# of regulations CPD series

CPD Presentation Date:
September 2025

Smart Document A – Structure

smart designs for strength CPD

This CPD offers an introductory overview designed to raise awareness of wind loading principles in structural design. Through case studies and practical examples, we will demonstrate how smart deliver commercially viable solutions to real-world challenges.

To book on future CPD or to register an interest in previous CPD please visit www.smartsystems.co.uk/cpd

Are there any errors, inaccuracies, or outdated information in this CPD?

*Your **feedback** supports continuous improvement, promotes **building safety**, and contributes to a **culture of peer review** and **professional accountability**.*
*We strive to deliver accurate and up-to-date content, but we recognise that interpretations can vary and standards may evolve.If you noticed **any mistakes**—whether due to misinterpretation, recent changes in regulations, or unclear explanations—**please let us know immediately** email: aa@smartsystems.co.uk*

E&OA

Document A
Structure
smart designs for strength

CPD Presentation date:
September 2025 E&OA

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Building Regulations A1

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A1. (1) The building shall be constructed so that the combined dead, imposed and wind loads are sustained and transmitted by it to the ground:

(a) safely; and

(b) without causing such deflection or deformation of any part of the building, or such movement of the ground, as will impair the stability of any part of another building.

(2) In assessing whether a building complies with sub-paragraph (1) regard shall be had to the imposed and wind loads to which it is likely to be subjected in the ordinary course of its use for the purpose for which it is intended.

Building Regulations A2

A2. The building shall be constructed so that ground movement caused by:

(a) swelling, shrinkage or freezing of the subsoil; or

(b) land-slip or subsidence (other than subsidence arising from shrinkage), in so far as the risk can be reasonably foreseen, will not impair the stability of any part of the building.

Building Regulations A3

A3. The building shall be constructed so that in the event of an accident the building will not suffer collapse to an extent disproportionate to the cause.

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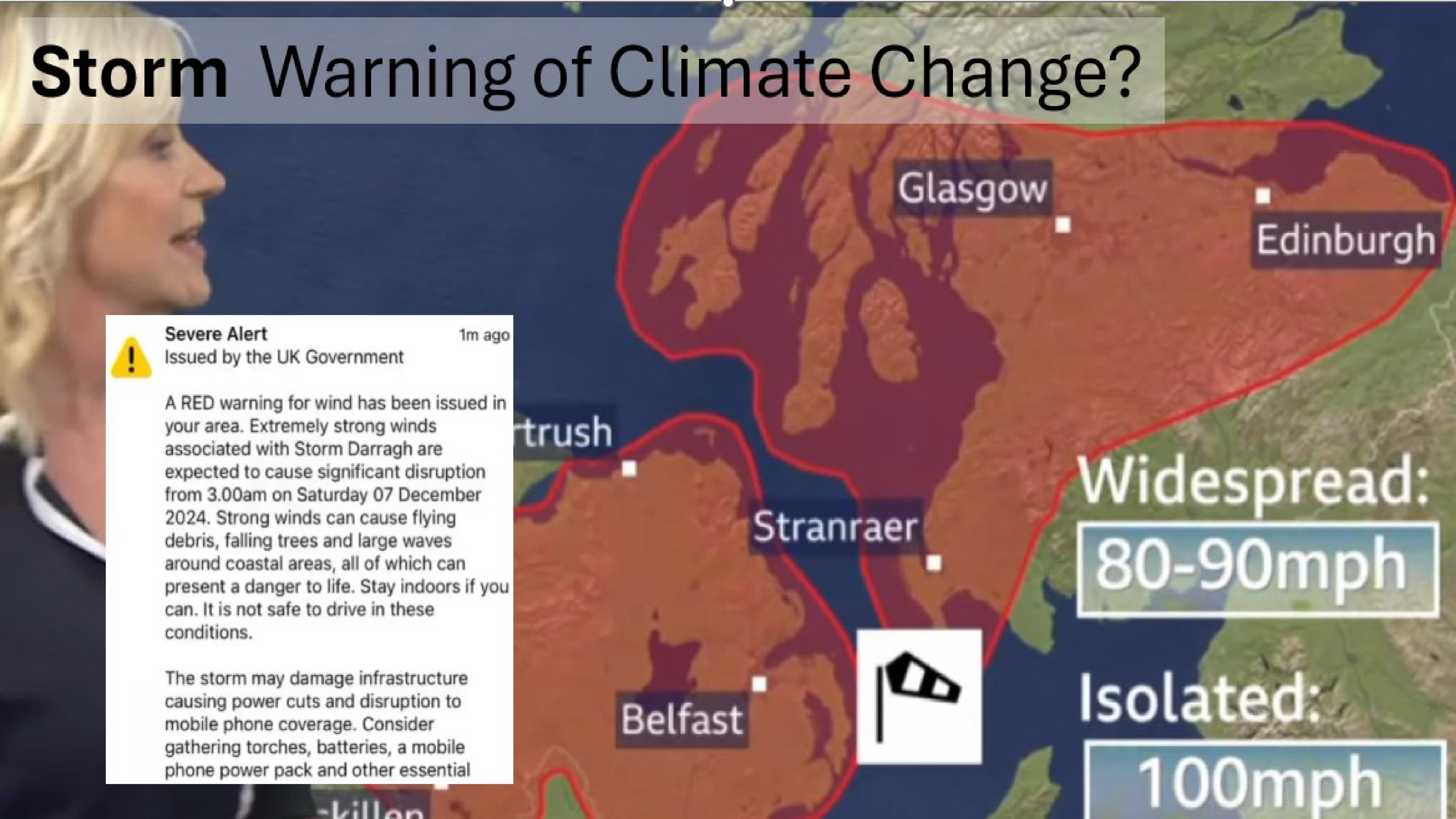
Wind Load Calculations (Pascals)

Storm Warning of Climate Change?

