United Kingdom of Great Britain and Northern Ireland

EDICT OF GOVERNMENT

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BS NA EN 1991-1-3 (2003) (English): UK National Annex to Eurocode 1. Actions on structures. General actions. Snow loads

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We will sell to no man, we will not deny or defer to any man either Justice or Right.

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NATIONAL ANNEX

NA to BS EN 1991-1-3:2003
Incorporating corrigendum no. 1

UK National Annex to Eurocode 1: Actions on structures —

Part 1-3: General actions — Snow loads

ICS 91.010.30; 91.080.01

BSI British Standards

Committees responsible for this National Annex

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Association of Consulting Engineers
British Constructional Steelwork Association
British Masonry Society
Building Research Establishment
Concrete Society
Health and Safety Executive
Highways Agency
Institution of Civil Engineers
Institution of Structural Engineers
National House Building Council
Office of the Deputy Prime Minister
Steel Construction Institute

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17170 Corrigendum No. 1	29 June 2007	NA.2.8 equation NA.1 A + 100 changed to A – 100. Figure NA.1 legend for Zone 1 changed from 0,25 to 0,30.

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National Annex (informative) to BS EN 1991-1-3:2003, Eurocode 1: Actions on structures — Part 1-3: General actions — Snow loads

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 1991-1-3:2003.

NA.1 Scope

This National Annex gives:

a) the UK decisions for the Nationally Determined Parameters described in the following subclauses of BS EN 1991-1-3:2003:

— **1.1** (2)
— **1.1** (3)
— **1.1** (4)
— **2** (3)
— **2** (4)
— **3.3** (1)
— **3.3** (3)
— **4.1** (1)
— **4.1** (2)
— **4.2** (1)
— **4.3** (1)
— **5.2** (2)
— **5.2** (5)
— **5.2** (6)
— **5.2** (7)
— **5.2** (8)
— **5.3.3** (4)
— **5.3.4** (3)
— **5.3.5** (1)
— **5.3.5** (3)
— **5.3.6** (1)
— **5.3.6** (3)
— **6.2** (2)
— **6.3** (1)
— **6.3** (2)
— Annex A (1)

b) the UK decisions on the status of BS EN 1991-1-3:2003 informative annexes;

c) references to non-contradictory complementary information.

NA.2 Nationally Determined Parameters

NA.2.1 Altitudes greater than 1 500 m [BS EN 1991-1-3:2003, 1.1 (2)]

The scope of BS EN 1991-1-3 does not include sites at altitudes above 1 500 m. For altitudes greater than 1 500 m specialist advice should be sought from the Meteorological Office on the snow loads likely to occur at the site.

NA.2.2 Design situations and load arrangements to be used for different locations [BS EN 1991-1-3:2003, 1.1 (3)]

The scope of BS EN 1991-1-3 states that information on design situations and load arrangements to be used for different locations is given in BS EN 1991-1-3:2003, Annex A.

The design situations summarized as case B2 in BS EN 1991-1-3:2003, Table A.1 should be the only exceptional condition to be checked for determining imposed roof snow loads in the UK.

NA.2.3 Snow load shape coefficients for exceptional snow drifts [BS EN 1991-1-3:2003, 1.1 (4)]

The scope of BS EN 1991-1-3 states that information on snow load shape coefficients for exceptional snow drifts is given in BS EN 1991-1-3:2003, Annex B.

BS EN 1991-1-3:2003, Annex B should be used in the UK in order to determine exceptional snow drift loads.

NA.2.4 Exceptional snow load on the ground [BS EN 1991-1-3:2003, 2 (3)]

Exceptional snow load on the ground should be treated as accidental actions.

NA.2.5 Load due to exceptional snow drift [BS EN 1991-1-3:2003, 2 (4)]

Drift loads determined using the guidance given in BS EN 1991-1-3:2003, Annex B should be treated as accidental actions.

NA.2.6 Locations with exceptional snow load on the ground but with no load due to exceptional snow drift [BS EN 1991-1-3:2003, 3.3 (1)]

Locations that experience these conditions are not considered to occur in the UK.

NA.2.7 Locations with exceptional snow load on the ground and with load due to exceptional snow drift [BS EN 1991-1-3:2003, 3.3 (3)]

BS EN 1991-1-3:2003, Annex B should be used in place of BS EN 1991-1-3:2003, **6.2** in order to determine the load case due to drifting in the UK.

