
British Standard

Slating and tiling

Part 2. Design charts for fixing roof slating
and tiling against wind uplift

Couvertures en tuiles et ardoises

Partie 2. Abaques de calcul des fixations résistantes au vent des couvertures en tuiles et en ardoises

Schieferdacheindeckungen

Teil 2. Bemessungstafeln für die windsichere Befestigung von Schieferdacheindeckungen

Foreword

This Part of BS 5534 has been prepared under the direction of the Elements and Components (of Diverse Materials) for Buildings Standards Committee.

BS 5534 is published in two Parts:

Part 1 Design

Part 2 Design charts for fixing roof slating and tiling against wind uplift

The design charts in this Part of BS 5534 have been prepared in accordance with BS 5534 : Part 1, with the intention that they may be used as design aids for quick reference and so avoid duplication of effort by designers. Acknowledgement is given to the assistance provided by the National Federation of Roofing Contractors from whose initial draft this Part of BS 5534 was prepared.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Contents

	Page
Foreword	Inside front cover
Committees responsible	Back cover
 Section one. General	
1 Scope	2
2 Symbols	2
 Section two. Use of equations, graphs and tables	
3 Accuracy	3
4 Wind loads	3
5 Resistance to wind uplift of slates and tiles	31
6 Resistance to wind uplift of underlay fixings	44
 Appendices	
A Method for determining deadweight and other geometric properties of slates and tiles	47
B Examples of the use of equations, graphs and tables	48
 Tables	
1 Ground roughness, building size and height above ground, factor S_2	6
2 Pressure coefficients C_{pe} for duo-pitch roofs	11
3 Pressure coefficients C_{pe} for monopitch roofs of rectangular buildings with $\frac{h}{w} < 2$	12
4 Wind uplift load q_t (N/m ²)	13
5 Deadweight resistance q_{tw} to wind uplift of slates and tiles	32
6 Basic withdrawal loads r_n for round nails	33
7 Nail withdrawal resistance R_n to wind loading	34
8 Wind uplift resistance of roofing deadweight q_{uw} for determining underlay nailing requirements	44
 Figures	
1 Map of UK showing basic wind speed (in m/s)	5
2 Wind uplift load q_t on slates or tiles	7
3 Wind uplift loading and deadweight and nail resistances for slated or tiled roofs	30
4 Transverse wind uplift and verge deadweight resistance	31
5 Nail resistance to uplift q_{tn} of centre-nailed slates or asbestos cement slates ignoring tail rivet strength	35
6 Nail resistance to uplift q_{tn} of head-nailed slates and tiles	37
7 Effective nail resistance factor K_n for courses nailed (tiles and head-nailed slates only)	42
8 Transverse wind uplift and verge nail resistance	43
9 Resistance to wind uplift q_{un} of batten nails for underlay fixing	45

Section one. General

1 Scope

This Part of BS 5534 provides design charts in the forms of graphs and tables for determining the deadweight and nail-fixing resistances against wind uplift of various types of slating and tiling in roofs of ridge height not exceeding 30 m above ground, for conditions in the UK, in accordance with BS 5534 : Part 1.

This Part of BS 5534 does not cover the design of proprietary fixing devices (e.g. clips, hooks and tail rivets) for which there are no British Standards. The wind uplift load to be resisted by a tile clip for single lap tiles is covered by BS 5534 : Part 1.

The wind uplift resistance of ridge tiles is determined in accordance with BS 5534 : Part 1.

Appendix A describes a method for determining the deadweight and other geometric properties of slates and tiles and appendix B gives examples of the use of the equations, graphs and tables.

NOTE. The titles of the publications referred to in this standard are listed on the inside back cover.

2 Symbols

For the purposes of this Part of BS 5534 the following symbols apply.

(a) Wind loading

C_{pe}	wind pressure external coefficient
C_{pi}	wind pressure internal coefficient
c	step height factor for slating or tiling
f	plan dimension of obstruction projecting from roof (see tables 2 and 3) (in m)
g	plan dimension of obstruction projecting from roof (see tables 2 and 3) (in m)
F_2	wind uplift force acting on slate or tile (in N)
H	height above ground of roof ridge (in m)
h	height above ground of eaves (in m)
l	greater horizontal dimension of building (in m)
q	dynamic pressure of wind (in N/m^2)
q_t	wind uplift load on slates or tiles (in N/m^2)
q_u	wind uplift load on underlay (in N/m^2)
S_1	topography factor for wind
S_2	ground roughness, building size and height above ground factor for wind
S_3	statistical return period factor for wind
S_4	directional factor for wind
V	basic wind speed (in m/s)
w	lesser horizontal dimension of building (in m)
y	dimension (see tables 2 and 3) (in m)

(b) Slating and tiling properties

B	width of tiling batten (in m)
b	cover width of slate or tile (in m)
b_{n1}	transverse distances from nails (1 and 2) to
b_{n2}	pivot edge (in m)

b_o	width of slate or tile (in m)
b_v	transverse distance of centre of mass of slate or tile to pivot edge (in m)
e	eaves overhang (in m)
G	batten gauge (in m)
G_n	spacing of batten nails along rafter (in m)
l_o	distance from tail of slate or tile to batten pivot point (in m)
l_s	distance between consecutive courses $= l_o - g$ (in m)
l_w	distance from centre of mass of slate or tile to batten pivot point (in m)
M_u	deadweight mass of roofing measured on slope (in kg/m^2)
m	distance between nail centre and head of slate (in m)
p	distance between nail centre and upper edge of batten (in m)
s	spacing of rafters (in m)
t	step height between courses (in m)
t_o	thickness of slate or tile (in m)
v	verge overhang (in m)
W_t	deadweight of slate or tile (in N)
W_{lt}	laid deadweight of slating or tiling (in N/m^2)
W_u	laid deadweight of slating or tiling, battens and underlay (in N)
α	laid pitch of slating or tiling (in degrees)
γ	density of slate (in N/m^3)
θ	rafter pitch (in degrees)

(c) Uplift resistance

d_n	pointside penetration of nail (in mm)
K_n	effective nail resistance factor for courses nailed
N	number of courses held down by a course of nails
q_{tn}	nail uplift resistance of a slate or tile (in N/m^2)
q_{tnx}, q_{tny}	nail uplift resistances of a slate or tile in the x and y directions, respectively (in N/m^2)
q_{tnv}	nail uplift resistance of verge slate (in N/m^2)
q_{tw}	deadweight resistance of a slate or tile on slope (in N/m^2)
q_{twb}	basic deadweight resistance of a slate or tile laid horizontally (in N/m^2)
q_{twvb}	Basic deadweight resistance of a verge slate or tile when exposed to wind acting against the edge of the verge (in N/m^2)
q_{uw}	deadweight resistance of underlay supports (in N/m^2)
q_{un}	underlay nailing resistance to uplift (in N/m^2)
R_n	withdrawal resistance of a nail (in N)
r_n	basic withdrawal resistance of a nail (in N per millimetre of pointside penetration)

$$X = \frac{g - m}{tb(l_o - t)} \quad (\text{see figure 5}) \quad (\text{in } m^{-2})$$

$$Y = \frac{2p}{ctb(l_o - 0.5ct)} \quad (\text{see figure 6}) \quad (\text{in } m^{-2})$$

Section two. Use of equations, graphs and tables

3 Accuracy

The design charts are considered to be sufficiently accurate for practical purposes in normal design. However, because of certain simplifying assumptions made in preparing them (see 4.3(a) and (c)) and the errors which may occur when scaling off or interpolating the data, they should not be relied upon where high accuracy is required or in exceptional design conditions; in such cases the loads and resistances should be calculated in accordance with the equations given. Examples of the use of the equations, graphs and tables are given in appendix B.

