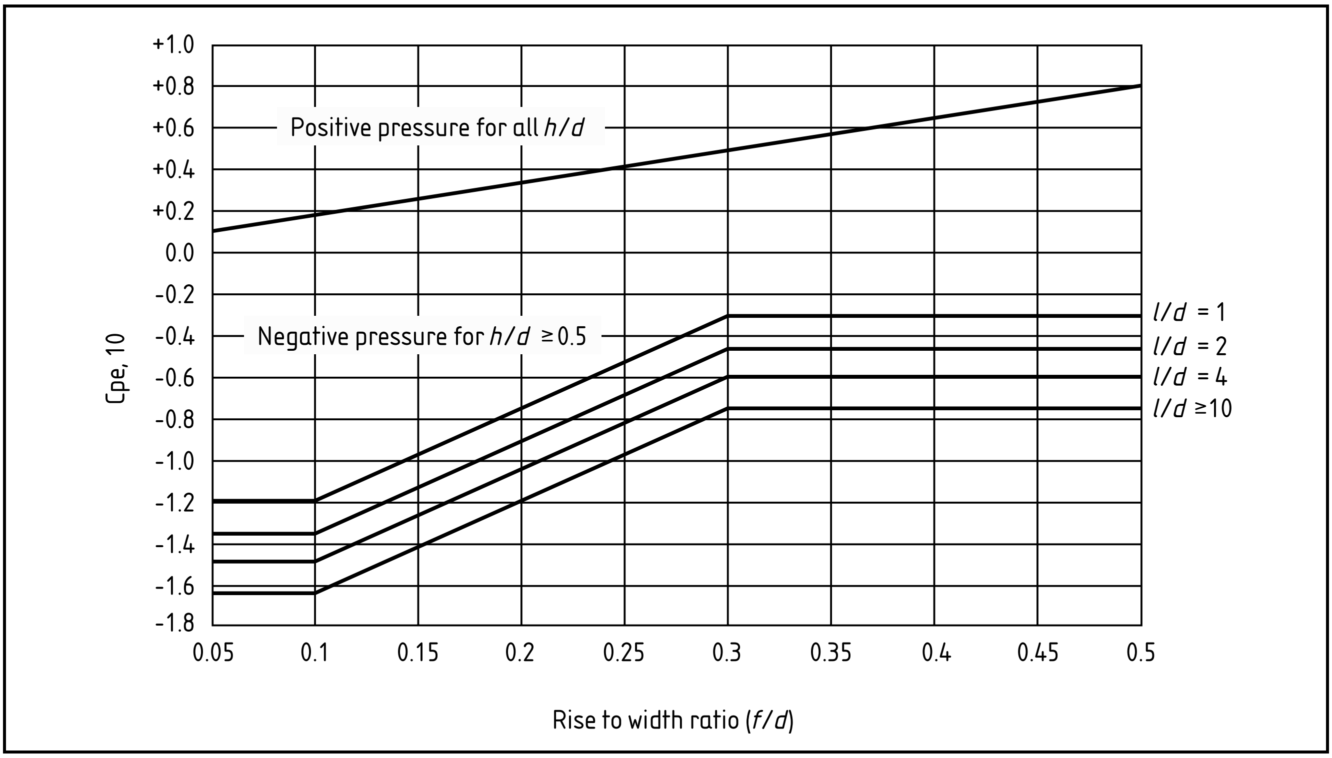
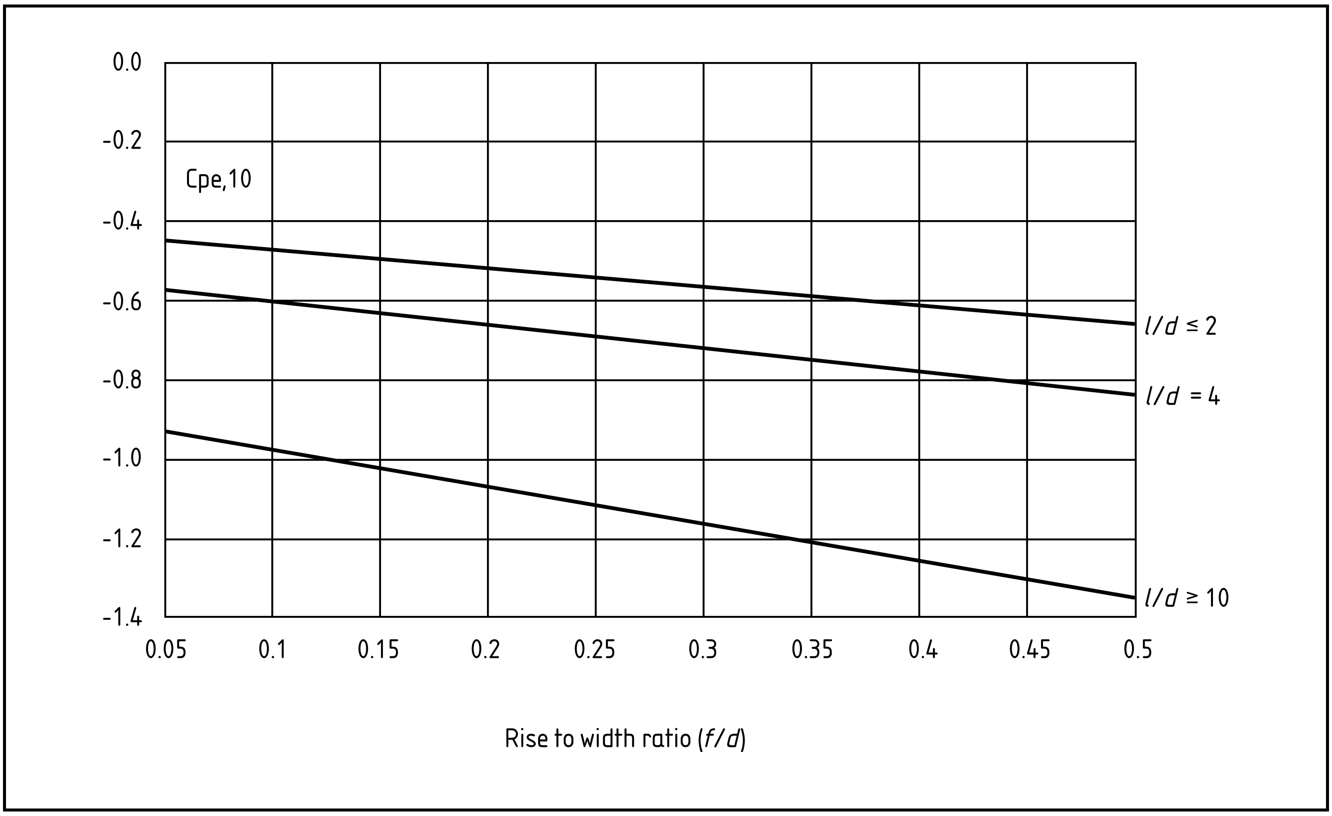


