

Price 50p

Simplified calculations

PREFACE

This leaflet includes a series of maps and a chart which have been prepared by Crittall-Hope Ltd. Research and Development Division to simplify the specification of performance requirements for windows.

Wind loading can be calculated by working to the method described in B.S. Code of Practice CP3 Chapter V Part 2 : 1970 but it is a fairly lengthy calculation.

A grading system covering wind loading, air infiltration and water penetration is suggested in B.S. DD4 :1971 "Recommendations for the Grading of Windows".

Both these documents have been used as the basis for this leaflet.



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HOW TO SPECIFY

Wind loading and Window performance

WIND LOADING

The design wind pressure can be calculated by reference to the method described in B.S. CP3 Chapter V Part 2. Alternatively, the wind loading requirements can be expressed as Sheltered, Moderate or Severe Exposure Grade in accordance with B.S. DD4 : 1971.

By using the grading system a window will frequently need to be over-designed and might have thicker glass and stronger coupling members than are really necessary.

It is therefore suggested that the wind loading is expressed as the Design Wind Pressure and the calculation can be eliminated by the following method.

How to Determine the Design Wind Pressure

1. Locate the site on the map of Basic Wind Speed Zones. Page 4.
2. Select the Design Wind Pressure from the Chart according to: Page 5.
 - a. The Basic Wind Speed Zone
 - b. The Height of the building above ground (or alternatively the height of the head of the window above ground).
 - c. The ground roughness category (see below).

The ground roughness categories are:

- Category 1 – Open country with no obstructions.
- Category 2 – Open country with scattered wind breaks.
- Category 3 – Country with many wind breaks, small towns, outskirts of large cities.
- Category 4 – Surfaces with large and frequent obstructions e.g. city centres.