4 Wind loads

4.1 General

In accordance with CP 3 : Chapter V : Part 2, the wind uplift load (q_t or q_u) depends firstly on the dynamic pressure of the wind (q) as affected by the basic wind speed (V), topography (S_1), ground roughness and size and height of building (S_2), the return period (S_3), and wind direction (S_4); and secondly on the geometric shapes of the roof and building (C_{pe} and C_{pi}).

4.2 Dynamic pressure of the wind

The dynamic pressure of the wind q (in N/m^2) should be determined by the following procedure.

(a) Select an appropriate basic wind speed V (in m/s) for the site. A guide to the basic wind speeds for the UK is shown in figure 1 and given in CP 3 : Chapter V : Part 2.

(b) Determine an appropriate value of the topography factor S_1 for the site. For most sites where no special local wind effects are present, $S_1 = 1.0$. For sites on exposed hills or valleys, a value for S_1 greater than 1.0 may be required and should be determined by reference to CP 3 : Chapter V : Part 2.

(c) Determine an appropriate value of S_2 , the factor relating to ground roughness of the site, building size and height above ground of the roof, by reference to table 1 or CP 3 : Chapter V : Part 2.

There are four ground roughness categories, ranging from category (1) for open country with no obstructions to category (4) for large and frequent obstructions, e.g. city centres. A photographic guide to these categories is given in the 'Wind Loading Handbook'*.

The building size refers to the dimensions of the building or element affected by the size of wind gust. In the case of slating and tiling, class A should be taken for wind loads acting on slates and tiles, and class B for underlays.

The height above ground should be taken to the top of the roof ridge. Alternatively, the roof may be divided into convenient parts and the wind load on each part calculated, using a value for S_2 that corresponds to the height above ground to the top of that part.

(d) Determine an appropriate value of factor S_3 , which is based on statistical concepts taking account of the degree of security required and the number of years during which there will be exposure to wind. Normally, for wind loads on permanent and completed buildings, $S_3 = 1.0$, corresponding to a 50-year return period. A lower value for temporary buildings or a higher value for exceptional safety requirements may be appropriate, as discussed in CP 3 : Chapter V : Part 2.

(e) Determine an appropriate value of wind directional factor S_4 . For this purpose the wind direction should be related to the direction of the roof slope. The value of S_4 ranges from 0.73 to 1.0. In normal design and where the location and orientation of the roof is not known with certainty at the time of design, assume $S_4 = 1.0$.

(f) For confirmation of statutory requirements in regard to the appropriate values of V , S_1 and the ground roughness category for a particular site, the local building control authority should be consulted. Advice may also be obtained from the Meteorological Office regarding wind speeds.

(g) Calculate the product $S_1 S_2 S_3 S_4$ to the nearest 0.02. The dynamic pressure of the wind q (in N/m^2) may then be calculated from:

$$q = 0.613 (S_1 S_2 S_3 S_4 V)^2 \quad (1)$$

Calculation of q may not be required if the alternative method of obtaining q_t by reference to tables 2 or 3 and 4 is followed (see 4.3).

4.3 Wind uplift on slates and tiles

The wind uplift load q_t at the tail of slates or tiles, which acts at right angles to the slate or tile surface, is generated by the dynamic pressure of the wind q . The value of q_t is affected by the eaves height, roof shape (duo-pitch or monopitch), obstructions and the building height-width ratio h/w . q_t should be calculated by one of the following procedures.

(a) Read off the values of q_t for the general area or local areas of the roof for the relevant value of q (calculated by equation (1)), from:

figure 2(a) for duo-pitch roofs with $h/w \leq 1/2$; or

figure 2(b) for duo-pitch roofs with $1/2 < h/w \leq 3/2$; or

figure 2(c) for duo-pitch roofs with $3/2 < h/w < 6$; or

figure 2(d) for monopitch roofs with $h/w < 2$.

Whereas BS 5534 : Part 1 and tables 2 and 3 give a number of different pressure coefficient values C_{pe} for calculating q_t for various local areas of a roof, in figure 2 only two local area values of q_t are given which are considered sufficient for simplified practical design: the maximum q_t value for all the various local areas of duo-pitch or monopitch roofs; and the q_t value for the local area around obstructions (e.g. a chimney).

(b) Alternatively, q_t may be obtained without first calculating q , by reference to tables 2 or 3 and 4. First, select an appropriate value of C_{pe} from table 2 or 3.

*Newberry, C.W. and Eaton, K.J. Wind Loading Handbook. BRE Report, 1974. Available from the Building Research Station, Garston, Watford, Herts WD2 7JR.

Then, with the calculated value $S_1 S_2 S_3 S_4$ (see 4.2(g)) and appropriate C_{pe} value, read off the required q_t value from the appropriate part of table 4.

(c) To obtain q_t by calculation, apply the equation:

$$q_t = q (C_{pe} - 1) \quad (2)$$

Table 4 and equation (2) are valid only where the roof has an underlay in accordance with BS 5534 : Part 1. For a roof without an underlay or where the underlay is not in accordance with BS 5534 : Part 1, reference should be made to BS 5534 : Part 1 for calculating wind loads on slates or tiles.

4.4 Wind uplift on underlay

The wind uplift load on the underlay q_u (in N/m^2) is given by:

$$q_u = q (C_{pe} - C_{pi}) \quad (3)$$

The value of C_{pi} for house roofs with ceilings may normally be taken as 0.2, or as 0.8 for an undercloak or underlay exposed at an overhanging eaves or verge (see BS 5534 : Part 1). For other cases see CP 3 : Chapter V : Part 2.