Figure NA.12 **External pressure coefficients $c_{pe,10}$ for zone B of vaulted roofs**



NA.2.30 Internal pressure – additional information regarding openings and background permeability [BS EN 1991-1-4:2005, 7.2.9 (2) Note]

In the absence of more specific information, values in Table NA.5 may be used. Modern construction methods are likely to lead to lower values than those in Table NA.5.

Table NA.5 **Typical permeability of construction in the UK**

Form of construction	Permeability (open area/total area)
Office curtain walling	$3,5 \times 10^{-4}$
Office internal partition walling	$7,0 \times 10^{-4}$
Housing	$10,5 \times 10^{-4}$
Housing Energy efficient housing	$4,0 \times 10^{-4}$

NA.2.31 Pressures on walls or roofs with more than one skin [BS EN 1991-1-4:2005, 7.2.10 (3) Note 1]

The recommended rule should be used.

NA.2.32 Pressures on walls or roofs with more than one skin [BS EN 1991-1-4:2005, 7.2.10 (3) Note 2]

The recommended rules should be used for multi-skin walls and roofs.

NOTE 1 This clause does not apply for small format overlapping roofing elements with unsealed laps, such as tiles or slates. These are to be designed according to BS 5534.

NOTE 2 Cavity walls are to be treated as single skin elements, when one or both leaves are constructed of small masonry units, i.e. brick, block, square dressed natural stone or random rubble masonry and the leaves are effectively tied together.

NA.2.33 Pressure coefficients for free-standing walls and parapets [BS EN 1991-1-4:2005, 7.4.1 (1)]

The recommended values given in BS EN 1991-1-4:2005 Table 7.9 should be used.

NA.2.34 The value of the horizontal eccentricity [BS EN 1991-1-4:2005, 7.4.3 (2)]

The recommended value should be used.

NOTE The horizontal eccentricity for road signs is given in BS EN 12899-1.

NA.2.35 Reduction factor for square sections with rounded corners [BS EN 1991-1-4:2005, 7.6 (1) Note 1]

The recommended values for ψ_r given in BS EN 1991-1-4:2005 Figure 7.24 should be used.

NA.2.36 Structural elements with sharp edged section [BS EN 1991-1-4:2005, 7.7 (1) Note 1]

The recommended force coefficient of 2,0 should be used for all sharp edged structural elements with sharp edged sections.

NA.2.37 Structural elements with regular polygonal section – values of the force coefficient $c_{f,0}$ [BS EN 1991-1-4:2005, 7.8 (1)]

The recommended values for $c_{f,0}$ given in BS EN 1991-1-4:2005 Table 7.11 should be used.

NA.2.38 Force coefficients for spheres [BS EN 1991-1-4:2005, 7.10 (1) Note 1]

The recommended values for $c_{f,x}$ given in BS EN 1991-1-4:2005 Figure 7.30 should be used.

NA.2.39 Reduction factor for scaffolding without air tightness devices and affected by solid building obstruction [BS EN 1991-1-4:2005, 7.11 (1) Note 2]

The recommended value given in BS EN 12811-1 should be used.

The procedures given do not take account of shelter effects from multiple plane frames or lattice structures. Significant reductions in the overall load on arrays of frames can occur for wind normal to the frames. See *Wind loading: a practical guide to BS 6399-2, wind loads on buildings* [3] and *Wind loads on unclad structures* [4].

NA.2.40 End effect factor [BS EN 1991-1-4:2005, 7.13 (1)]

The recommended values given in BS EN 1991-1-4:2005 Figure 7.36 should be used.