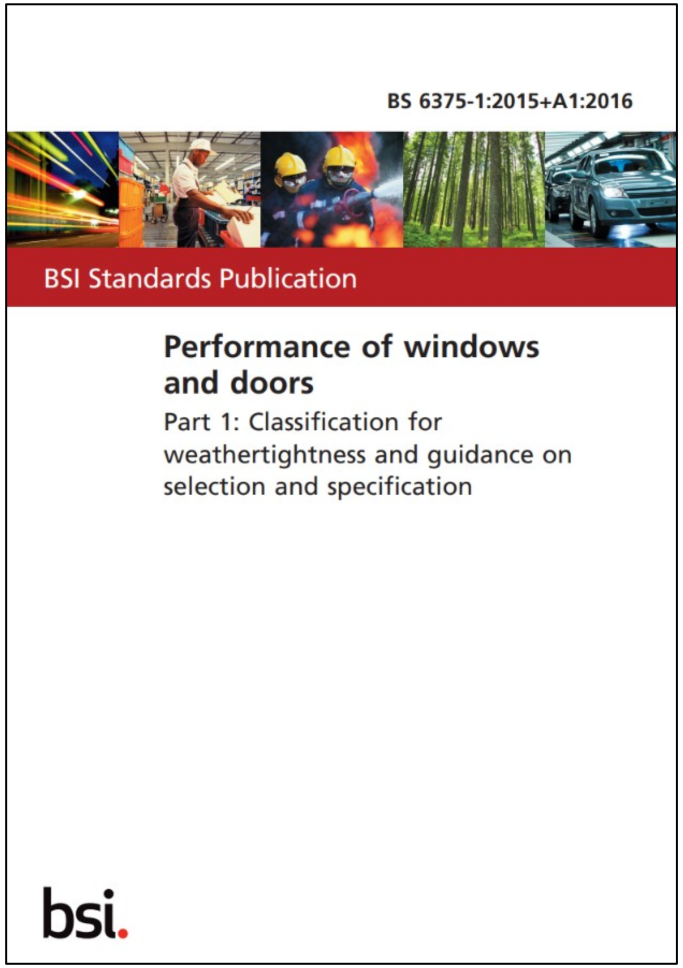


Severe Alert 1m ago
Issued by the UK Government

A RED warning for wind has been issued in your area. Extremely strong winds associated with Storm Darragh are expected to cause significant disruption from 3.00am on Saturday 07 December 2024. Strong winds can cause flying debris, falling trees and large waves around coastal areas, all of which can present a danger to life. Stay indoors if you can. It is not safe to drive in these conditions.

The storm may damage infrastructure causing power cuts and disruption to mobile phone coverage. Consider gathering torches, batteries, a mobile phone power pack and other essential

BS6375-1 Annex A


BS 6375-1:2015+A1:2016

BSI Standards Publication

Performance of windows and doors

Part 1: Classification for weathertightness and guidance on selection and specification

bsi.

A.2 Abbreviated method of determination of wind load for low-rise buildings

A.2.1 Procedure

To find the wind load the procedure below shall be followed.

a) Using the site location, select the basic wind speed $V_{b,map}$ from Figure A.1. (This is used as the site wind speed in Table A.2.)

b) Select the site terrain category (A, B, C, D, E or F) in accordance with **A.2.2**.

c) Determine the design height (h), which is the height of the wall in which the windows or doorsets are to be installed or the ridge height for dormer windows, and select the design height band to be used [see Note a)].

d) Using the basic wind speed $V_{b,map}$, the site terrain category and the design height (h), select the wind load at sea level in accordance with **A.2.3**.

e) Determine the altitude factor (F_A) in accordance with **A.2.4**.

f) Determine the appropriate [A1⟩ orography factor (F_O) ⟨A1] in accordance with **A.2.5**.

g) Determine the dormer factor (F_D) (see **A.2.6**).

h) Determine the funnelling factor (F_F) (see **A.2.7**).

i) The wind load is given by Equation A.1:

$$\text{[A1⟩ Table A.2 value} \times F_A \times F_O \times F_D \times F_F \text{ ⟨A1]} \tag{A.1}$$