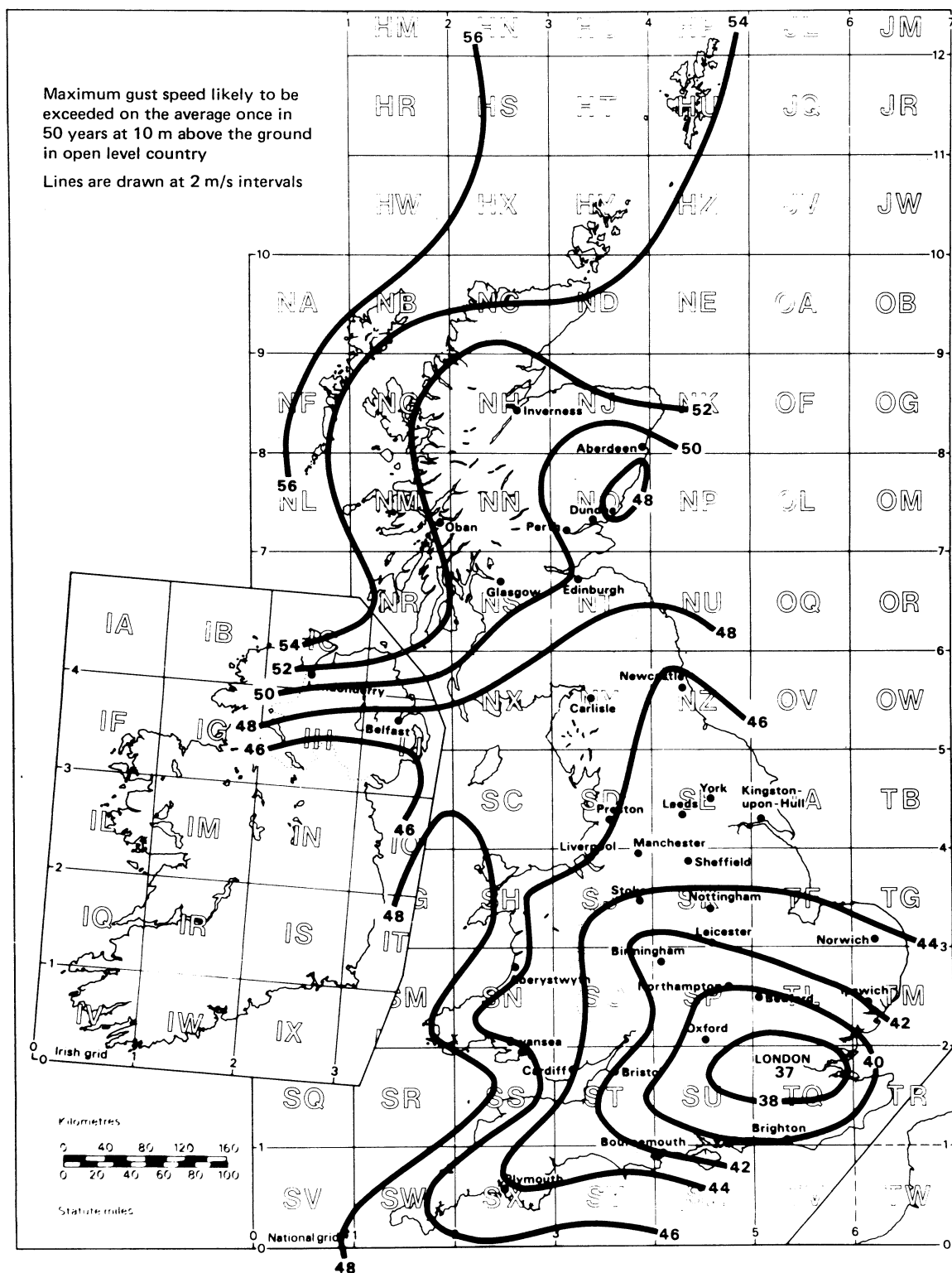
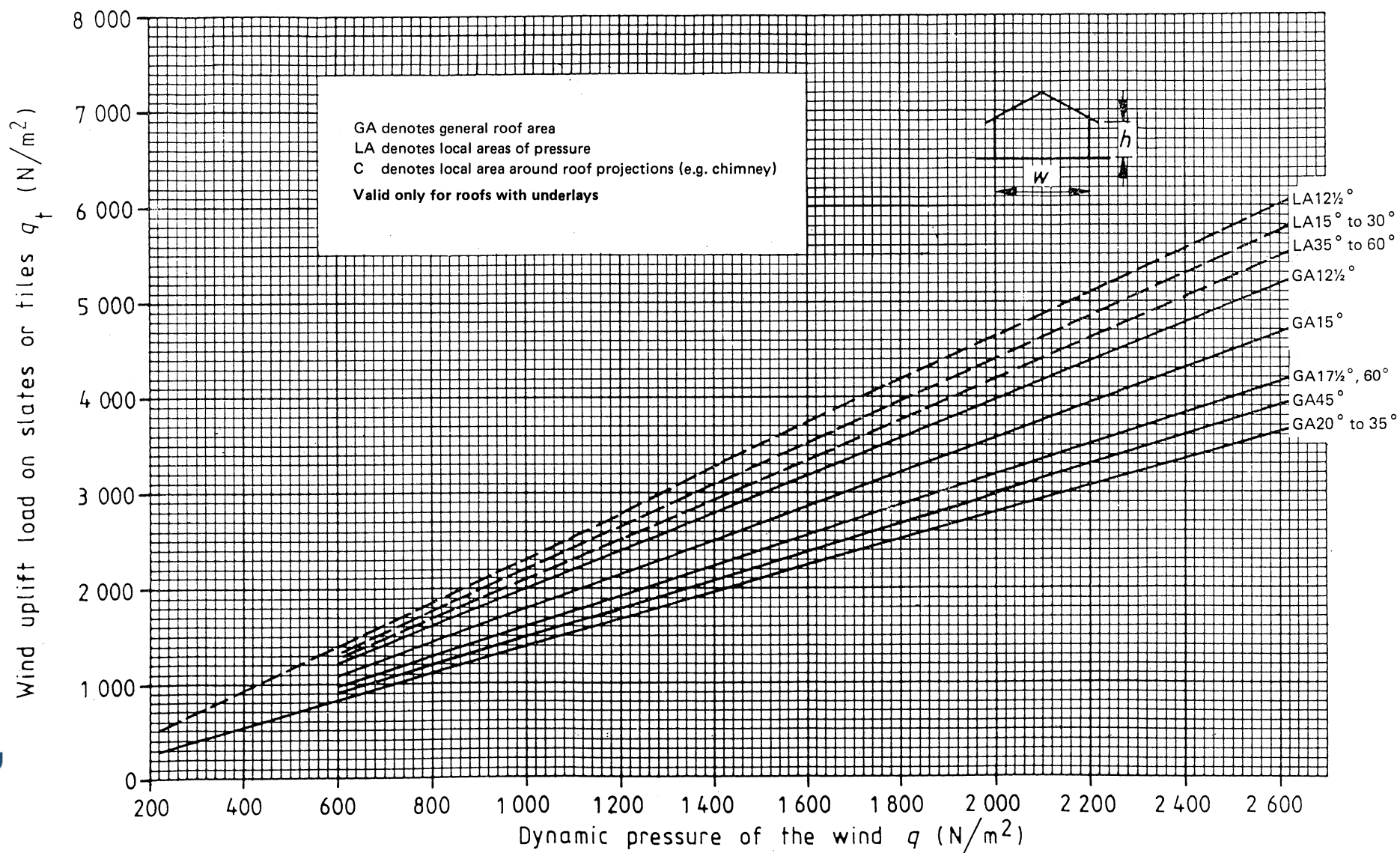