NA.2.8 Characteristic value of snow load on the ground [BS EN 1991-1-3:2003, 4.1 (1)]

The characteristic ground snow loads s_k to be used in the UK should be obtained from the map shown in Figure NA.1 and Equation (NA.1).

$$s_k = [0{,}15 + (0{,}1Z + 0{,}05)] + \left(\frac{A - 100}{525}\right) \quad \text{(NA.1)}$$

where

s_k is the characteristic ground snow load (kN/m^2);

Z is the zone number obtained from the map in Figure NA.1;

A is the site altitude (m).

Unusual local effects may not have been accounted for in the analysis undertaken to produce the ground snow load map given in Figure NA.1. These include local shelter from the wind, which can result in increased local snow loads and local configurations in mountainous areas, which may funnel the snow and give increased local loading. If the designer suspects that there are unusual local conditions that need to be taken into account, then for coastal sites below 100 m the map value should be used without the altitude modification. Alternatively, and in other cases, the Meteorological Office should be consulted.

NA.2.9 Refined characteristic value of snow load on the ground [BS EN 1991-1-3:2003, 4.1 (2)]

Where a more refined characteristic ground snow load value s_k is required, the Meteorological Office should be consulted.

NA.2.10 Other representative values for snow load on the ground [BS EN 1991-1-3:2003, 4.2 (1)]

The UK National Annex to BS EN 1990 gives values that should be used in the UK for the coefficients ψ_0, ψ_1 and ψ_2.

NA.2.11 Treatment of exceptional snow load on the ground [BS EN 1991-1-3:2003, 4.3 (1)]

The coefficient for exceptional snow loads C_{esl} should take a value of 2,0 as recommended in BS EN 1991-1-3.

NA.2.12 Determining load arrangements for snow loads on roofs [BS EN 1991-1-3:2003, 5.2 (2)]

BS EN 1991-1-3:2003, Annex B should be used to determine the imposed roof loads due to drifted snow for:

a) multi-span roofs [in place of BS EN 1991-1-3:2003, **5.3.4** (3)];

b) roofs abutting and close to taller structures [in place of BS EN 1991-1-3:2003, **5.3.6** (3)];

c) drifting at projections and obstructions [in place of BS EN 1991-1-3:2003, **6.2** (2)].

NA.2.13 Load arrangements for artificial removal or redistribution of snow on a roof [BS EN 1991-1-3:2003, 5.2 (5)]

In certain cases, snow may be artificially removed from or redistributed on a roof, e.g. due to excessive heat loss through a small section of roof or manually to maintain access to a service door. This can result in more severe load imbalances occurring than those resulting from BS EN 1991-1-3:2003, **5.3** and Annex B (which have been derived for natural deposition patterns). To provide for these situations, if they are likely to occur and other information is not available, a load case should be considered comprising the minimum imposed uniformly distributed load (BS EN 1991-1-3:2003, **5.3**) on any portion of the roof area and zero load on the remainder of the area.

NA.2.14 Load arrangements for situations arising from rainfall on snow on roofs [BS EN 1991-1-3:2003, 5.2 (6)]

The UK National Annex to BS EN 1991-1-1 specifies minimum imposed loads on roofs with access for maintenance only. These values allows for a certain build-up of water but it does not allow for the effect of drains becoming blocked due to debris or ice. Specialist advice should be sought where the consecutive melting and freezing of snow together with possible rainfall is likely to occur and block roof drainage.