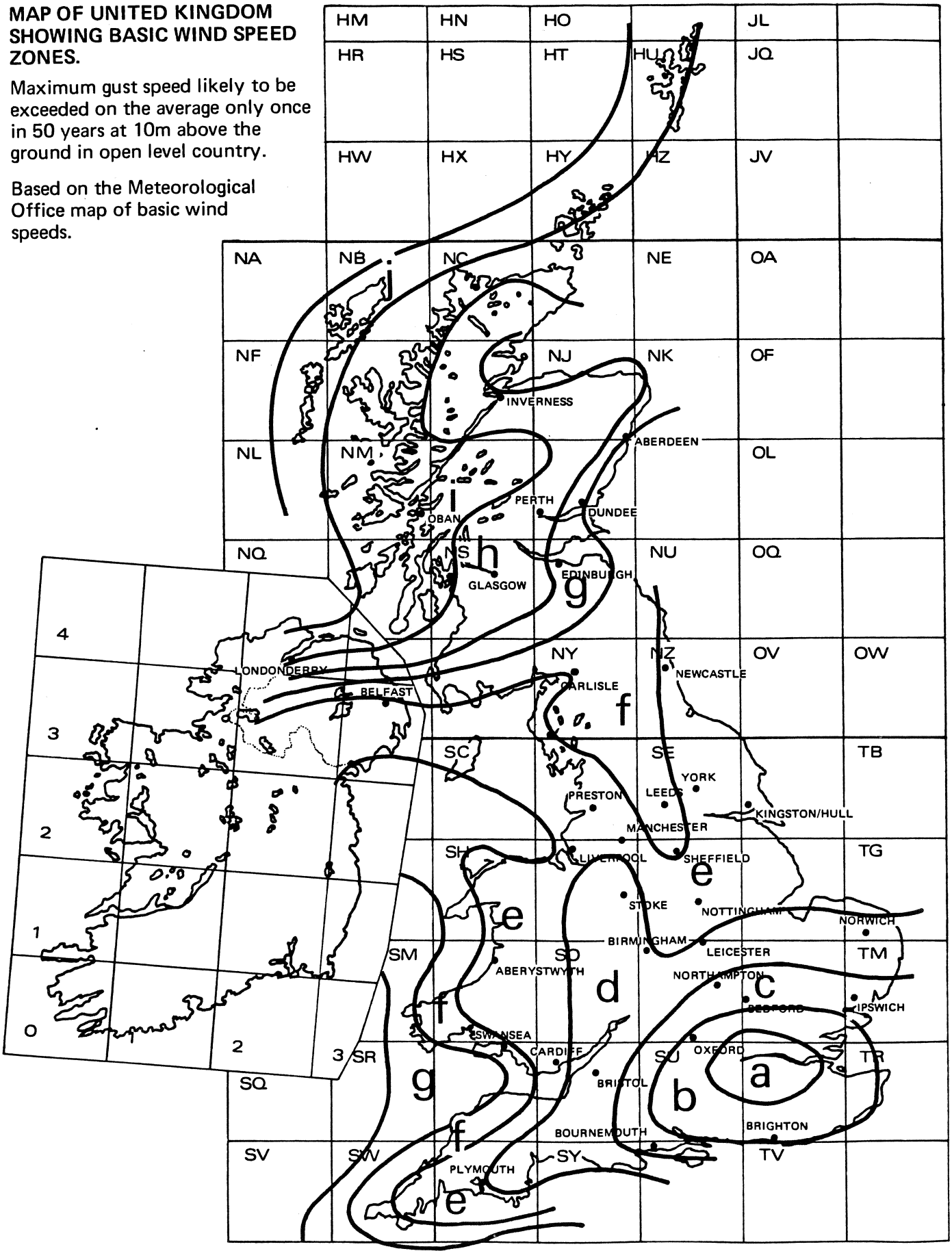
Notes

- (i) In the preparation of the Chart it has been assumed that the S_1 factor (topography factor) is 1.0. This will apply in most cases unless the building is on very hilly exposed hill slopes or crests where acceleration is known to occur or in valleys shaped to produce a funnelling of the wind. In these cases the S_1 factor should be 1.1 and in which case the design wind pressure will be 20% greater than the figures shown on the chart.
- (ii) A combined external and internal pressure coefficient of 1.4 has been assumed. This will be found to be adequate for all square or rectangular buildings unless there is a large opening in one of the sides. A loading bay might be an example. Where there is such an opening, or the building is of an unusual shape or is more than 30 m high the design wind pressure should be calculated in accordance with B.S. CP3 Chapter V Part 2.

MAP OF UNITED KINGDOM SHOWING BASIC WIND SPEED ZONES.

Maximum gust speed likely to be exceeded on the average only once in 50 years at 10m above the ground in open level country.

Based on the Meteorological Office map of basic wind speeds.



BASIC WIND SPEED ZONE	HEIGHT				HEIGHT				HEIGHT				HEIGHT							
	UP TO 3m				UP TO 5m				UP TO 10m				UP TO 20m				UP TO 30m			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