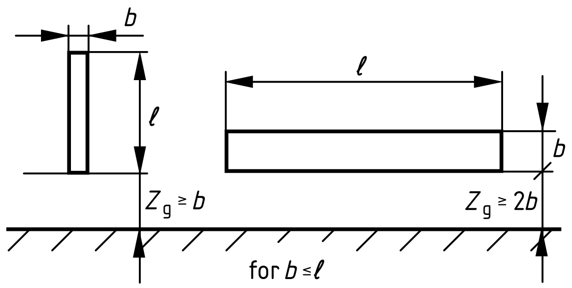
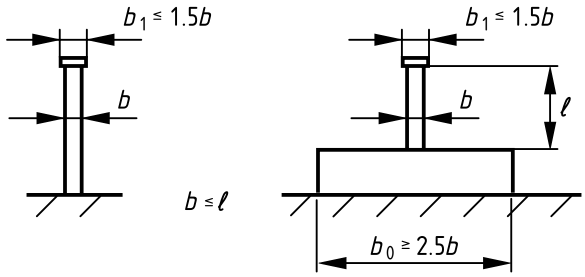
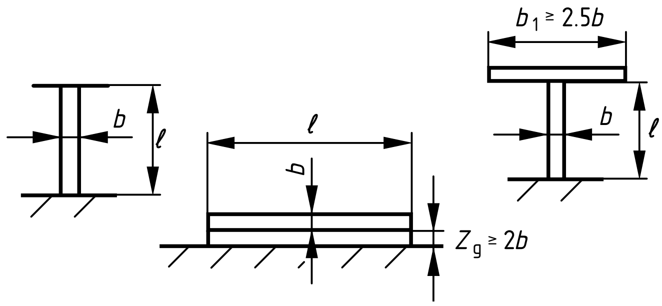
NA.2.41 Effective slenderness factor [BS EN 1991-1-4:2005, 7.13 (2)]

BS EN 1991-1-4:2005 Table 7.16 should not be used. The values of λ given in Table NA.6 should be used.

NA.2.42 Wind action for other types of bridges [BS EN 1991-1-4:2005, 8.1 (1) Note 1]

No additional guidance is given for wind actions on other types of bridges (e.g. arch bridges, moving bridges and bridges with multiple or significantly curved decks). Guidance on wind actions on elements of such bridges may be derived from the relevant clauses of BS EN 1991-1-4:2005, as modified by this National Annex. For the derivation of the overall response to wind action on such bridges, specialist advice should be sought.

Table NA.6 **Values of λ for cylinders, polygonal sections, rectangular sections, sharp edged structural sections and lattice structures**

Position of the structure, wind normal to the plane of the page	Effective slenderness λ
	$\lambda = l/b$
	$\lambda = 2l/b$
	$\lambda = \infty$

NA.2.43 Angle of the wind direction relative to the deck axis [BS EN 1991-1-4:2005, 8.1 (1) Note 2]

BS EN 1991-1-4:2005 Figure 8.2 and Figure 8.6 should be used to define the angle of the wind directions relative to the deck axis.

NA.2.44 Fundamental value of the basic velocity to be used when considering road traffic simultaneously with the wind [BS EN 1991-1-4:2005, 8.1 (4)]

The value of $v^*_{b,o}$ to be used is v_{bo}, but the maximum value of $q_{\mathrm{p}}(z)$, as obtained from Equation NA.3 should be limited to 750 Pa, where z is the height of the deck above ground level.

NA.2.45 Fundamental value of the basic velocity to be used when considering railway traffic simultaneously with the wind [BS EN 1991-1-4:2005, 8.1 (5)]

The value of $v^*_{b,o}$ to be used is v_{bo}, but the maximum value of $q_{\mathrm{p}}(z)$, as obtained from Equation NA.3 should be limited to 980 Pa, where z is the height of the deck above ground level.

NA.2.46 Choice of the response calculation procedure [BS EN 1991-1-4:2005, 8.2 (1) Note 1]

NA.2.46.1 Along wind response (in the wind direction)

Highway and railway bridges of less than 200 m span do not normally require explicit allowance for dynamic response in the along wind direction, in the completed (in service) condition.

NA.2.46.2 Vertical wind response

Dynamic magnification effects due to vertical response can also be ignored provided either:

a) the fundamental frequencies in both bending and torsion calculated in accordance with BS EN 1991-1-4:2005 Annex F are greater than 1 Hz;

or

(NA.5) b) $P(z)\dfrac{\sigma_{\mathrm{fm}}b}{\sigma_{\mathrm{c}}} \leqslant 1{,}0$

where

$$P(z) = \left(\frac{v_{\mathrm{m}}(z)}{n_{\mathrm{b}}b}\right)^2\left(\frac{\rho b^2}{m}\right)$$

ρ is the density of air taken as 1,226 kg/m³;

b is the overall width of the bridge deck (see BS EN 1991-1-4:2005 Figure 8.2);

m is the mass per unit length of the bridge (see Note 1);

$v_{\mathrm{m}}(z)$ is the site mean wind velocity (for relieving areas) obtained from **4.3.1** using $c_{\mathrm{r}}(z)$ from NA.2.11;

z_{s} is the average height of the deck above ground level (see BS EN 1991-1-4:2005 Figure 6.1);

n_{b} is the natural frequency in bending (see Note 2);

σ_{fm} is the peak stress in the structure per unit deflection in the first mode of vibration, derived for the most highly stressed location in the relevant element;

σ_{c} is a reference stress as follows:

for steel beam elements σ_{c} = 600 MPa for the longitudinal flange bending stress; or

for truss bridges, σ_{c}= 750 MPa for the chord axial stress; or

for concrete elements (composite or concrete bridges), σ_{c} = 80 MPa for the primary bending concrete stress; or

for cable-stayed bridges, the peak stay axial stress should additionally be examined, σ_{c} with = 1 200 MPa.