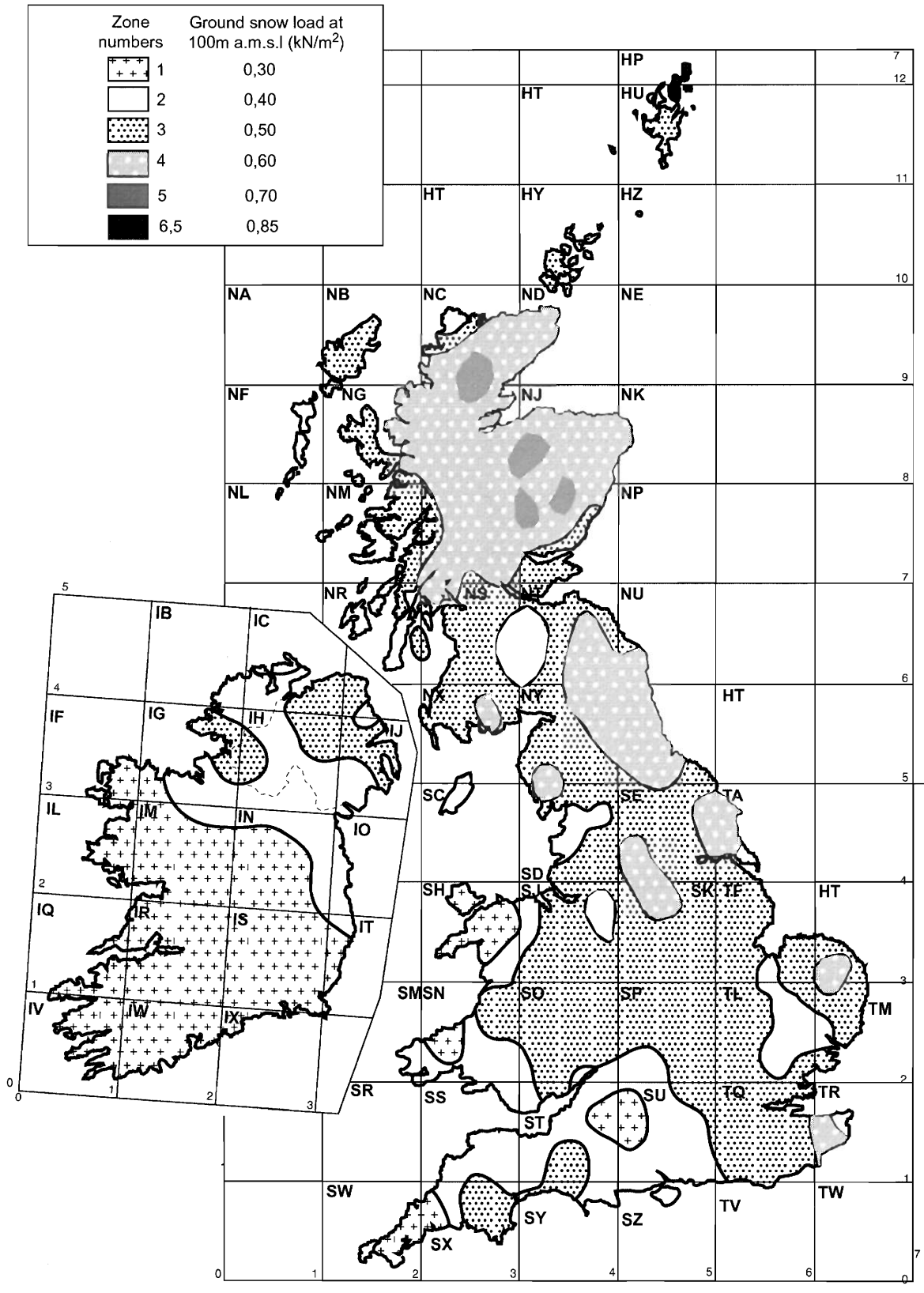

Figure NA.1 — Characteristic ground snow load map

NA.2.15 Exposure coefficient used for determining snow load on a roof [BS EN 1991-1-3:2003, 5.2 (7)]

The recommended value for exposure coefficient C_e in the UK is 1,0 for all topographies.

NA.2.16 Thermal coefficient used to account for the reduction of snow load on roofs with high thermal transmittance [BS EN 1991-1-3:2003, 5.2 (8)]

The recommended value for thermal coefficient C_t in the UK is 1,0 for all roofing materials.

NA.2.17 Drifted snow load arrangement for pitched roofs [BS EN 1991-1-3:2003, 5.3.3 (4)]

The load arrangement given in Figure NA.2 and Table NA.1 should be used in place of BS EN 1991-1-3:2003, **5.3.3** (4) to determine the drifted snow load on a duo-pitched roof in the UK.