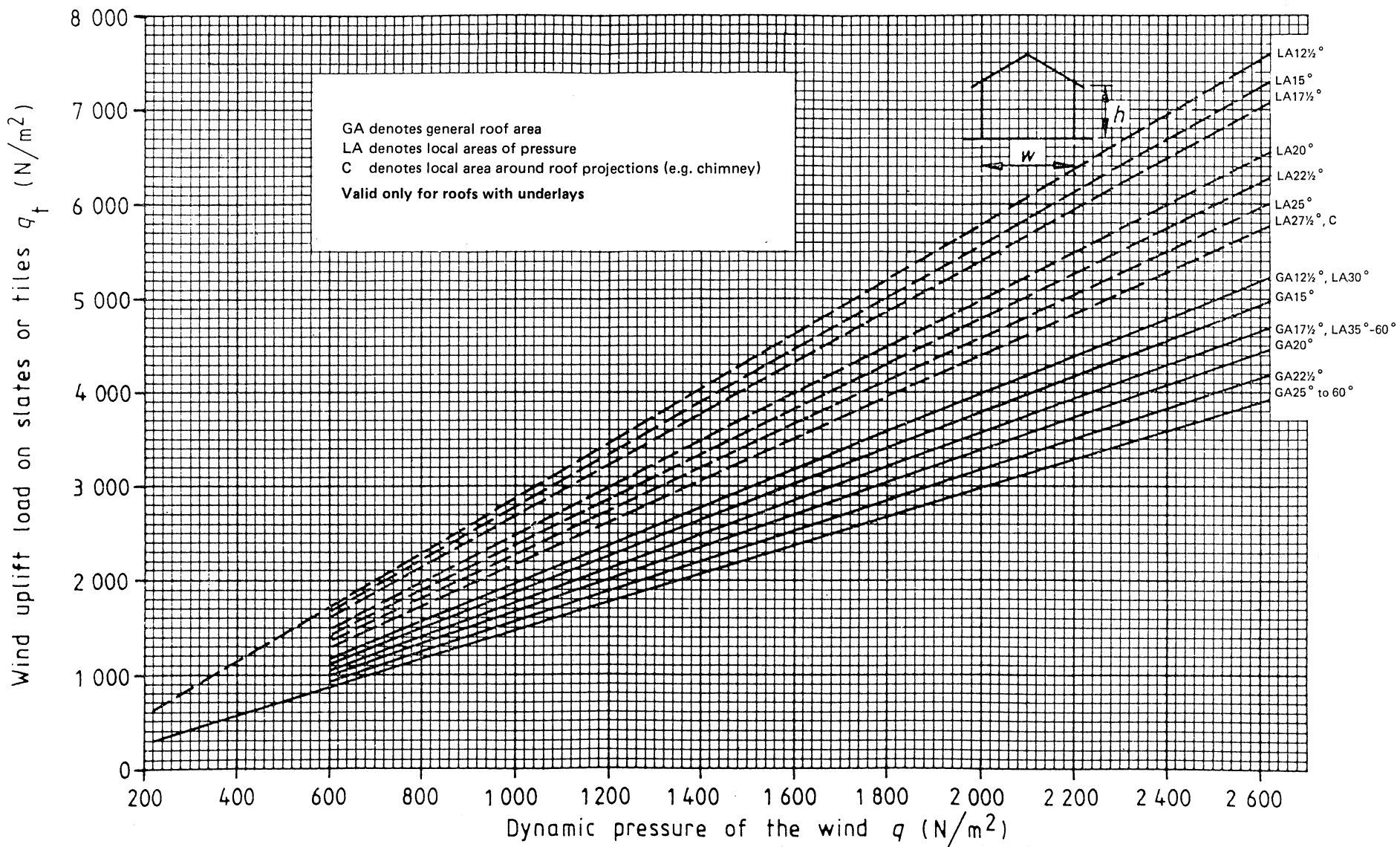
Figure 1. Map of UK showing basic wind speed (in m/s)

Table 1. Ground roughness, building size and height above ground, factor S_2 *								
Height above ground of roof ridge H	Factor S_2							
	(1) Open country with no obstructions		(2) Open country with scattered windbreaks		(3) Country with many windbreaks; small towns; outskirts of large cities		(4) Surface with large and frequent obstructions, e.g. city centres	
	Class A	B	Class A	B	Class A	B	Class A	B
m								
3 or less	0.83	0.78	0.72	0.67	0.64	0.60	0.56	0.52
5	0.88	0.83	0.79	0.74	0.70	0.65	0.60	0.55
10	1.00	0.95	0.93	0.88	0.78	0.74	0.67	0.62
15	1.03	0.99	1.00	0.95	0.88	0.83	0.74	0.69
20	1.06	1.01	1.03	0.98	0.95	0.90	0.79	0.75
30	1.09	1.05	1.07	1.03	1.01	0.97	0.90	0.85
*Abstracted from CP 3 : Chapter V : Part 2 : 1972.								