NOTE 1 Units are to be applied consistently, particularly with respect to ρ and m; preferably ρ ought to be in kg/m³, with other parameters all in consistent units.

NOTE 2 Frequencies are to be derived by dynamic/eigenvalue analysis of the structure; see BS EN 1991-1-4:2005 Annex F, which contains approximate formulae for standard bridge arrangements.

If these conditions are satisfied, the procedure given in BS EN 1991-1-4:2005 **8.3.2** (as modified by this National Annex) may be used for single span bridges or the procedure given for continuous bridges in **NA.2.53** should be used.

If these conditions are not satisfied, the dynamic effects of turbulence response should be considered and specialist advice sought.

NA.2.46.3 Aerodynamic stability

The following criteria should be used to assess whether a bridge is susceptible to aerodynamic excitation and whether dynamic response procedures are needed.

The aerodynamic susceptibility parameter P_b should be derived in order to categorize the structure using the equation:

$$P_b = P(z)\left(\frac{16b}{L}\right) \quad \text{(NA.6)}$$

where

L is the length of the relevant maximum span of the bridge;

$P(z)$, b are defined in **NA.2.46.2**b).

The bridge should then be categorized as follows:

a) Bridges designed to carry the loadings specified in BS EN 1991-2, built of normal construction, are considered to be subject to insignificant effects in respect of all forms of aerodynamic excitation when $P_b < 0{,}04$. However, the procedure of BS EN 1991-1-4:2005 in conjunction with this National Annex may still be applied if required, provided the relevant criteria given in PD 6688-1-4 [4] are satisfied.

b) Bridges having $0{,}04 \leqslant P_b \leqslant 1{,}00$ should be considered to be within the scope of the procedure of BS EN 1991-1-4 in conjunction with this National Annex, and should be considered adequate with regard to each potential type of excitation if they satisfy the relevant criteria given in PD 6688-1-4 [4].

c) Bridges with $P_b > 1{,}00$ should be considered to be potentially very susceptible to aerodynamic excitation and should be subject to wind tunnel tests.

For the purpose of this categorization, normal construction may be considered to include bridges constructed in steel, concrete, aluminium or timber, including composite construction, and whose overall shape is generally covered by BS EN 1991-1-4:2005 Figure 8.1.

Normal highway bridges of less than 25 m span would generally be found to be category a). Bridges of spans greater than 250 m are likely to be category c).

Covered footbridges, cable supported bridges and other structures where any of the parameters b, L or n_{1b} cannot be accurately derived should be considered as category c).

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[4] In preparation.

The application of these rules to bridges of novel design should be agreed with the relevant authority.

The calculation of $v_m(z)$ should take account of sites where the wind flow might be abnormally affected by steep sloping valleys, unusual terrain or topography. (See BS EN 1991-1-4:2005 **A.3**.) The treatment for the application of the rules for twin deck configurations and the treatment of proximity effects are given in PD 6688-1-4[5].

NA.2.47 Force coefficients for parapets and gantries on bridges [BS EN 1991-1-4:2006, 8.3 (1)]

The force coefficients for parapets and gantries on bridges should be obtained from BS EN 1991-1-4:2005 **7.4**, **7.6**, **7.7**, **7.8**, **7.9** and **7.11** as appropriate.

NA.2.48 Reduction in drag coefficient for F_w [BS EN 1991-1-4:2005, 8.3.1 (2)]

The values of F_W defined in BS EN 1991-1-4:2005 **8.3.2** (1) should not be reduced according to BS EN 1991-1-4:2005 **8.3.1** (2).

NA.2.49 Values of the wind load factor *C* [BS EN 1991-1-4:2005, 8.3.2 (1)]

The values of *C* given in Table NA.7 should be used.

Table NA.7 **Values of wind load factor *C***

b/d_{tot}	$z_e \leqslant$ 20 m	z_e = 50 m
$\leqslant$ 0,5	7,4	9,1
$\geqslant$ 4,0	4,0	4,9

NA.2.50 Value of the force coefficient $c_{f,z}$ [BS EN 1991-1-4:2006, 8.3.3 (1) Note 1]

BS EN 1991-1-4:2005 **8.3.3** (1) should be used.

[5] In preparation.

NA.2.51 Value of the force coefficient $c_{f,y}$ [BS EN 1991-1-4:2006, 8.3.4 (1)]

The following longitudinal wind forces, in the y-direction, should be taken into account.