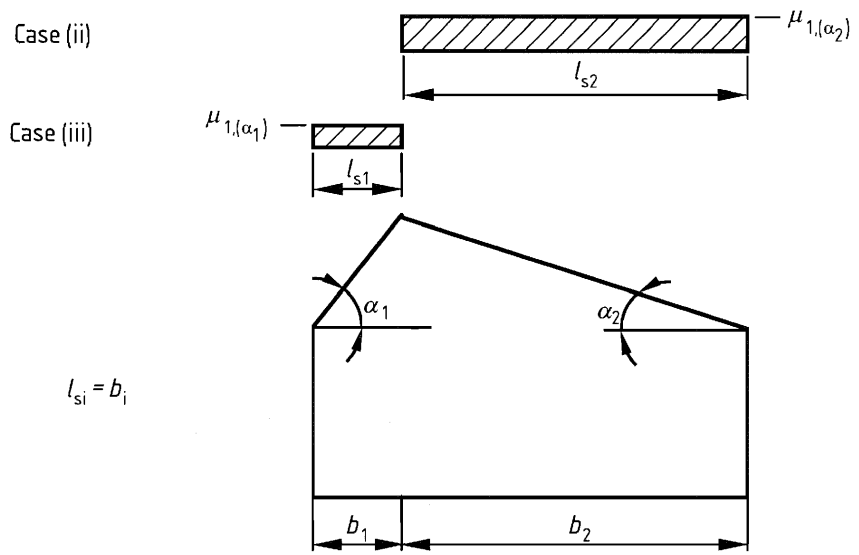

Figure NA.2 — Drifted snow load arrangement for a duo-pitched roof in the UK

Table NA.1 — Drifted snow load shape coefficient for a duo-pitched roof in the UK

Snow load shape coefficent	Angle of pitch of roof (α_i, i =1,2)			
	$0° \le \alpha_1 \le 15°$	$15° < \alpha_1 \le 30°$	$30° < \alpha_1 < 60°$	$\alpha_1 \ge 60°$
μ_1	0,8	$0,8 + 0,4(\alpha - 15)/15$	$1,2(60 - \alpha)/30$	0,0

NA.2.18 Drifted snow load arrangement for multi-span roofs [BS EN 1991-1-3:2003, 5.3.4 (3)]

BS EN 1991-1-3:2003, Annex B should be used in place of the drift load arrangement given in BS EN 1991-1-3:2003, **5.3.4** (3).

NA.2.19 Snow load shape coefficient for cylindrical roofs [BS EN 1991-1-3:2003, 5.3.5 (1)]

The roof shape coefficient μ_3 should take an upper value of 2,0 as recommended in BS EN 1991-1-3.

NA.2.20 Drifted snow load arrangement for cylindrical roofs [BS EN 1991-1-3:2003, 5.3.5 (3)]

The load arrangement given in Figure NA.3 and Table NA.2 should be used in place of BS EN 1991-1-3:2003, **5.3.5** (3).

The angles shown in Figure NA.3 are defined as follows:

δ is the angle between the horizontal and the tangent to the roof at the eaves.

α for $\delta \leq 60°$ is the angle between the horizontal and a line drawn from the crown to the eaves.

α for $\delta > 60°$ is the angle between the horizontal and a line drawn from the crown to the point of the roof where the tangent to the surface makes an angle of 60° with the horizontal.

The load arrangements shown in Figure NA.3 need only be considered for roofs where α is greater than 15°. The value for the snow load shape coefficient for one side of the roof should be zero, while the values for the other side should be obtained from Figure NA.3 and Table NA.2. The values for the snow load shape coefficients are assumed to be constant in the direction parallel to the eaves.

Table NA.2 — Drifted snow load shape coefficients for a cylindrical roof in the UK

Snow load shape coefficient	Equivalent slope for curved roof α			
	$0° \leq \alpha \leq 15°$	$15° < \alpha \leq 30°$	$30° < \alpha < 60°$	$\alpha \geq 60°$
μ_1	0	0,4	0,4	0
μ_2	0	$0,8 + 0,4[(\alpha - 15)/15]$	$1,2(60 - \alpha)/30$	0
μ_3	0	$\mu_2(60 - \delta)/30$	$\mu_2(60 - \delta)/30$	0

NA.2.21 Snow load shape coefficient for a roof abutting and close to taller construction works [BS EN 1991-1-3:2003, 5.3.6 (1)]

BS EN 1991-1-3:2003, Annex B should be used to determine the drifted snow load case. This method does not include the snow load shape coefficient μ_w, therefore, no range of values is specified for this coefficient for use in the UK.