BS6375-1 **Figure 1**

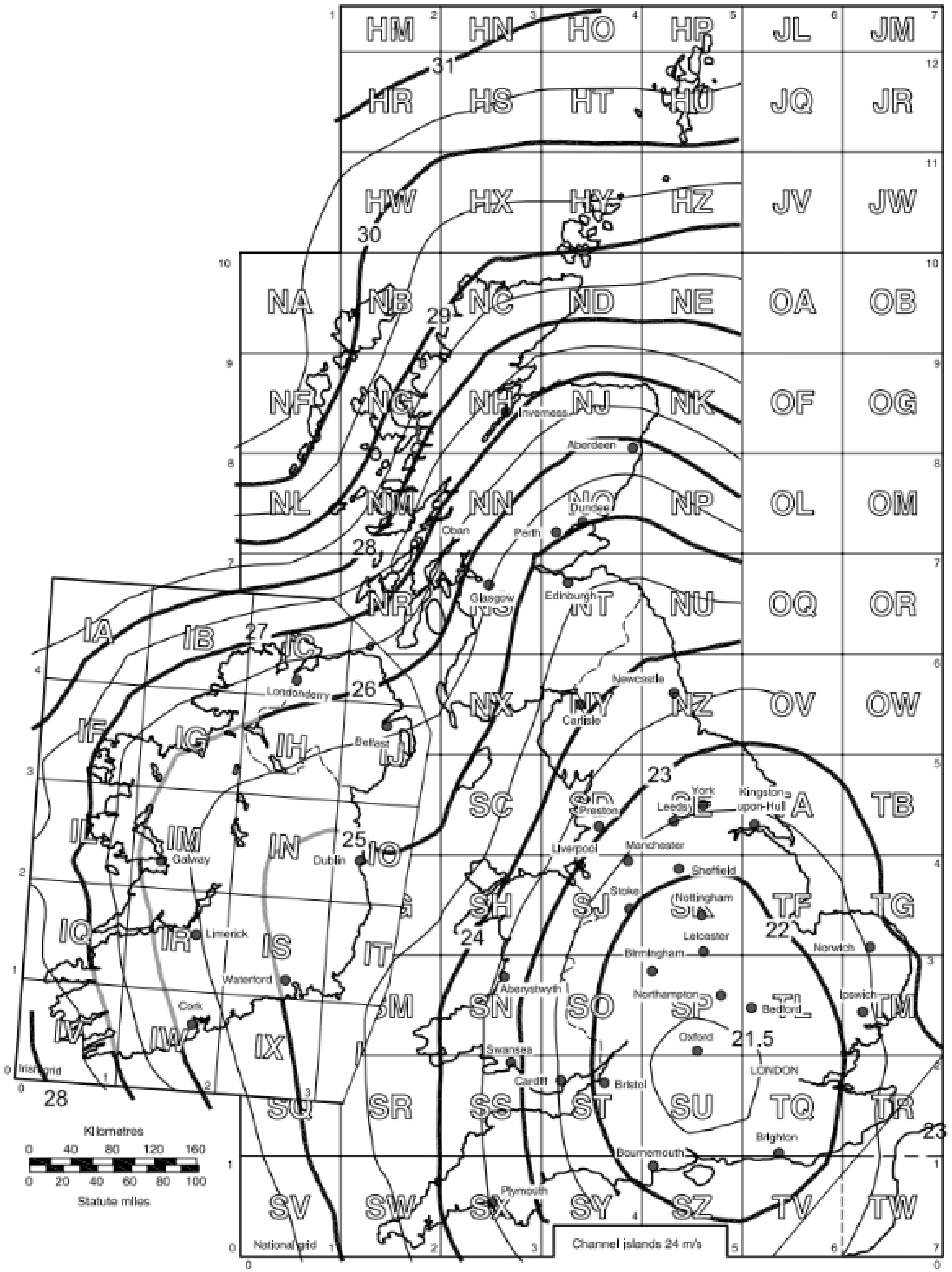
C1

Figure A.1 **Basic wind speed $V_{b,map}$**

NOTE 1 Taken from NA to BS EN 1991-1-4:2005+A1:2010, Figure NA.1.

NOTE 2 This map is intended for sites in the United Kingdom, Isle of Man and Channel Islands only.

NOTE 3 The isopleths in the Republic of Ireland are shown for purposes of interpolation only. C1

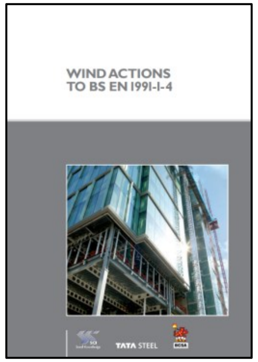


CPD Presentation Date:
September 2025 E&OA

BS6375-1 **Table 1**

Table A.1 **Site terrain categories**

	Open country and up to 0.5 km into town	More than 0.5 km in to town
Distance from coast up to 1.0 km	A	D
Distance from coast 1 to 10 km	B	E
Distance from coast more than 10 km	C	F



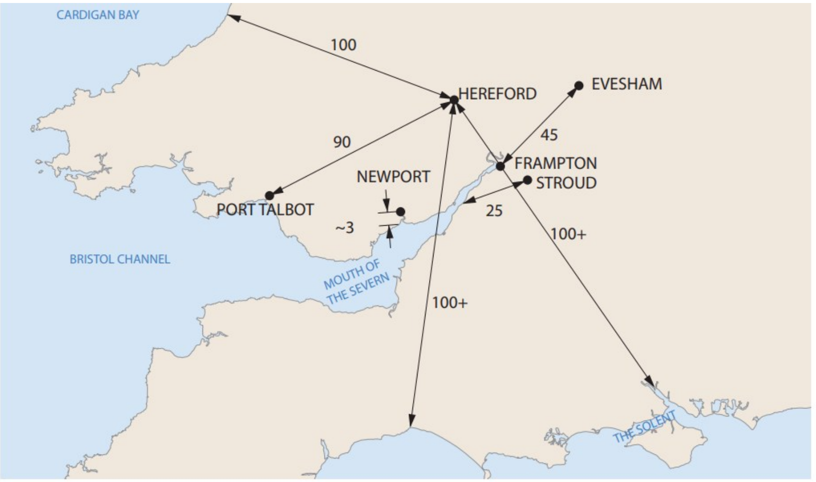


Figure 5.8
Map of the Severn to illustrate the BRE Digest 436 estuary rule (distances in km)

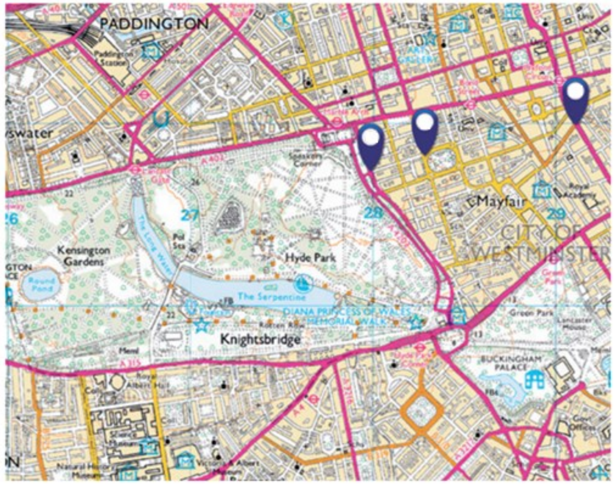


Figure 5.10
Hyde Park and Mayfair, London

BS6375-1 **Table 2**

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Table A.2 **Wind load at sea level**