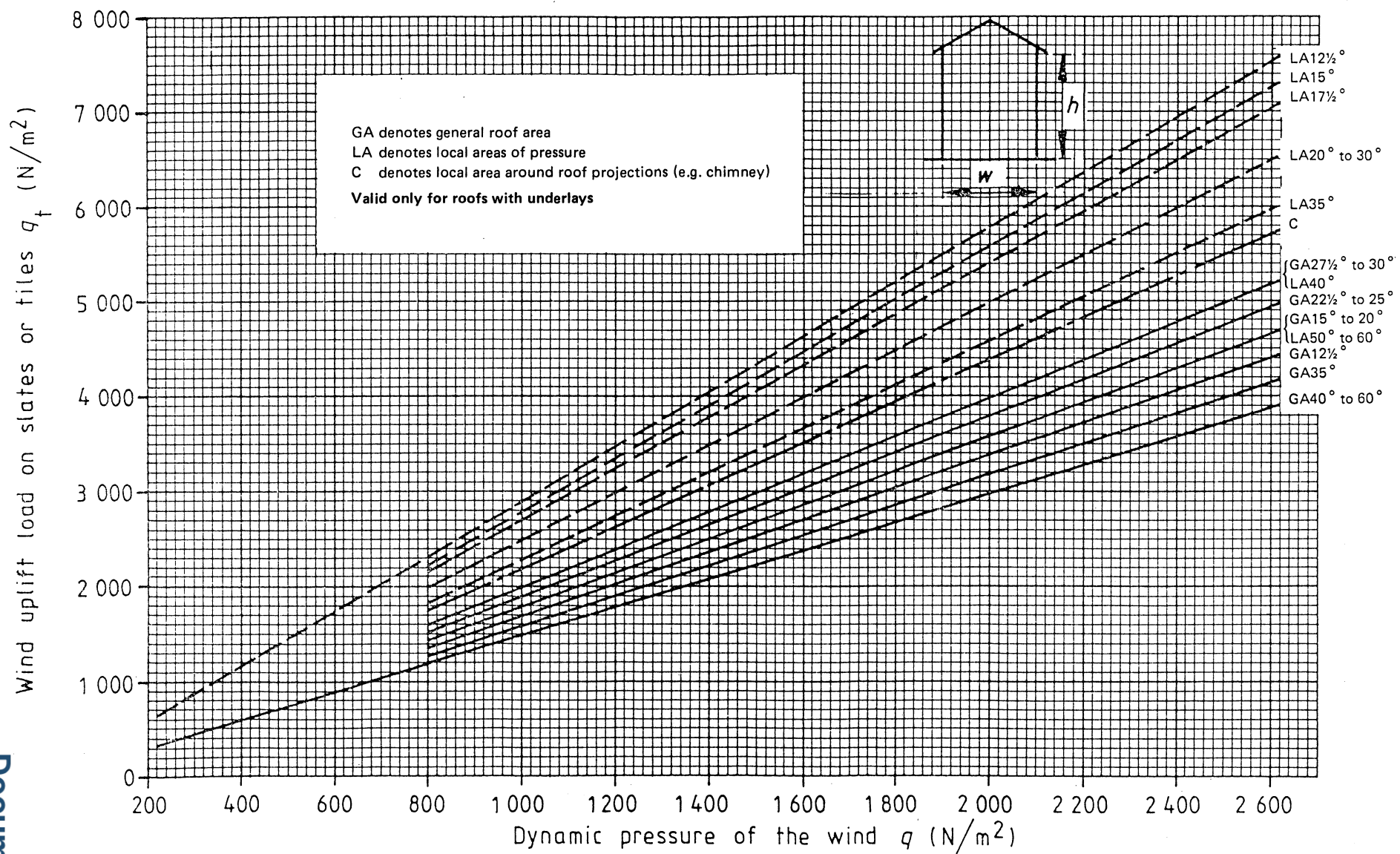
(a) Duo-pitched roofs where building height ratio $h/w \leq \frac{1}{2}$

Figure 2. Wind uplift load q_t on slates or tiles



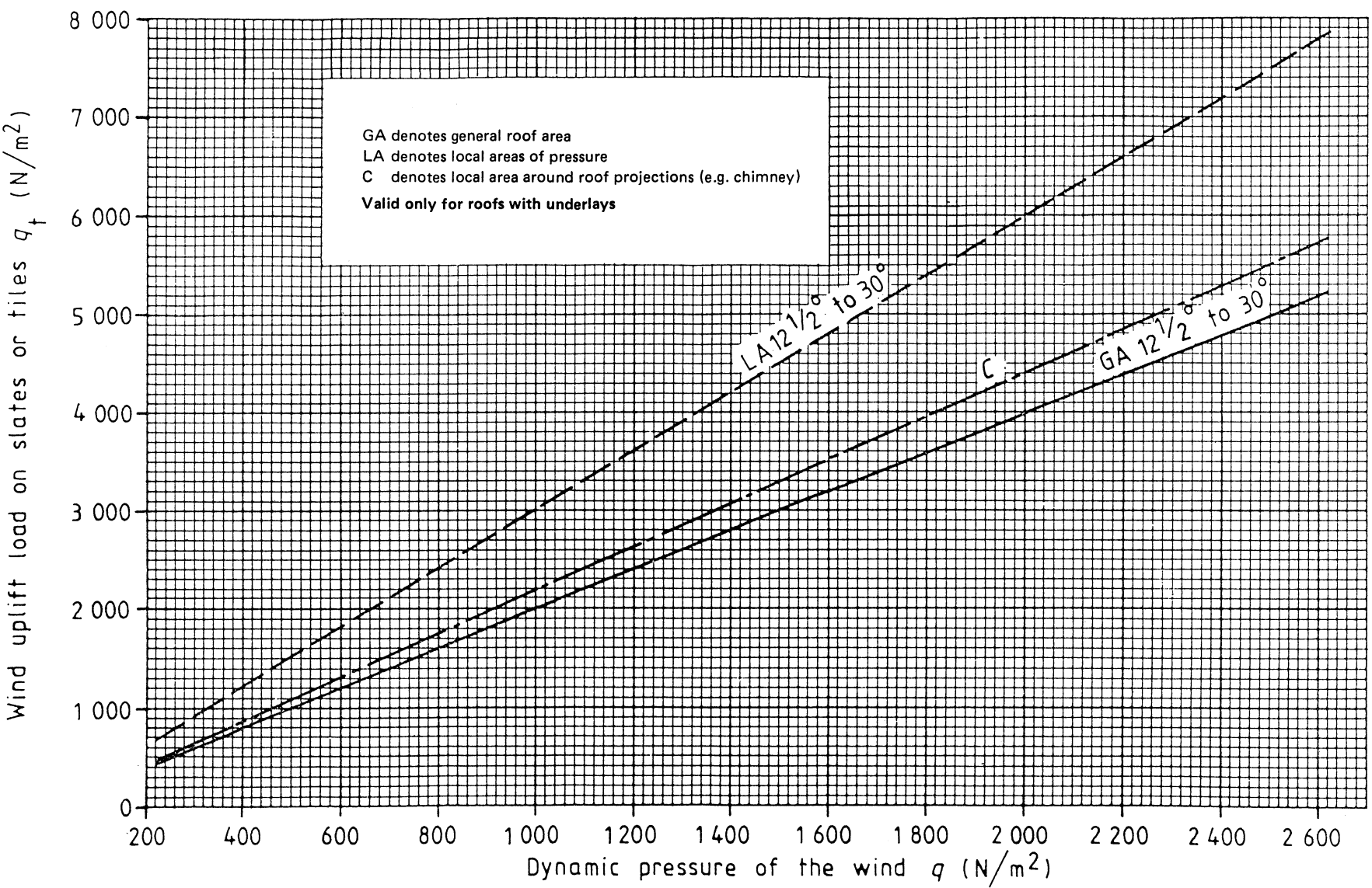
(b) Duo-pitched roofs where building height ratio $\frac{1}{2} < h/w \leq 3/2$

Figure 2. Wind uplift load q_t on slates or tiles (continued)



(c) Duo-pitched roofs where building height ratio $3/2 < h/w < 6$

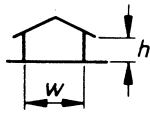
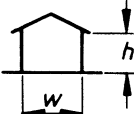
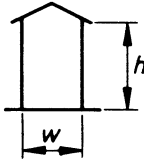
Figure 2. Wind uplift load q_t on slates or tiles (continued)



(d) Monopitch roofs of rectangular buildings where building height ratio $h/w < 2$

Figure 2. Wind uplift load q_t on slates or tiles (concluded)