NA.2.22 Drifted snow load arrangement for a roof abutting and close to taller construction works [BS EN 1991-1-3:2003, 5.3.6 (3)]

BS EN 1991-1-3:2003, Annex B should be used to determine the drifted snow load case.

NA.2.23 Drifting at projections and obstructions [BS EN 1991-1-3:2003, 6.2 (2)]

BS EN 1991-1-3:2003, Annex B should be used to determine the drifted snow load case.

NA.2.24 Altitude at which to consider the effects of snow overhanging the edge of a roof [BS EN 1991-1-3:2003, 6.3 (1)]

BS EN 1991-1-3:2003, **6.3** should be used for sites at altitudes greater than 800 m above sea level.

NA.2.25 Calculating the loads caused by snow overhanging the edge of a roof [BS EN 1991-1-3:2003, 6.3 (2)]

When calculating the load caused by snow overhanging the edge of a roof, the coefficient for the irregular shape of the snow k should be determined in accordance with the Note to BS EN 1991-1-3:2003, **6.3** (2).

NA.2.26 Design situations and load arrangements to be used for different locations [BS EN 1991-1-3:2003, Annex A]

The localized drifts given in BS EN 1991-1-3:2003, Annex B have been classified as exceptional drifts due to the maritime climate of the UK.

Load case B2 described in BS EN 1991-1-3:2003, Annex A should be used in place of BS EN 1991-1-3:2003, **6.2** for local drifting at projections and obstructions.