Basic wind speed ($V_{b,map}$) at sea level	Design height (h)	Wind load at sea level for site terrain category (see Table A.1)					
		A	B	C	D	E	F
m/s	m	Pa	Pa	Pa	Pa	Pa	Pa
21	≤3	642	568	514	477	460	417
	3–6	752	705	639	666	641	582
	6–10	839	815	740	822	798	726
	10–15	907	904	824	907	904	824
22	≤3	705	623	565	523	505	457
	3–6	826	773	702	731	704	639
	6–10	920	894	813	902	876	796
	10–15	995	992	904	995	992	904
23	≤3	770	681	617	572	552	500
	3–6	902	845	767	799	769	698
	6–10	1 006	977	888	986	958	870
	10–15	1 088	1 084	988	1 088	1 084	988
24	≤3	839	742	672	623	601	544
	3–6	983	921	835	869	838	760
	6–10	1 095	1 064	967	1 073	1 043	948
	10–15	1 185	1 181	1 076	1 185	1 181	1 076
25	≤3	910	805	729	676	652	591
	3–6	1 066	999	906	943	909	825
	6–10	1 188	1 155	1 049	1 165	1 132	1 028
	10–15	1 285	1 281	1 167	1 285	1 281	1 167

BS6375-1 **Table 2** cont...

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26	≤3	985	871	789	731	705	639
	3–6	1 153	1 080	980	1 020	983	892
	6–10	1 285	1 249	1 135	1 260	1 224	1 112
	10–15	1 390	1 386	1 263	1 390	1 386	1 263
27	≤3	1 062	939	850	788	760	689
	3–6	1 244	1 165	1 057	1 100	1 060	962
	6–10	1 386	1 347	1 224	1 358	1 320	1 200
	10–15	1 499	1 494	1 362	1 499	1 494	1 362
28	≤3	1 142	1 010	915	848	818	741
	3–6	1 337	1 253	1 137	1 183	1 140	1 034
	6–10	1 491	1 449	1 316	1 461	1 420	1 290
	10–15	1 612	1 607	1 464	1 612	1 607	1 464
29	≤3	1 225	1 083	981	909	877	795
	3–6	1 435	1 344	1 219	1 269	1 223	1 110
	6–10	1 599	1 554	1 412	1 567	1 523	1 384
	10–15	1 730	1 724	1 571	1 730	1 724	1 571
30	≤3	1 311	1 159	1 050	973	939	850
	3–6	1 535	1 438	1 305	1 359	1 309	1 187
	6–10	1 711	1 663	1 511	1 677	1 630	1 481
	10–15	1 851	1 845	1 681	1 851	1 845	1 681
31	≤3	1 400	1 238	1 121	1 039	1 003	908
	3–6	1 639	1 536	1 393	1 451	1 398	1 268
	6–10	1 827	1 776	1 614	1 791	1 740	1 581
	10–15	1 976	1 970	1 795	1 976	1 970	1 795

BS6375-1 **Table 3**

A.2.4 Altitude factor

Altitude factor (F_A) shall be selected from Table A.3 or determined from Equation A.2.

Table A.3 **Table for factor F_A for specific altitudes**

Altitude m	Factor F_A	Altitude m	Factor F_A
0	1.00	225	1.56
25	1.05	250	1.56
50	1.10	275	1.63
75	1.16	300	1.69
100	1.21	325	1.76
125	1.27	350	1.82
150	1.32	375	1.89
175	1.38	400	1.96
200	1.44	425	2.03