The longitudinal wind F_{wy} (in newtons), taken as acting at the centroids of the appropriate areas, should be the more severe of either:

a) the longitudinal wind load on the superstructure, F_{sy} alone; or

b) the sum of the nominal longitudinal wind load on the superstructure, F_{sy} and the nominal longitudinal wind load on the live load, F_{Ly}, derived separately, as given as appropriate in 1) to 6):

1) All superstructures with solid elevation

$$F_{sv} = 0.25 q_p(z) A_{ref} C_{fx} \tag{NA.7}$$

where:

$q_p(z)$ is as defined in **NA.2.17** the appropriate value of $q_p(z)$ for superstructures with or without live load being adopted;

A_{ref} is as defined in BS EN 1991-1-4:2005 **8.3.1** (4) (a) for the superstructure alone;

C_{fx} is the force coefficient for the superstructure (excluding reduction for inclined webs) as defined in BS EN 1991-1-4:2005 **8.3.1**, but not less than 1,3.

2) All truss girder superstructures

$$F_{sv} = 0.5 q_p(z) A_{ref} C_{fx} \tag{NA.8}$$

where:

$q_p(z)$ is as defined in **NA.2.17**, the appropriate value of $q_p(z)$ for structures with or without live load being adopted;

A_{ref} is as defined in BS EN 1991-1-4:2005 **8.3.1** (4) (b);

C_{fx} is as defined in BS EN 1991-1-4:2005 **8.3.1**.

3) Live load on all superstructures

$$F_{Ly} = 0.5 q_p(z) A_{ref} C_{fx} \tag{NA.9}$$

where:

$q_p(z)$ is as defined in **NA.2.17**, the appropriate value of $q_p(z)$ for superstructures with live load being adopted;

A_{ref} is the area of live load derived in accordance with BS EN 1991-1-4:2005 **8.3.1** (5) and the appropriate horizontal wind loaded length as defined in Note 1 to **NA.2.53**;

C_{fx} = 1,45.

4) Parapets and safety fences

i) With vertical infill members, the longitudinal force should be taken as 0,8 times the force in the x-direction on the element.

ii) With two or three horizontal rails only, the longitudinal force should be taken as 0,4 times the force in the x-direction on the element.

iii) With mesh panels, the longitudinal force should be taken as the force in the x-direction on the element.

5) Cantilever brackets extending outside main girders or trusses.

The longitudinal force is the force derived from a horizontal wind acting at 45° to the longitudinal axis on the areas of each bracket not shielded by a fascia girder or adjacent bracket. The drag coefficient C_{fx} should be taken from BS EN 1991-1-4:2005 **7.6**, **7.7**, **7.8**, **7.9** or **7.11** as appropriate.

6) Piers

The force derived from a horizontal wind acting along the longitudinal axis of the bridge should be taken as

$$F_{Ly} = q_p(z) A_{ref} C_{fy} \quad \text{(NA.10)}$$

where:

$q_p(z)$ is as defined in **NA.2.17**;

A_{ref} is the solid area in projected elevation normal to the longitudinal wind direction (in m^2);

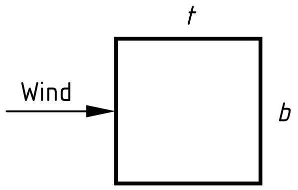
C_{fy} is the force coefficient, taken from **NA.2.52**, with values of b and t interchanged.

NA.2.52 Simplified rules for wind effects on bridge piers [BS EN 1991-1-4:2005, 8.4.2 (1) Note 1]

For simplicity, upper bound values of the force coefficient C_{fp} for piers may be taken from Table NA.8. These values have been based on BS EN 1991-1-4:2005 **7.6** using an end-effect factor for a value of 2 × height/breadth.

*NOTE The procedure given in **NA.2.23** is to be used for the treatment of asymmetric loading on bridge piers.*

Table NA.8 **Force coefficient C_{fp} for piers**

Plan shape	$\frac{t}{b}$	C_{fp} for pier $\frac{\text{height}}{\text{breadth}}$ ratios of						
		1	2	4	6	10	20	40
	⩽ 0,25	1,31	1,37	1,43	1,49	1,61	1,76	1,92
	0,333	1,36	1,43	1,49	1,56	1,68	1,84	2,00
	0,50	1,44	1,51	1,58	1,65	1,78	1,95	2,12
	0,667	1,50	1,57	1,65	1,72	1,85	2,03	2.21
	1,0	1,35	1,42	1,48	1,54	1,66	1,83	1,99
NOTE b is the dimension normal to the direction of wind.	1,5	1,17	1,23	1,28	1,34	1,44	1,58	1,72
	2	1,04	1,09	1,14	1,19	1,28	1,41	1,53
	3	0,86	0,90	0,94	0,98	1,06	1,16	1,26
	⩾ 4	0,73	0,77	0,80	0,83	0,90	0,99	1,07
Square on diagonal		1,0	1,1	1,1	1,2	1,2	1,3	1,4
Octagonal		0,82	0,86	0,90	0,94	1,01	1,11	1,20
12 sided polygon		0,69	0,73	0,76	0,79	0,85	0,94	1,02
Circle with smooth surface where $1{,}5tV_m(z) \geqslant 6\ m^2/s$		0,44	0,46	0,48	0,50	0,54	0,60	0,65
Circle with smooth surface where $1{,}5tV_m(z) < 6\ m^2/s$. Also circle with rough surface or with projections		0,76	0,79	0,83	0,86	0,93	1,02	1,11

NOTE 1 After erection of the superstructure, C_{fp} is to be derived for a height/breadth ratio of 40.

NOTE 2 For a rectangular pier with radiused corners, the value of C_{fp} derived from Table NA.8 is to be multiplied by $(1 - 15r/b)$ or 0,5, whichever is greater.