a	850	650	500	400	950	800	600	450	1250	1100	750	550	1400	1300	1100	750	1450	1400	1250	1000
b	950	700	550	450	1050	850	650	500	1400	1200	850	600	1550	1450	1250	850	1650	1550	1400	1100
c	1050	800	600	500	1150	950	700	550	1500	1300	900	700	1700	1600	1350	950	1800	1700	1550	1250
d	1150	850	700	500	1300	1050	800	600	1650	1450	1000	750	1850	1750	1500	1050	1950	1900	1700	1350
e	1250	950	750	550	1400	1150	900	650	1800	1550	1100	800	2050	1950	1650	1150	2150	2100	1850	1450
f	1350	1000	800	600	1550	1250	950	700	2000	1700	1200	900	2200	2100	1800	1250	2350	2250	2000	1600
g	1500	1100	900	650	1700	1350	1050	750	2150	1850	1300	950	2400	2300	2000	1350	2550	2450	2200	1750
h	1600	1200	950	700	1800	1450	1150	850	2300	2000	1400	1050	2600	2450	2100	1450	2750	2650	2350	1900
i	1700	1300	1000	800	1950	1550	1200	900	2500	2150	1500	1100	2800	2650	2250	1550	2950	2850	2550	2050
j	1850	1400	1100	850	2100	1700	1300	950	2700	2350	1650	1200	3000	2850	2450	1700	3200	3100	2750	2200

DESIGN WIND PRESSURES in N/m² (Assuming Cp = 1.4)

S₁ = 1.0

- Notes. 1. All pressures have been rounded up or down to the nearest N/m² (47.88 N/m² = 1 lbf/ft²).
 2. Building life factor is assumed to be 1.0.
 3. For sites with S₁ = 1.1 factor add 20% to above figures to approx design wind pressure.
 4. For explanation of categories 1,2,3 and 4 See page 3.