BS6375-1 **Table 4**

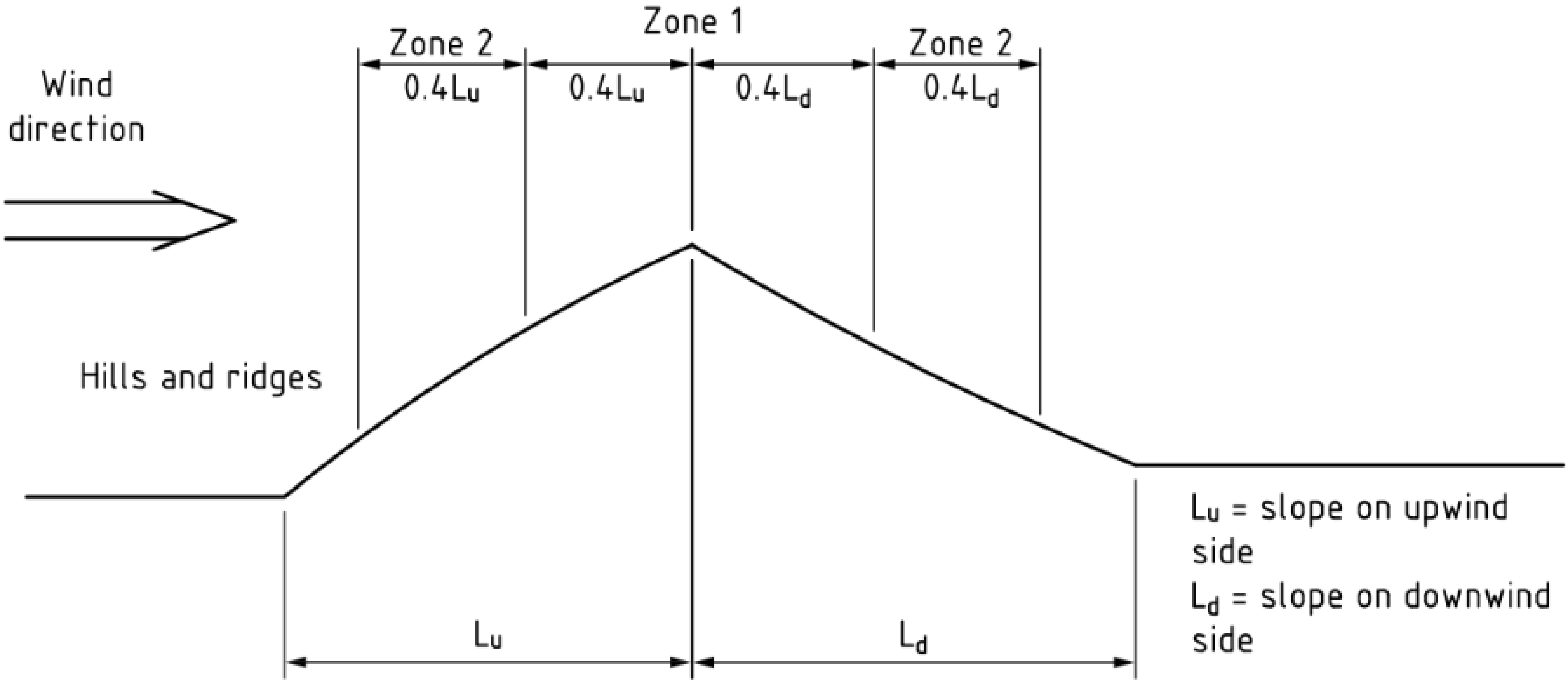
A.2.5 Orography factor

An orography factor (F_O) shall be used where hills, ridges, cliffs and escarpments might have an adverse effect on the wind load on a building. The appropriate orography factor shall be obtained using Table A.4.

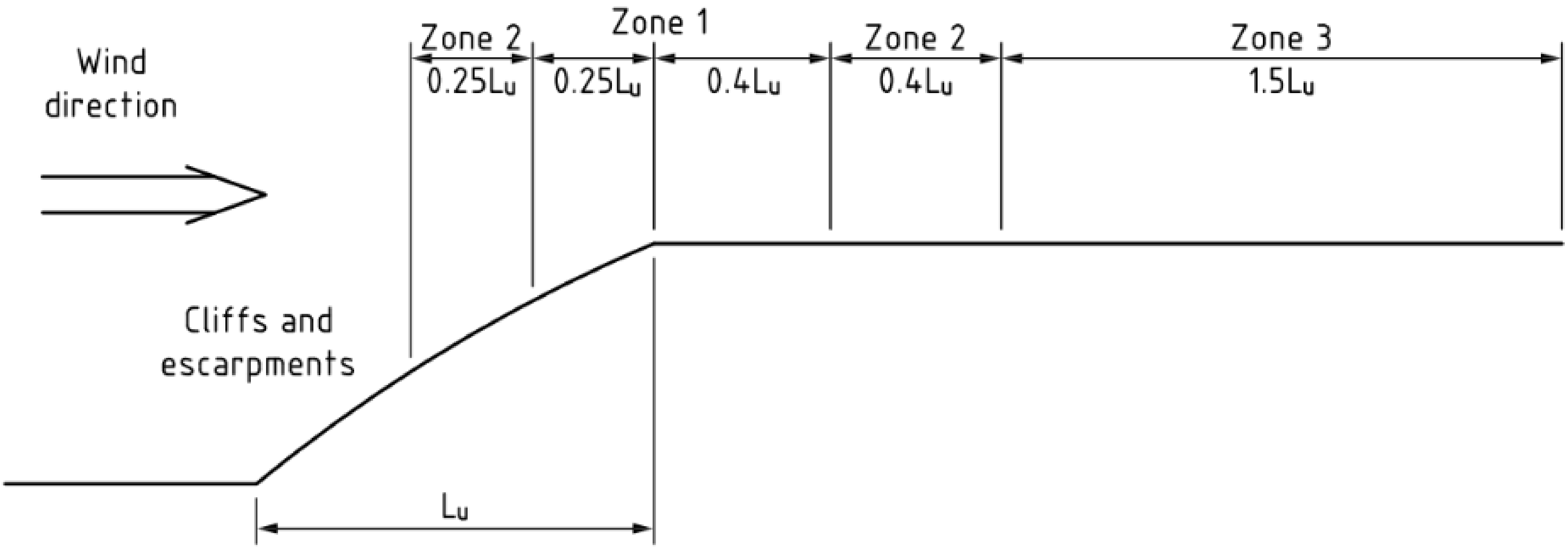
Table A.4 **Orography factor**

Orographic category and description	**Factor F_O according to zone from Figure A.2**		
	Zone 1	**Zone 2**	**Zone 3**
Category 1: Nominally flat terrain, average slope < 1/20	1.0	1.0	1.0
Category 2: Shallow terrain, average slope < 1/10	1.25	1.14	1.10
Category 3: Moderately steep terrain, average slope ≤ 1/5	1.54	1.28	1.21
Category 4: Steep terrain, average slope > 1/5	1.85	1.44	1.32