Table 2. Pressure coefficients C_{pe} for duo-pitch roofs

Building height ratio	Roof pitch*	General roof areas	Local areas of pressure				
			V	R	E ₁	E ₂	C
$\frac{h}{w} \leq \frac{1}{2}$ 	degrees						
	12½	-1.0	-1.3	-1.2	-1.3	-1.0	-1.2
	15	-0.8	-1.2	-1.2	-1.1	-0.8	-1.2
	17½	-0.6	-1.1	-1.2	-0.9	-0.8	-1.2
	20	-0.4	-1.0	-1.2	-0.7	-0.7	-1.2
	22½	-0.4	-1.0	-1.2	-0.7	-0.7	-1.2
	25	-0.4	-0.9	-1.2	-0.7	-0.7	-1.2
	27½	-0.4	-0.9	-1.2	-0.7	-0.7	-1.2
	30	-0.4	-0.8	-1.2	-0.7	-0.7	-1.2
	35	-0.4	-0.8	-1.1	-0.7	-0.7	-1.2
	45	-0.5	-0.7	-1.1	-0.7	-0.7	-1.2
	60	-0.6	-0.7	-1.1	-0.7	-0.7	-1.2
$\frac{1}{2} < \frac{h}{w} \leq \frac{3}{2}$ 	12½	-1.0	-1.9	-1.2	-1.9	-1.5	-1.2
	15	-0.9	-1.8	-1.1	-1.8	-1.5	-1.2
	17½	-0.8	-1.7	-1.1	-1.7	-1.5	-1.2
	20	-0.7	-1.5	-1.0	-1.5	-1.5	-1.2
	22½	-0.6	-1.4	-1.0	-1.4	-1.4	-1.2
	25	-0.5	-1.3	-1.0	-1.2	-1.2	-1.2
	27½	-0.5	-1.2	-1.0	-1.0	-1.0	-1.2
	30	-0.5	-1.0	-1.0	-0.8	-0.8	-1.2
	35	-0.5	-0.8	-0.8	-0.8	-0.8	-1.2
	45	-0.5	-0.8	-0.8	-0.8	-0.8	-1.2
	60	-0.5	-0.8	-0.8	-0.8	-0.8	-1.2
$\frac{3}{2} < \frac{h}{w} < 6$ 	12½	-0.7	-1.9	-1.2	-1.9	-1.9	-1.2
	15	-0.8	-1.8	-1.2	-1.8	-1.8	-1.2
	17½	-0.8	-1.7	-1.2	-1.7	-1.7	-1.2
	20	-0.8	-1.5	-1.2	-1.5	-1.5	-1.2
	22½	-0.9	-1.5	-1.2	-1.4	-1.4	-1.2
	25	-0.9	-1.5	-1.1	-1.3	-1.3	-1.2
	27½	-1.0	-1.5	-1.1	-1.2	-1.2	-1.2
	30	-1.0	-1.5	-1.0	-1.0	-1.0	-1.2
	35	-0.6	-1.3	-0.9	-0.9	-0.9	-1.2
	40	-0.5	-1.0	-0.8	-0.8	-0.8	-1.2
	50	-0.5	-0.8	-0.8	-0.8	-0.8	-1.2
	60	-0.5	-0.8	-0.8	-0.8	-0.8	-1.2

NOTE. h is the height to eaves or parapet and w is the lesser horizontal dimension of a building.

These coefficients are derived from table 8 of CP 3 : Chapter V : Part 2 : 1972 and interpolated to give values for intermediate roof pitches. For the general areas the condition $\alpha = 0^\circ$ has been adopted.

*Slated or tiled roofs covered by BS 5534 : Part 1 cannot necessarily be used at all of the pitches listed.

Key plan

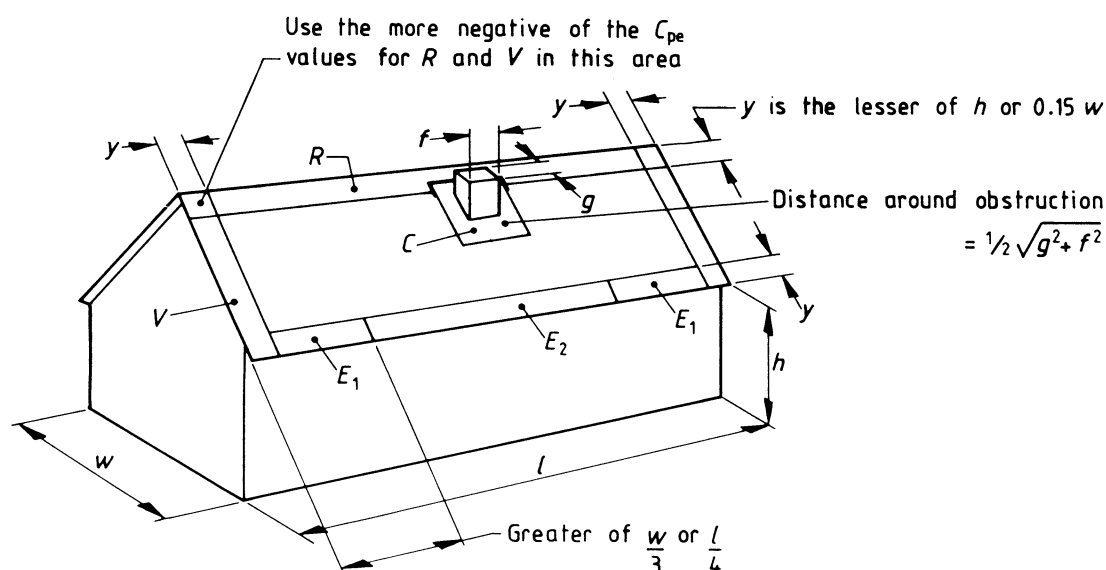


Table 3. Pressure coefficients C_{pe} for monopitch roofs of rectangular buildings with $\frac{h}{w} < 2$

Roof pitch*	General roof areas		Local areas of pressure					
	H	L	H ₁	H ₂	L ₁	L ₂	V	C
degrees								
12½	-1.0	-1.0	-1.9	-1.2	-1.9	-1.5	-2.0	-1.2
15	-1.0	-1.0	-1.8	-1.0	-1.8	-1.4	-2.0	-1.2
17½	-1.0	-1.0	-1.8	-1.0	-1.8	-1.4	-2.0	-1.2
20	-1.0	-1.0	-1.8	-1.0	-1.8	-1.4	-2.0	-1.2
22½	-1.0	-1.0	-1.8	-1.0	-1.4	-1.2	-2.0	-1.2
25	-1.0	-0.9	-1.8	-1.0	-0.9	-0.9	-2.0	-1.2
27½	-1.0	-0.8	-1.8	-1.0	-0.8	-0.8	-2.0	-1.2
30	-1.0	-0.8	-1.8	-1.0	-0.8	-0.8	-2.0	-1.2

*Slated or tiled roofs covered by BS 5534 : Part 1 cannot necessarily be used at all of the pitches listed.