NOTE 3 For a pier with triangular nosings, C_{fp} is to be derived as for the rectangle encompassing the outer edges of the pier.

NOTE 4 For a pier tapering with height, C_{fp} is to be derived for each of the unit heights into which the support has been subdivided (see BS EN 1991-1-4:2005 Figure 7.4). Mean values of t and b for each unit height is to be used to evaluate t/b. The overall pier height and the mean breadth of each unit height is to be used to evaluate height/breadth.

*NOTE 5 On relieving areas, use F_m instead of F_W (see **NA.2.53**).*

NA.2.53 Quasi-static procedure for along wind effects

a) For single span bridges the simplified procedure given in BS EN 1991-1-4:2005 **8.3.2** as modified by this National Annex may be used. Alternatively, and for continuous bridges, the procedure given in (2) and (3) should be applied.

b) Where wind on any part of the bridge or its elements increases the effect under consideration (adverse areas) the wind forces should be calculated in accordance with BS EN 1991-1-4:2005 **5.3** (2) using values of c_s from Table NA.3. The value of c_d should be taken as 1,0.

NOTES for use of Table NA.3 for bridges:

*NOTE 1 The horizontal wind loaded length is to be that giving the most severe effect. Where there is only one adverse area (see BS EN 1991-2) for the element or structure under consideration, the wind loaded length is the base length of the adverse area. Where there is more than one adverse area, as for continuous construction, the maximum effect is to be determined by consideration of any one adverse area or a combination of adverse areas, using the wind force F_W, derived from **5.3** (2), using the value of c_s from Table NA.3 using b + h as the base length or the total combined base lengths. The remaining adverse areas, if any, and the relieving areas, are subjected to wind having the relieving wind force F_m, derived from (3). Forces F_W and F_m are to be derived separately for bridges with and without live load. (See **NA.2.44** and **NA.2.45**.)*

*NOTE 2 Where the bridge is located near the top of a hill, ridge, cliff or escarpment, the height above the local ground level ought to allow for the significance of the orographic feature in accordance with BS EN 1991-1-4:2005 **4.3.3**. In such cases, the size factor c_s is to be taken as 1,0. For bridges over tidal waters, the height above ground is to be measured from the mean water level.*

NOTE 3 Vertical elements such as piers and towers are to be divided into strips in accordance with the procedure given in BS EN 1991-1-4:2005 Figure 7.4 and the appropriate factor and wind force are to be derived for each strip.

c) Where wind on any part of a bridge or element gives relief to the member under consideration, a relieving wind force, F_m, should be applied using Equation NA.11.

(NA.11) $$F_m = \frac{1}{2}\rho v_m^2(z) C_f A_{ref}$$

or by vectorial summation over the individual structural parts using Equation NA.12.

(NA.12) $$F_m = \frac{1}{2}\rho \sum v_m^2(z) C_f A_{ref}$$

Where $v_m(z)$ is obtained from **4.3** using $c_r(z)$ as obtained from **NA.2.11**.

NA.2.54 Transition between roughness categories [BS EN 1991-1-4:2005, A.2 (1)]

BS EN 1991-1-4:2005 **A.2** (1) should not be used; the following rules should be used instead.

The classification of roughness categories has been simplified to give three terrain categories as defined in **NA.2.11**.

Transition between terrain categories is defined in terms of the upwind distance to a previous, less rough category. Effectively, for sites in Country terrain this means the upwind distance from the site to the coastline and, for sites in Town terrain, the distance from the site to the upwind edge of the town or urban boundary. The effect of transition between roughness categories is included in Figure NA.3 to Figure NA.8.

NA.2.55 The value for air density [BS EN 1991-1-4:2006, E.1.3.3 (1) Note]

The air density ρ should be taken as 1,226 kg/m^3.

NA.2.56 NDPs in BS EN 1991-1-4:2005 Annex E

BS EN 1991-1-4:2005 Annex E should not be used. See PD 6688-1-4 [6)].

[6)] In preparation.

NA.3 Decision on the status of informative annexes

NA.3.1 BS EN 1991-1-4:2005, Annex A – Terrain effects

BS EN 1991-1-4:2005, Annex A may be used with the exception of **A.2**.

NA.3.2 BS EN 1991-1-4:2005, Annex B – Procedure 1 for structural factor $c_s c_d$

BS EN 1991-1-4:2005 Annex B may be used.

NA.3.3 BS EN 1991-1-4:2005, Annex C – Procedure 2 for structural factor $c_s c_d$

BS EN 1991-1-4:2005, Annex C should not be used.

NA.3.4 BS EN 1991-1-4:2005, Annex D – $c_s c_d$ values for different types of structures

BS EN 1991-1-4:2005, Annex D should not be used.

NA.3.5 BS EN 1991-1-4:2005, Annex E – Vortex shedding and aeroelastic instability

BS EN 1991-1-4:2005, Annex E should not be used. See replacement information in PD 6688-1-4 [7].

NA.3.6 BS EN 1991-1-4:2005, Annex F – Dynamic characteristics of structures

BS EN 1991-1-4:2005, Annex F may be used.

NA.4 Reference to non-contradictory complementary information

Non-contradictory complementary information for use with BS EN 1991-1-4 is given in PD 6688-1-4 [7].