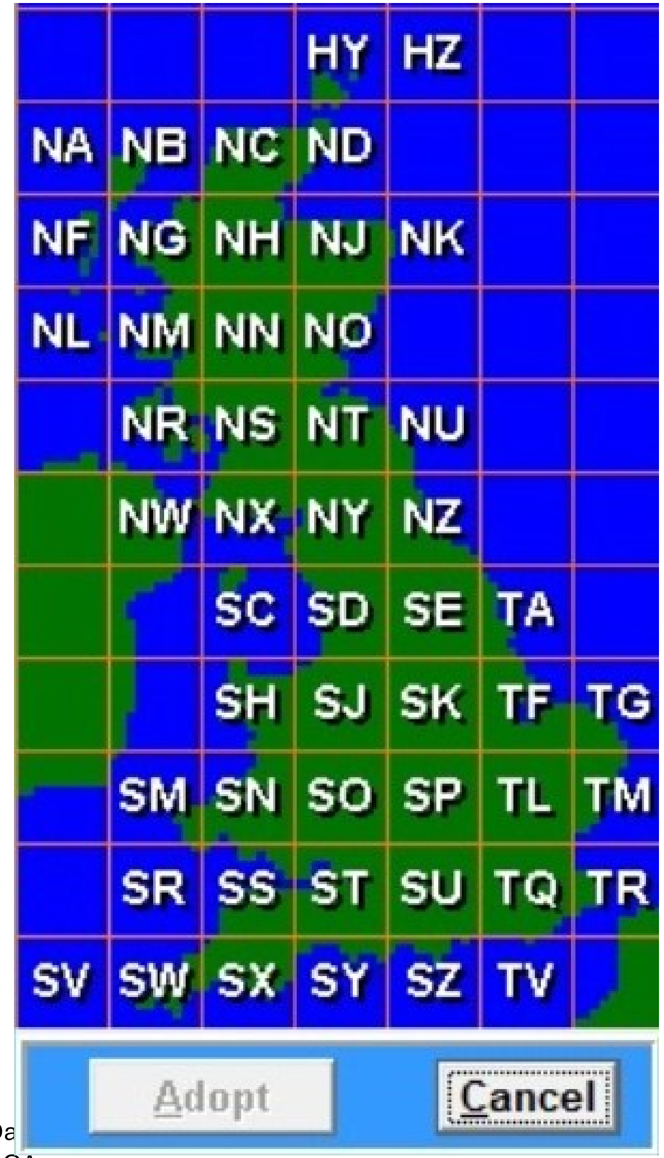
Orography Factor Hills



Orography Factor Cliffs



BREVe Software



BREVe Software tool originally developed by the BRE Building Research Establishment to support wind load calculations in construction.

BRE no longer maintains or updates the software.

BREVe remains in use across engineering consultancies for terrain-sensitive wind analysis and compliance reporting.

Ordnance Survey – Elevation Contours

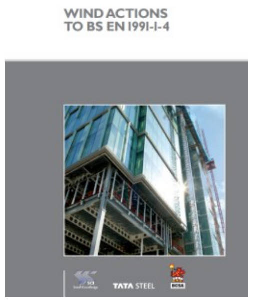


Figure 5.12

Open source contours

smart software – powered by OS

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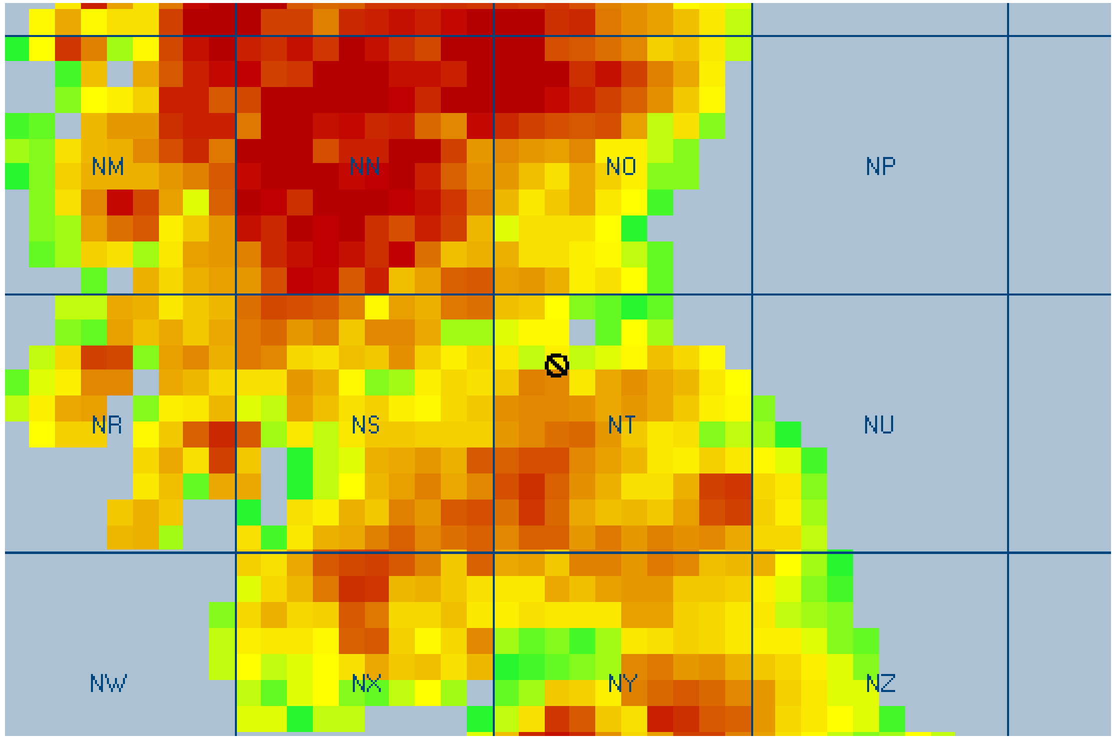
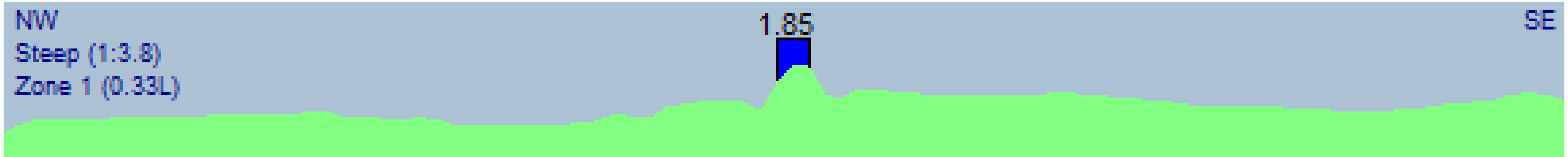


Smart Wind Load Calculator
Powered by OS Data - ordnance survey

Smart calculator uses postcode data to provide OS Grid Refence to proposes Site Elevation and Orography factors based on guidance from SCI