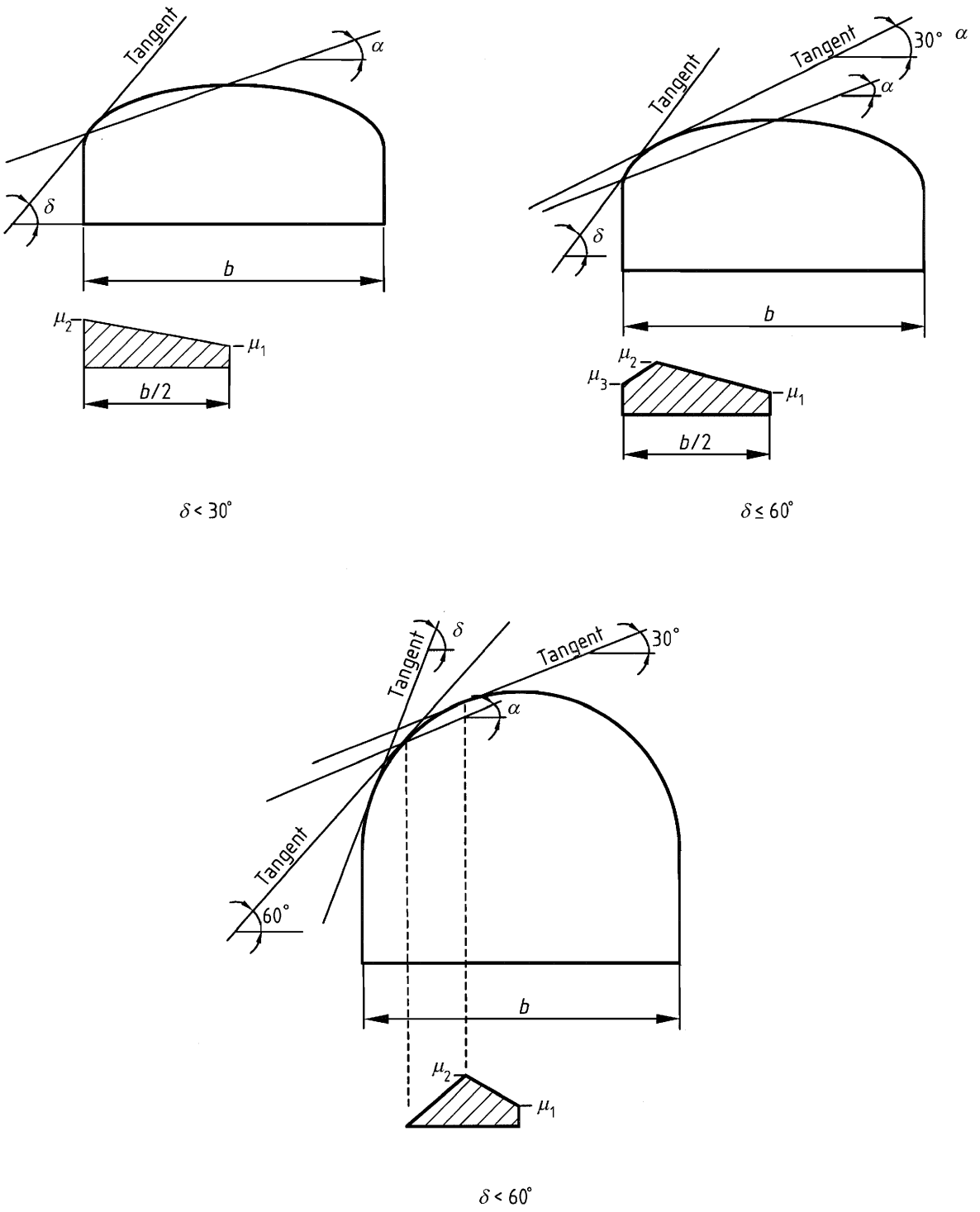

Figure NA.3 — Drifted snow load arrangements for a cylindrical roof in the UK

NA.3 Decisions on the status of informative annexes

NA.3.1 European ground snow load maps [BS EN 1991-1-3:2003, Annex C]

BS EN 1991-1-3:2003, Annex C should not be used to determine ground snow loads in the UK. The ground snow load map given in Figure NA.1 should be used.

NA.3.2 Adjustment of the ground snow load according to return period [BS EN 1991-1-3:2003, Annex D]

BS EN 1991-1-3:2003, Annex D may only be used in the UK for determining annual probabilities of exceedance smaller than 0,2.

NA.3.3 Bulk weight density of snow [BS EN 1991-1-3:2003, Annex E]

BS EN 1991-1-3:2003, Annex E may be used in the UK.

NA.4 References to non-contradictory complementary information

NA.4.1 Specialist aspects of snow loading [BS EN 1991-1-3:2003, 1.1 (8)]

NA.4.1.1 *Snow loading on bridges*

Snow loads should be considered in accordance with local conditions. For those local conditions prevailing in the United Kingdom, this loading may generally be ignored. However, there are circumstances, e.g. for opening bridges, covered bridges including roofed footbridges, or where stability due to permanent loads is critical, when snow loading should be taken into account in the design.

On ordinary bridges the accumulation of any material quantity of snow will effectively reduce the traffic loads, probably by amounts greater than the snow loads, but certainly to such an extent that the combined mass of snow and traffic loading will not exceed the nominal live load. On opening bridges, however, snow load can be significant. These bridges are likely to be designed to move under permanent loads only and the added weight could have serious adverse effects on machinery and moving parts. On swing bridges too, where snow might have been cleared from one wing of the rotating structure but not the other, the stability against overturning could be impaired.

NA.4.1.2 *Combination of actions on bridges*

The combination of snow and wind loads, and the value of ψ, for the design of bridges is given in BS EN 1990:2002, Annex A2[1)].

NA.4.2 Snow load shape coefficients for exceptional snow loads

Additional information concerning the snow load shape coefficients given in BS EN 1991-1-3:2003, Annex B is given in BRE Digest 439, *Roof loads due to local drifting of snow* [1].

NA.4.3 Snow load shape coefficients for roofs intersecting at right angles

Shape coefficients and drift lengths for roofs intersecting at 90° are given in BRE Digest 439, *Roof loads due to local drifting of snow* [1].

[1)] In preparation.

Bibliography

Standards publications

BS EN 1990:2002, *Eurocode — Basis of structural design.*

NA to BS EN 1990:2002, *UK National Annex for Eurocode 0 — Basis of structural design.*

NA to BS EN 1991-1-1, *UK National Annex to Eurocode 1: Actions on structures — Part 1-1: General actions — Densities, self-weight, imposed loads for buildings.*

Other publications

[1] BRE Digest 439, *Roof loads due to local drifting of snow*, Watford: BRE, 1999.

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