EXPOSURE GRADING SYSTEM-AIR AND WATER PENETRATION

B.S. CP3 Chapter V Part 2 : 1970 and B.S. DD4 : 1971 include a Meteorological Office map which shows the basic wind speeds in the United Kingdom at a height of 10 metres above ground in open level country.

DD4 gives the grades of exposure as:

Sheltered 40 m/s

Moderate 45 m/s

Severe (a) 50 m/s

Severe (b) 55 m/s

} For the purpose of Air Infiltration and Water Penetration there is only one "Severe" grade

It is all too easy (and incorrect) to directly compare these wind speeds with those shown on the map and assume, for example, that S.E. England within the area marked 40 m/s is the extent of the Sheltered Exposure Grade.

The speeds shown on the map are Basic Wind Speeds which have to be converted to Design Wind Speeds before the Exposure Grade can be determined.

The maps which follow incorporate this conversion and therefore show the extent of each exposure grade according to the height of building and nature of the terrain.

How to use the Exposure Grade Maps

1. Select the appropriate map according to height of windows above ground.
2. Locate the site on the map and read off the exposure grade according to the appropriate category. These categories are given on page 3.

Notes

Although the maps are suitable for most situations, they cannot be used:

- (a) If the building is more than 30 m in height above ground.
- (b) If the Topography Factor is 1.1 (see note (i) page 3).

WARNING

In some areas the localised exposure conditions may be found to be in excess of the exposure calculated for that area. Where local experience indicates that this might be the case details should be given as it may be necessary to select a higher performance window.

LOCATION OF EXPOSURE GRADES

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MAP 1

HEIGHT Up to 3 metres

Topography factor S1 = 1.0

Building life factor S3 = 1.0

Based on the Meteorological Office Map of basic wind speeds and information from B.S. DD4.

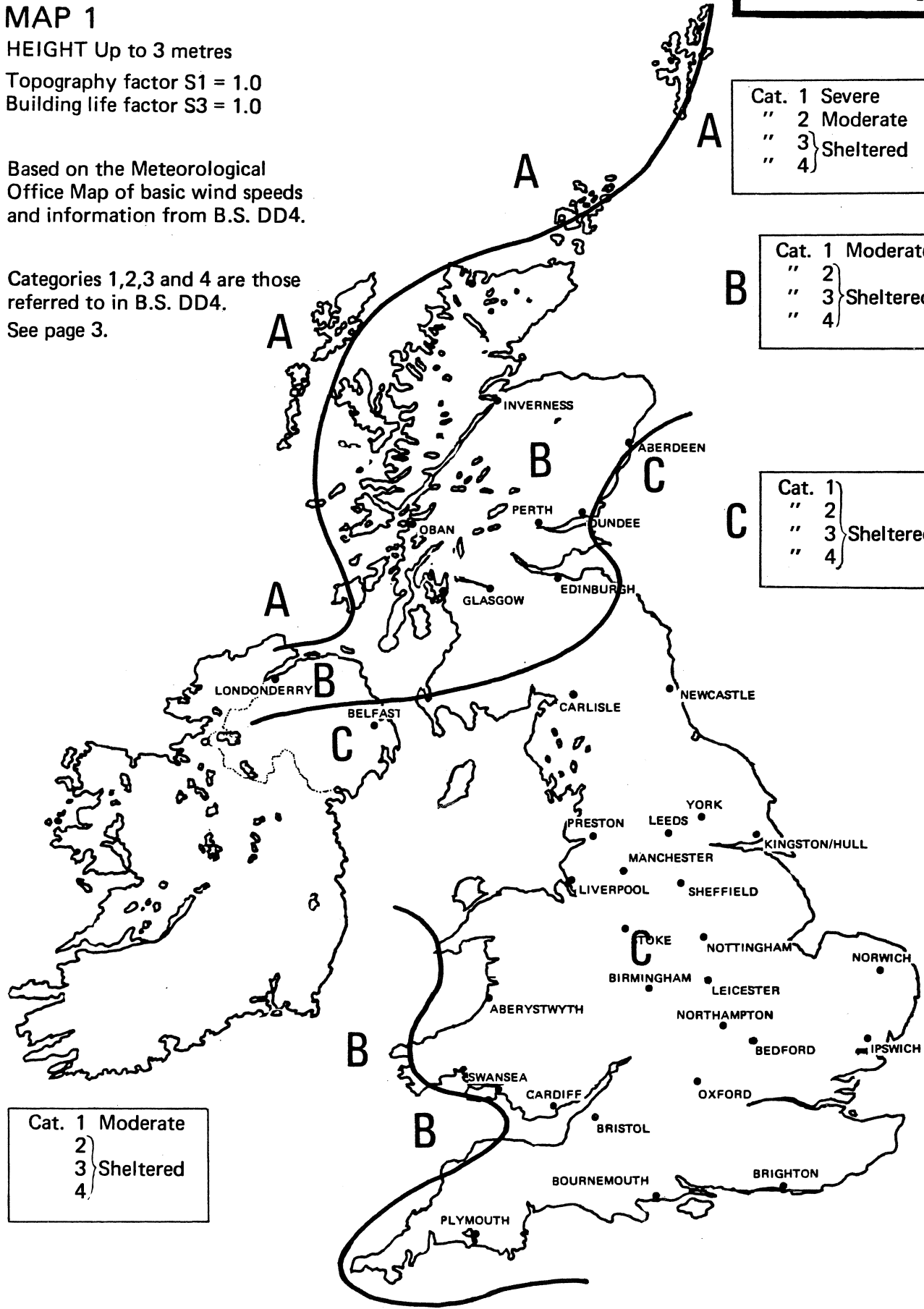
Categories 1,2,3 and 4 are those referred to in B.S. DD4.