Gradient Steep 1:3.8
Zone 1 0.33L
Factor 1.85



Orography and Elevation Factors

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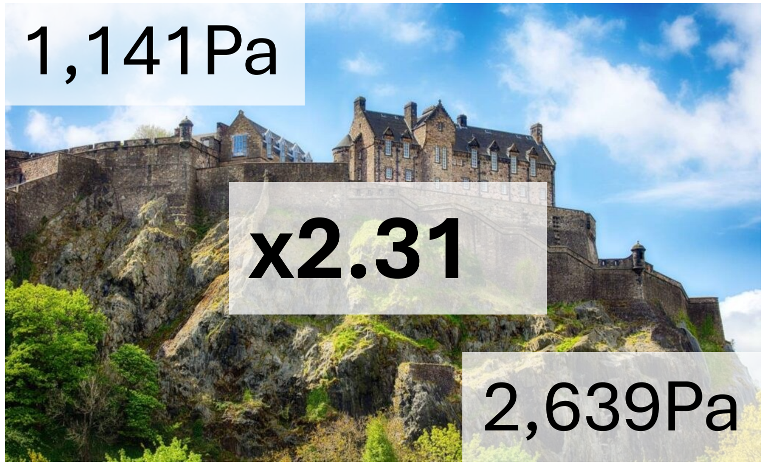
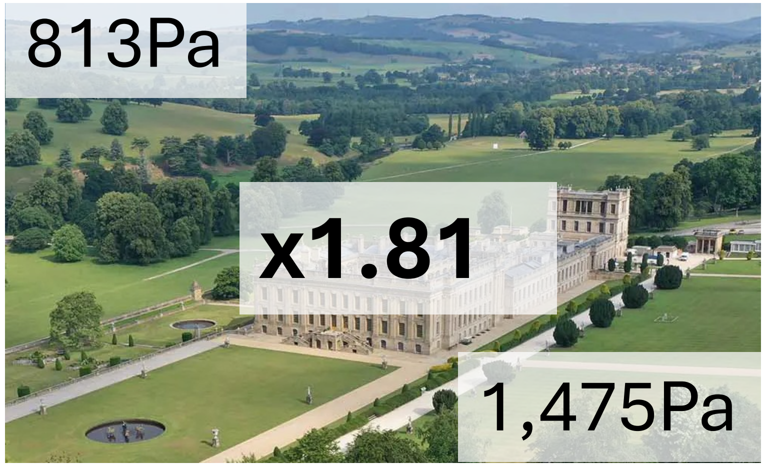
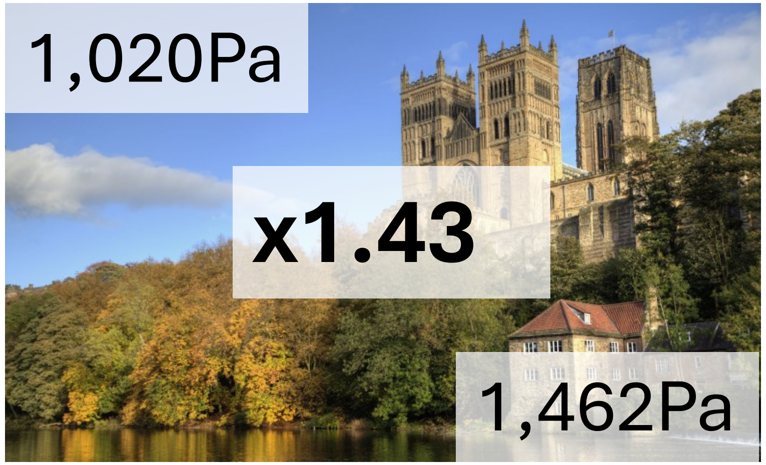