Key plan

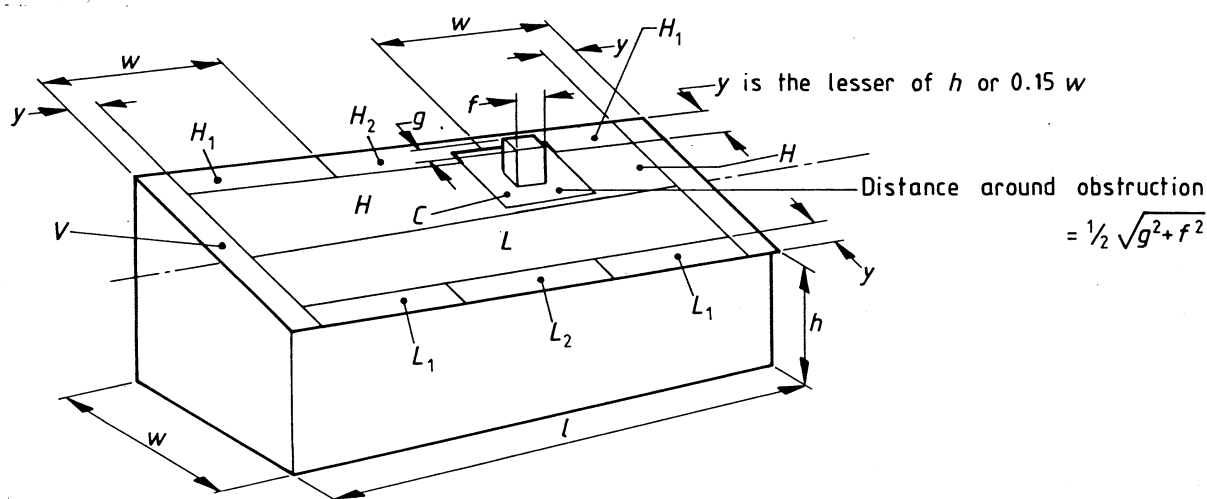


Table 4. Wind uplift load q_t (N/m²)
(a) For $C_{pe} = -0.40$

$S_1 S_2 S_3 S_4$	Wind uplift load q_t (N/m ²) at basic wind speed (m/s) of									
	38	40	42	44	46	48	50	52	54	56
0.38	-179	-198	-219	-240	-262	-286	-310	-335	-361	-389
0.40	-198	-220	-242	-266	-291	-316	-343	-371	-400	-431
0.42	-219	-242	-267	-293	-320	-349	-378	-409	-441	-475
0.44	-240	-266	-293	-322	-352	-383	-415	-449	-484	-521
0.46	-262	-291	-320	-352	-384	-418	-454	-491	-530	-569
0.48	-286	-316	-349	-383	-418	-456	-494	-535	-577	-620
0.50	-310	-343	-378	-415	-454	-494	-536	-580	-626	-673
0.52	-335	-371	-409	-449	-491	-535	-580	-627	-677	-728
0.54	-361	-400	-441	-484	-530	-577	-626	-677	-730	-785
0.56	-389	-431	-475	-521	-569	-620	-673	-728	-785	-844
0.58	-417	-462	-509	-559	-611	-665	-722	-781	-842	-905
0.60	-446	-494	-545	-598	-654	-712	-772	-835	-901	-969
0.62	-476	-528	-582	-639	-698	-760	-825	-892	-962	-1035
0.64	-508	-562	-620	-681	-744	-810	-879	-951	-1025	-1102
0.66	-540	-598	-659	-724	-791	-861	-935	-1011	-1090	-1172
0.68	-573	-635	-700	-768	-840	-914	-992	-1073	-1157	-1244
0.70	-607	-673	-742	-814	-890	-969	-1051	-1137	-1226	-1319
0.72	-642	-712	-785	-861	-941	-1025	-1112	-1203	-1297	-1395
0.74	-679	-752	-829	-910	-994	-1083	-1175	-1271	-1370	-1474
0.76	-716	-793	-874	-960	-1049	-1142	-1239	-1340	-1445	-1555
0.78	-754	-835	-921	-1011	-1105	-1203	-1305	-1412	-1523	-1637
0.80	-793	-879	-969	-1063	-1162	-1265	-1373	-1485	-1602	-1722
0.82	-833	-923	-1018	-1117	-1221	-1330	-1443	-1560	-1683	-1810
0.84	-874	-969	-1068	-1172	-1281	-1395	-1514	-1637	-1766	-1899
0.86	-917	-1016	-1120	-1229	-1343	-1462	-1587	-1716	-1851	-1990
0.88	-960	-1063	-1172	-1287	-1406	-1531	-1661	-1797	-1938	-2084
0.90	-1004	-1112	-1226	-1346	-1471	-1602	-1738	-1880	-2027	-2180
0.92	-1049	-1162	-1281	-1406	-1537	-1674	-1816	-1964	-2118	-2278
0.94	-1095	-1213	-1338	-1468	-1605	-1747	-1896	-2050	-2211	-2378
0.96	-1142	-1265	-1395	-1531	-1674	-1822	-1977	-2139	-2306	-2480
0.98	-1190	-1319	-1454	-1596	-1744	-1899	-2061	-2229	-2403	-2585
1.00	-1239	-1373	-1514	-1661	-1816	-1977	-2146	-2321	-2503	-2691
1.02	-1289	-1429	-1575	-1729	-1889	-2057	-2232	-2414	-2604	-2800
1.04	-1340	-1485	-1637	-1797	-1964	-2139	-2321	-2510	-2707	-2911
1.06	-1392	-1543	-1701	-1867	-2040	-2222	-2411	-2607	-2812	-3024
1.08	-1445	-1602	-1766	-1938	-2118	-2306	-2503	-2707	-2919	-3139
1.10	-1499	-1661	-1832	-2010	-2197	-2393	-2596	-2808	-3028	-3256
1.12	-1555	-1722	-1899	-2084	-2278	-2480	-2691	-2911	-3139	-3376
1.14	-1611	-1785	-1967	-2159	-2360	-2570	-2788	-3016	-3252	-3498
1.16	-1668	-1848	-2037	-2236	-2444	-2661	-2887	-3123	-3367	-3621
1.18	-1726	-1912	-2108	-2313	-2529	-2753	-2987	-3231	-3484	-3747
1.20	-1785	-1977	-2180	-2393	-2615	-2847	-3090	-3342	-3604	-3875
1.22	-1844	-2044	-2253	-2473	-2703	-2943	-3193	-3454	-3725	-4006
1.24	-1905	-2111	-2328	-2555	-2792	-3040	-3299	-3568	-3848	-4138
1.26	-1967	-2180	-2403	-2638	-2883	-3139	-3406	-3684	-3973	-4273
1.28	-2030	-2250	-2480	-2722	-2975	-3240	-3515	-3802	-4100	-4409
1.30	-2094	-2321	-2558	-2808	-3069	-3342	-3626	-3922	-4229	-4548
1.32	-2159	-2393	-2638	-2895	-3164	-3445	-3738	-4043	-4360	-4689
1.34	-2225	-2466	-2718	-2983	-3261	-3550	-3852	-4167	-4494	-4833
1.36	-2292	-2540	-2800	-3073	-3359	-3657	-3968	-4292	-4629	-4978
1.38	-2360	-2615	-2883	-3164	-3458	-3766	-4086	-4419	-4766	-5125
1.40	-2429	-2691	-2967	-3256	-3559	-3875	-4205	-4548	-4905	-5275
1.42	-2499	-2769	-3053	-3350	-3662	-3987	-4326	-4679	-5046	-5427
1.44	-2570	-2847	-3139	-3445	-3766	-4100	-4449	-4812	-5189	-5581
1.46	-2642	-2927	-3227	-3542	-3871	-4215	-4573	-4947	-5334	-5737
1.48	-2714	-3008	-3316	-3639	-3978	-4331	-4700	-5083	-5482	-5895

NOTE. Negative sign denotes uplift.