[7] In preparation.

Annex A (informative) Flowcharts for obtaining q_p

Figure A.NA.1 **Flowchart for obtaining q_p for sites in country**

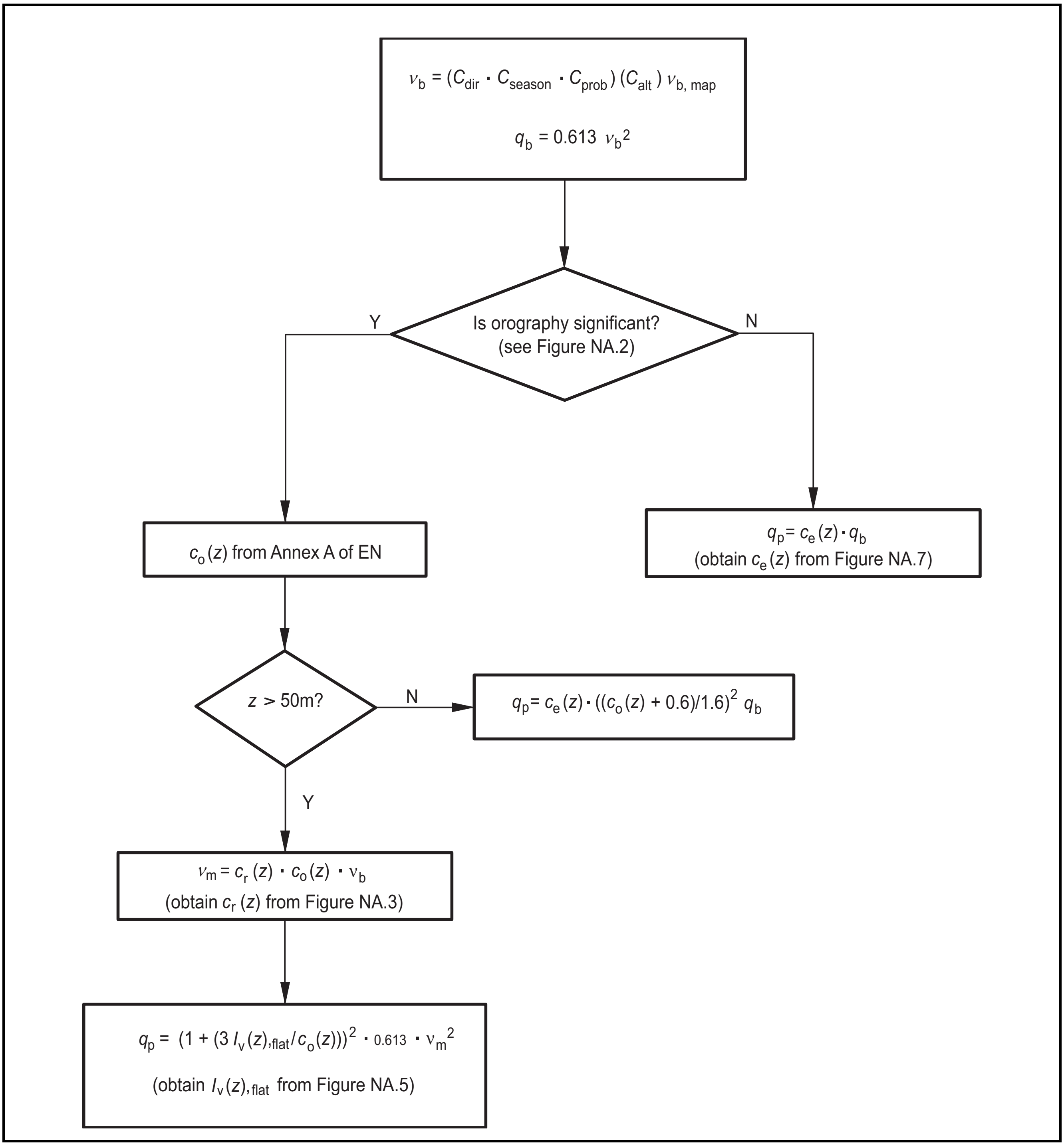
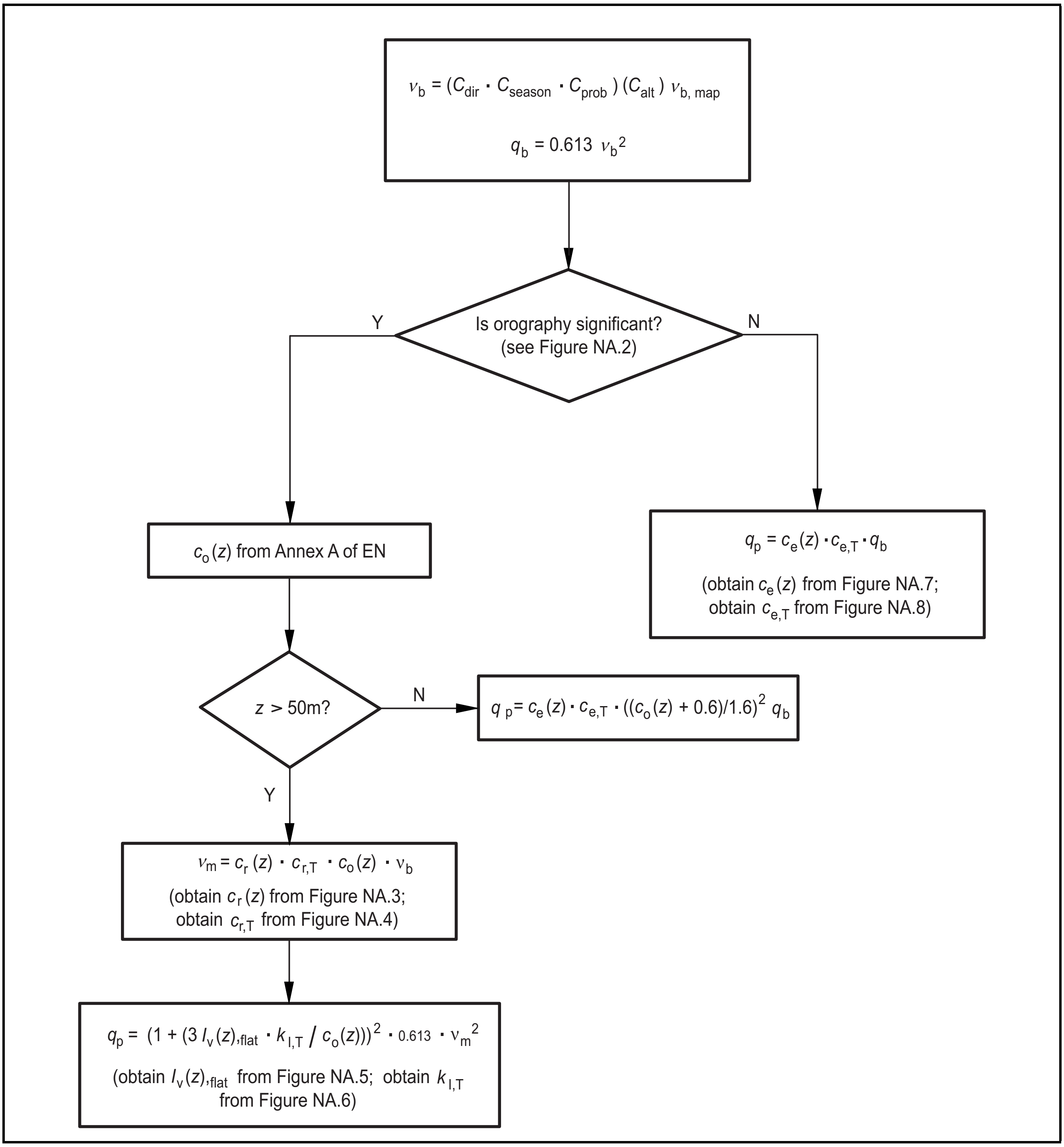