See page 3.

Cat. 1 Severe
 " 2 Moderate
 " 3 } Sheltered
 " 4 }

B
 Cat. 1 Moderate
 " 2 } Sheltered
 " 3 }
 " 4 }

C
 Cat. 1 }
 " 2 } Sheltered
 " 3 }
 " 4 }



B
 Cat. 1 Moderate
 2 } Sheltered
 3 }
 4 }

TECHNICAL LIBRARY PERFORMANCE	EXPOSURE GRADES HEIGHT 3 Metres S1=1.0	Map 1
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LOCATION OF EXPOSURE GRADES

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MAP 2

HEIGHT Up to 5 metres

Topography factor S1 = 1.0

Building life factor S3 = 1.0

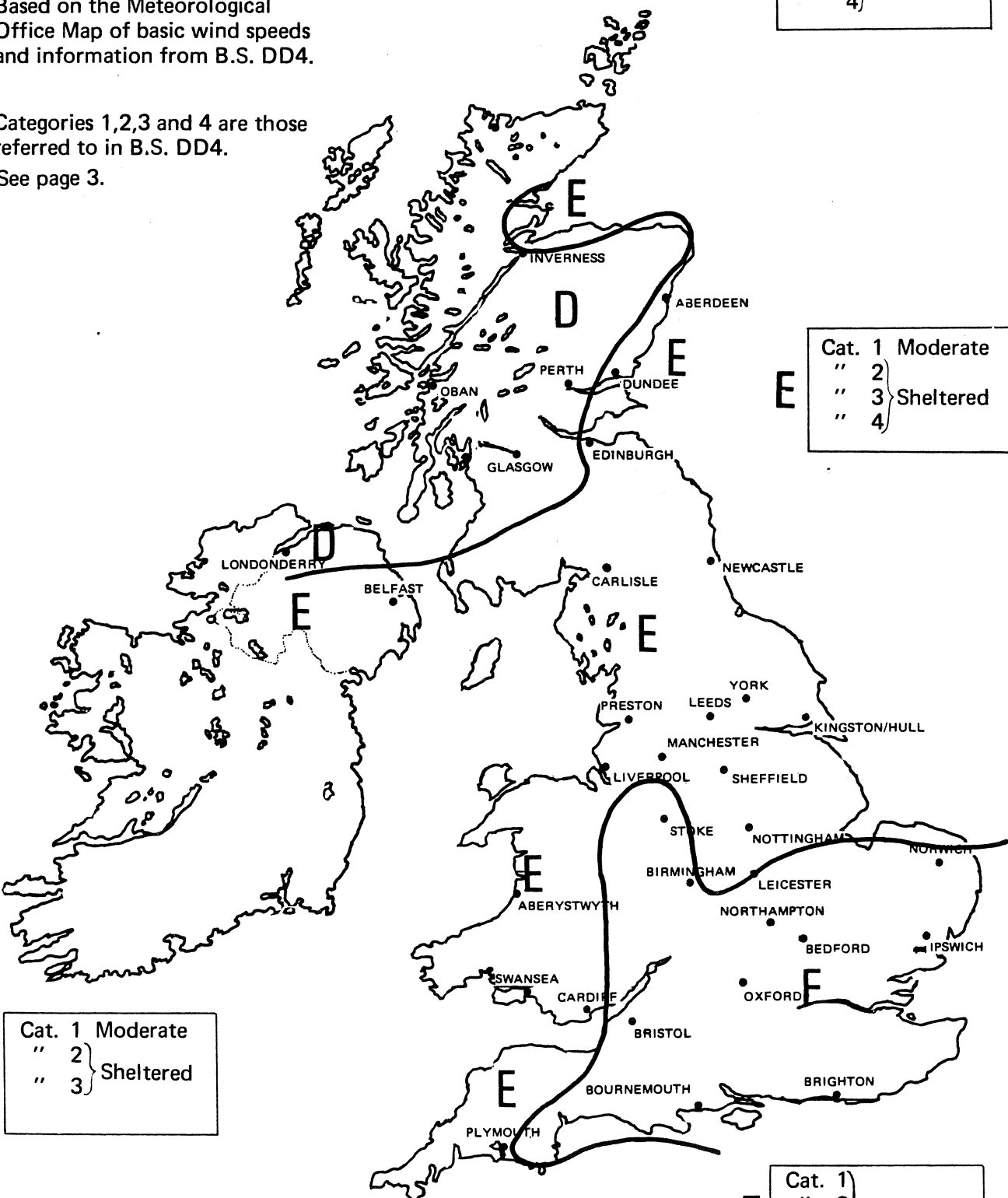
Based on the Meteorological Office Map of basic wind speeds and information from B.S. DD4.