Table 4. Wind uplift load q_t (N/m²) (continued)(b) For $C_{pe} = -0.50$

$S_1 S_2 S_3 S_4$	Wind uplift load q_t (N/m ²) at basic wind speed (m/s) of									
	38	40	42	44	46	48	50	52	54	56
0.38	-192	-212	-234	-257	-281	-306	-332	-359	-387	-416
0.40	-212	-235	-260	-285	-311	-339	-368	-398	-429	-461
0.42	-234	-260	-286	-314	-343	-374	-405	-439	-473	-509
0.44	-257	-285	-314	-345	-377	-410	-445	-481	-519	-558
0.46	-281	-311	-343	-377	-412	-448	-486	-526	-567	-610
0.48	-306	-339	-374	-410	-448	-488	-530	-573	-618	-664
0.50	-332	-368	-405	-445	-486	-530	-575	-622	-670	-721
0.52	-359	-398	-439	-481	-526	-573	-622	-672	-725	-780
0.54	-387	-429	-473	-519	-567	-618	-670	-725	-782	-841
0.56	-416	-461	-509	-558	-610	-664	-721	-780	-841	-904
0.58	-447	-495	-546	-599	-655	-713	-773	-836	-902	-970
0.60	-478	-530	-584	-641	-700	-763	-828	-895	-965	-1038
0.62	-510	-566	-623	-684	-748	-814	-884	-956	-1031	-1108
0.64	-544	-603	-664	-729	-797	-868	-942	-1018	-1098	-1181
0.66	-578	-641	-707	-775	-848	-923	-1001	-1083	-1168	-1256
0.68	-614	-680	-750	-823	-900	-980	-1063	-1150	-1240	-1333
0.70	-651	-721	-795	-872	-953	-1038	-1126	-1218	-1314	-1413
0.72	-688	-763	-841	-923	-1009	-1098	-1192	-1289	-1390	-1495
0.74	-727	-806	-888	-975	-1065	-1160	-1259	-1362	-1468	-1579
0.76	-767	-850	-937	-1028	-1124	-1224	-1328	-1436	-1549	-1666
0.78	-808	-895	-987	-1083	-1184	-1289	-1399	-1513	-1631	-1754
0.80	-850	-942	-1038	-1139	-1245	-1356	-1471	-1591	-1716	-1845
0.82	-893	-989	-1091	-1197	-1308	-1424	-1546	-1672	-1803	-1939
0.84	-937	-1038	-1144	-1256	-1373	-1495	-1622	-1754	-1892	-2035
0.86	-982	-1088	-1200	-1317	-1439	-1567	-1700	-1839	-1983	-2133
0.88	-1028	-1139	-1256	-1379	-1507	-1641	-1780	-1925	-2076	-2233
0.90	-1075	-1192	-1314	-1442	-1576	-1716	-1862	-2014	-2172	-2336
0.92	-1124	-1245	-1373	-1507	-1647	-1793	-1946	-2104	-2269	-2441
0.94	-1173	-1300	-1433	-1573	-1719	-1872	-2031	-2197	-2369	-2548
0.96	-1224	-1356	-1495	-1641	-1793	-1952	-2119	-2291	-2471	-2657
0.98	-1275	-1413	-1558	-1710	-1869	-2035	-2208	-2388	-2575	-2769
1.00	-1328	-1471	-1622	-1780	-1946	-2119	-2299	-2486	-2681	-2884
1.02	-1381	-1531	-1688	-1852	-2024	-2204	-2392	-2587	-2790	-3000
1.04	-1436	-1591	-1754	-1925	-2104	-2291	-2486	-2689	-2900	-3119
1.06	-1492	-1653	-1822	-2000	-2186	-2380	-2583	-2794	-3013	-3240
1.08	-1549	-1716	-1892	-2076	-2269	-2471	-2681	-2900	-3127	-3363
1.10	-1607	-1780	-1963	-2154	-2354	-2563	-2781	-3008	-3244	-3489
1.12	-1666	-1845	-2035	-2233	-2441	-2657	-2884	-3119	-3363	-3617
1.14	-1726	-1912	-2108	-2313	-2529	-2753	-2987	-3231	-3485	-3747
1.16	-1787	-1980	-2183	-2395	-2618	-2851	-3093	-3346	-3608	-3880
1.18	-1849	-2048	-2258	-2479	-2709	-2950	-3201	-3462	-3733	-4015
1.20	-1912	-2119	-2336	-2563	-2802	-3051	-3310	-3580	-3861	-4152
1.22	-1976	-2190	-2414	-2650	-2896	-3153	-3421	-3701	-3991	-4292
1.24	-2042	-2262	-2494	-2737	-2992	-3257	-3535	-3823	-4123	-4434
1.26	-2108	-2336	-2575	-2826	-3089	-3363	-3649	-3947	-4257	-4578
1.28	-2175	-2410	-2657	-2917	-3188	-3471	-3766	-4074	-4393	-4724
1.30	-2244	-2486	-2741	-3008	-3288	-3580	-3885	-4202	-4531	-4873
1.32	-2313	-2563	-2826	-3102	-3390	-3691	-4005	-4332	-4672	-5024
1.34	-2384	-2642	-2912	-3196	-3494	-3804	-4128	-4464	-4814	-5178
1.36	-2456	-2721	-3000	-3293	-3599	-3918	-4252	-4599	-4959	-5333
1.38	-2529	-2802	-3089	-3390	-3705	-4035	-4378	-4735	-5106	-5491
1.40	-2602	-2884	-3179	-3489	-3813	-4152	-4506	-4873	-5255	-5652
1.42	-2677	-2967	-3271	-3589	-3923	-4272	-4635	-5013	-5406	-5814
1.44	-2753	-3051	-3363	-3691	-4035	-4393	-4767	-5156	-5560	-5979
1.46	-2830	-3136	-3457	-3795	-4147	-4516	-4900	-5300	-5715	-6147
1.48	-2908	-3223	-3553	-3899	-4262	-4640	-5035	-5446	-5873	-6316

NOTE. Negative sign denotes uplift.