Figure A.NA.2 **Flowchart for obtaining q_p for sites in town**



Advisory note regarding BS EN 1991-1-4, 7.2.3 to 7.2.6

Calibration of BS EN 1991-1-4 against BS 6399-2 has shown that there are differences in the values of pressure coefficients and in some cases the EN values are significantly different to those currently used in the UK. National choice is not allowed for the external pressure coefficients. It is therefore recommended that the external pressure coefficients in BS 6399-2 continue to be used to maintain the current levels of safety and economy of construction. The tables affected together with the corresponding figures that define the zones are as follows.

Type of roof		Relevant tables and figures in BS EN 1991-1-4	Recommended tables and figures in BS 6399-2
1	**Flat roofs**	Table 7.2 and Figure 7.6	Table 8 and Figure 17
2	**Mono pitch roofs**	Tables 7.3a) and 7.3b) and Figure 7.7	Table 9 and Figure 19
3	**Duo pitch roofs**	Tables 7.4a) and 7.4b) and Figure 7.8	Table 10 and Figure 20
4	**Hipped roofs**	Table 7.5 and Figure 7.9	Table 11 and Figure 21

Attention is drawn to the requirement in the EN that fixings and small areas should be designed using $C_{pe,1}$ coeffiecients given in BS EN 1991-1-4. There is no equivalent coefficient in the BS for this.

Bibliography

Standards publications

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 5534, *Code of practice for slating and tiling (including shingles)*

BS EN 1991-2, *Eurocode 1: Actions on structures – Part 2: Traffic loads on bridges*

BS EN 1993-3-1, *Eurocode 3 – Design of steel structures – Part 3-1: Towers, masts and chimneys*

BS EN 12811-1, *Temporary works equipment. Scaffolds. Performance requirements and general design*

BS EN 12899-1, *Fixed, vertical road traffic signs – Part 1: Fixed signs*

PD 6688-1-4 [8)], *Background paper to National Annex to BS EN 1991-1-4*

Other publications

[1] COOK, N.J. *The designer's guide to wind loading of building structures – Part 2: Static structures.* Butterworth-Heinemann Ltd, 1990.

[2] CERMAK, J.E., and N. Isyumov (editors). ASCE (American Society of Civil Engineers) manuals and reports on engineering practice. No 67. *Wind tunnel studies of buildings and structures*. ASCE, 1999.

[3] COOK, N.J. *Wind loading: a practical guide to BS 6399-2 wind loads on buildings*. Thomas Telford Ltd, 1999.

[4] BLACKMORE, P. BRE Digest SD5. *Wind loads on unclad structures.* BRE Press, 2004.

8) In preparation.

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