Categories 1,2,3 and 4 are those referred to in B.S. DD4.

See page 3.

D	Cat 1	Severe
	" 2	Moderate
	" 3	Sheltered
	" 4	

E	Cat. 1	Moderate
	" 2	Sheltered
	" 3	
	" 4	



E	Cat. 1	Moderate
	" 2	Sheltered
	" 3	

F	Cat. 1	Sheltered
	" 2	
	" 3	
	" 4	

LOCATION OF EXPOSURE GRADES

Crittall-Hope

MAP 3

HEIGHT Up to 10 metres
 Topography factor S1 = 1.0
 Building life factor S3 = 1.0

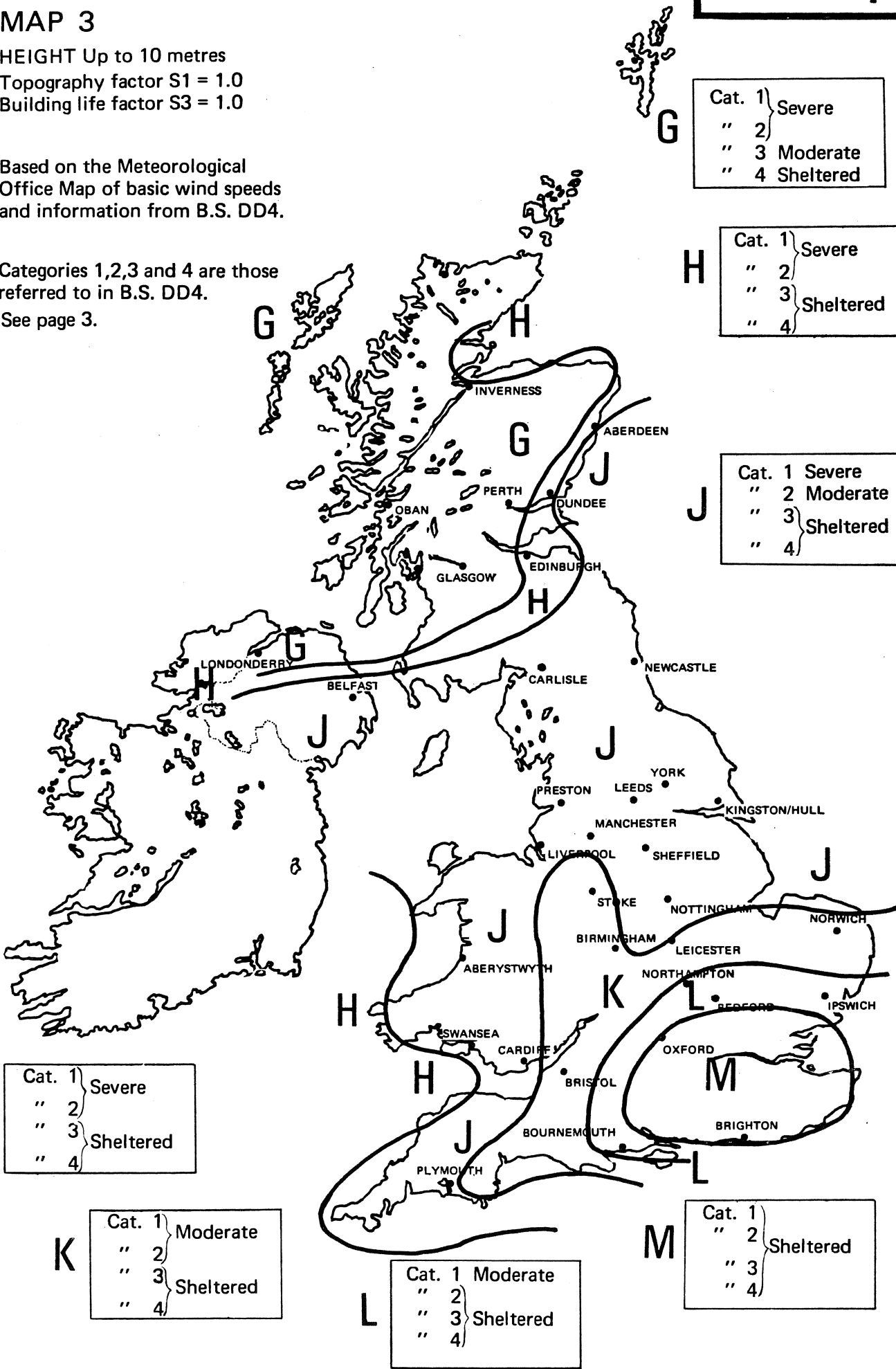
Based on the Meteorological Office Map of basic wind speeds and information from B.S. DD4.

Categories 1,2,3 and 4 are those referred to in B.S. DD4.
 See page 3.

Cat. 1 } Severe
 " 2 }
 " 3 } Moderate
 " 4 } Sheltered

Cat. 1 } Severe
 " 2 }
 " 3 } Sheltered
 " 4 }

Cat. 1 Severe
 " 2 Moderate
 " 3 } Sheltered
 " 4 }



H
 Cat. 1 } Severe
 " 2 }
 " 3 } Sheltered
 " 4 }

K
 Cat. 1 } Moderate
 " 2 }
 " 3 } Sheltered
 " 4 }

L
 Cat. 1 } Moderate
 " 2 }
 " 3 } Sheltered
 " 4 }

M
 Cat. 1 }
 " 2 } Sheltered
 " 3 }
 " 4 }

LOCATION OF EXPOSURE GRADES

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MAP 4

HEIGHT Up to 20 metres

Topography factor S1 = 1.0

Building life factor S3 = 1.0

Based on the Meteorological Office Map of basic wind speeds and information from B.S. DD4.

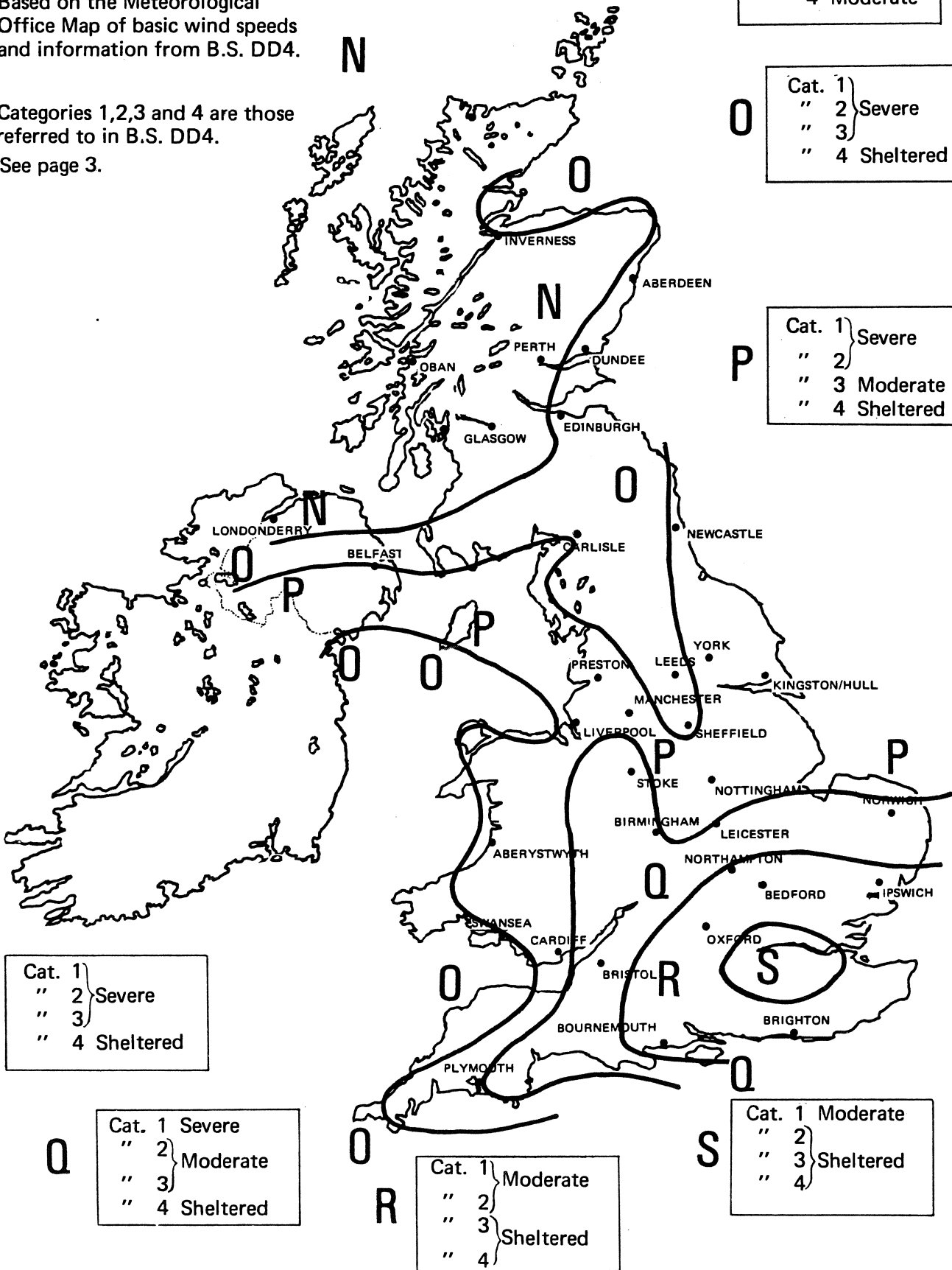
Categories 1,2,3 and 4 are those referred to in B.S. DD4.

See page 3.

Cat. 1 }
 " 2 } Severe
 " 3 }
 " 4 } Moderate

Cat. 1 }
 " 2 } Severe
 " 3 }
 " 4 } Sheltered

Cat. 1 }
 " 2 } Severe
 " 3 } Moderate
 " 4 } Sheltered



O
 Cat. 1 }
 " 2 } Severe
 " 3 }
 " 4 } Sheltered

Q
 Cat. 1 Severe
 " 2 } Moderate
 " 3 }
 " 4 } Sheltered

R
 Cat. 1 }
 " 2 } Moderate
 " 3 } Sheltered
 " 4 }

S
 Cat. 1 Moderate
 " 2 }
 " 3 } Sheltered
 " 4 }

LOCATION OF EXPOSURE GRADES

MAP 5

HEIGHT Up to 30 metres

Topography factor S1 = 1.0

Building life factor S3 = 1.0

Based on the Meteorological Office Map of basic wind speeds and information from B.S. DD4.

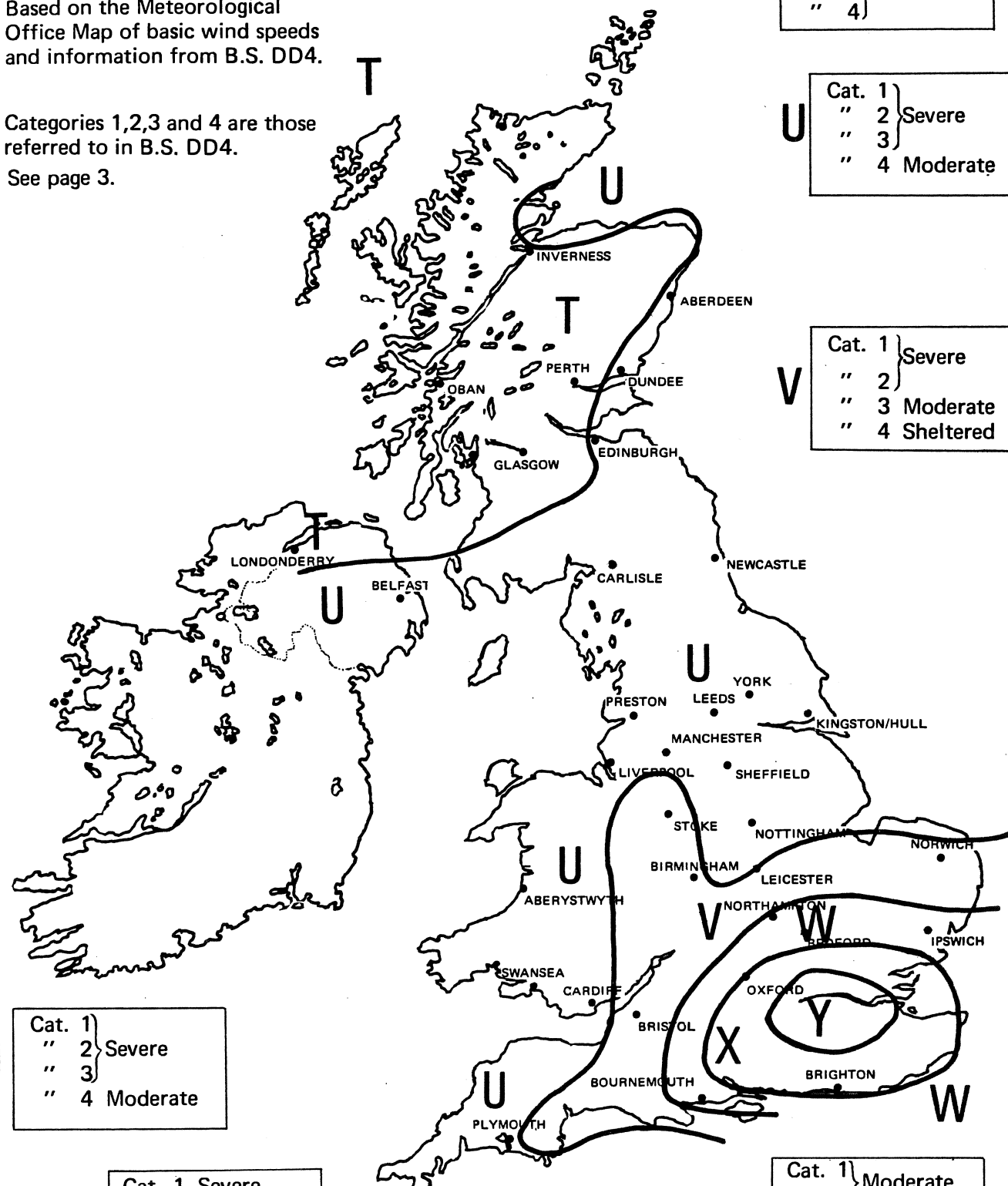
Categories 1,2,3 and 4 are those referred to in B.S. DD4.

See page 3.

Cat. 1	} Severe
" 2	
" 3	
" 4	

Cat. 1	} Severe
" 2	
" 3	
" 4	Moderate

Cat. 1	} Severe
" 2	
" 3	Moderate
" 4	Sheltered



Cat. 1	} Severe
" 2	
" 3	
" 4	

Cat. 1	} Severe
" 2	
" 3	Moderate
" 4	Sheltered

Cat. 1	} Moderate
" 2	
" 3	
" 4	

Cat. 1	} Moderate
" 2	
" 3	} Sheltered
" 4	

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TECHNICAL LIBRARY PERFORMANCE	EXPOSURE GRADES HEIGHT 30 Metres S1=1.0	Map 5.
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