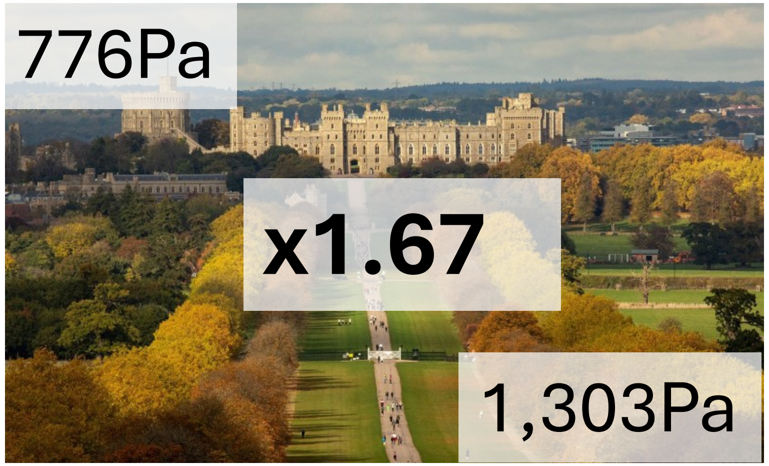
Edinburgh Castle



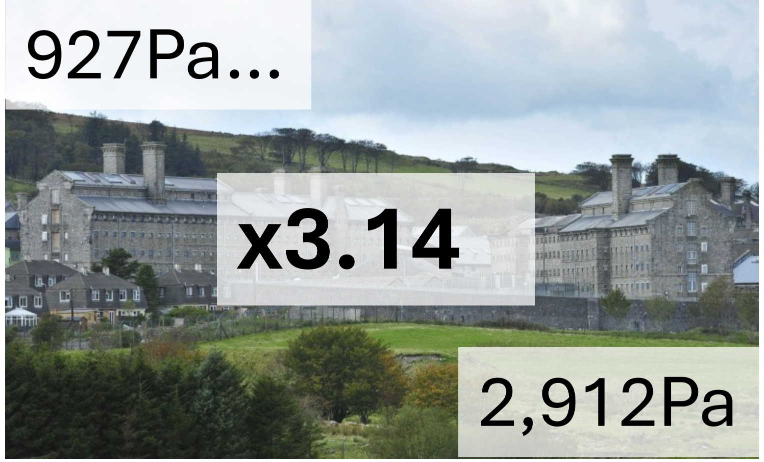
Chatsworth House



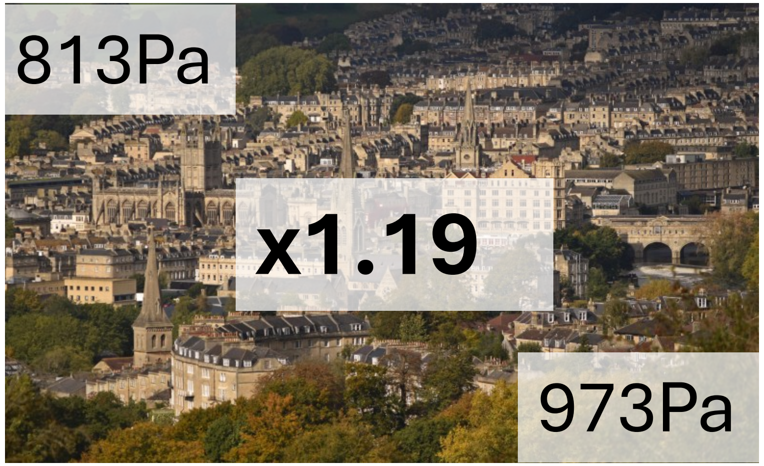
Durham Cathedral



Windsor Castle



HMP Dartmoor



Bath Abbey

Equivalent Wind Speed 1:50 Year

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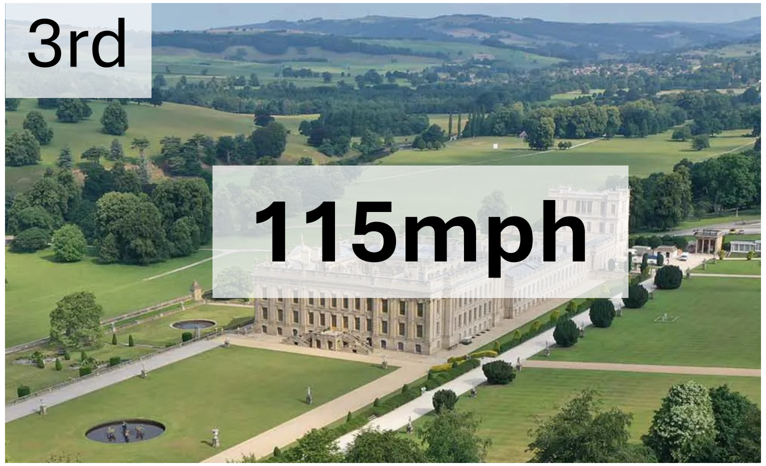
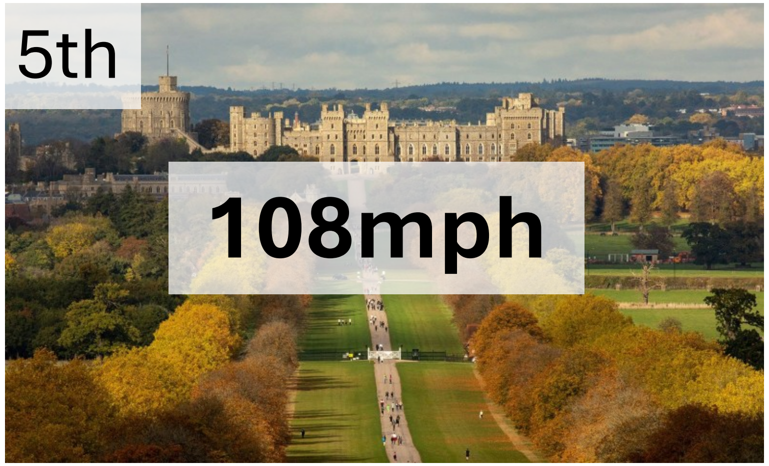
Edinburgh Castle



Chatsworth House

Durham Cathedral



Windsor Castle

HMP Dartmoor

Bath Abbey

Document A Wind Load

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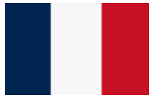
Wind Load

Wind Load 2,400 Pascal

240kg/m²
or 146mph

Blaise Pascal
1623 1662

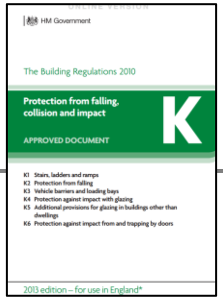


BS 6375-1 Annex A: Abbreviated Method for Wind Load.

This method provides an estimate of wind load in Pascals, tailored for surveyors, based on the following factors:

- **Map Basic Wind Speed**
- **Terrain Category**
- **Building Height**
- **Site Elevation**
- **Orography Effects**
- Funnelling Factor*
- Dormer Factor*

*For further details refer to BS6375-1 and EN 1991-1-4



Barrier Load (Newtons)

Document A Barrier Load

	UDL kN/m^2	Wind Load Pa	Line kN/m	Point kN
Low Risk	0.5	500Pa	0.36	0.25
Medium Risk	1.0	1,000Pa	0.74	0.5
High Risk	1.5	1,500Pa	1.5	1.5

UDL: Uniform Distributed Load applied over the whole area of the barrier

Line Load: A load along a line, typically applied at the top of the barrier (e.g., handrail).

Point Load: A load applied at a single point,typically at the centre of the infill (e.g. glass/panel)

Barrier Load PD6688-1-1

Table 2 **Uniformly distributed and concentrated loads applicable to infills for walls and parapets – To be read with BS EN 1991-1-1:2002, Table NA.8**

Category of loaded area	Sub-category	Examples	A uniformly distributed load applied to the infill kN/m^2	A point load applied to a part of the infill kN
A (including sub-categories in Table NA.2)	(i)	All areas within or serving exclusively one dwelling including stairs, landings etc but excluding external balconies and edges of roofs [see (vii)]	0,5	0,25
	(ii)	Residential areas not covered by (i)	1,0	0,5
B and C1 (including sub-categories in Table NA.2)	(iii)	Areas not susceptible to overcrowding in office and institutional buildings, reading rooms and classrooms including stairs	1,0	0,5
	(iv)	Restaurants and cafes	1,5	1,5
C2, C3, C4 and D (including sub-categories in Table NA.2)[A)]	(v)	Areas having fixed seating within 530 mm of the barrier, balustrade or parapet	1,5	1,5
	(vi)	Stairs, landings, balustrades, corridors and ramps	1,0	0,5
	(vii)	External balconies and edges of roofs Footways within building curtilage and adjacent to basement/sunken areas	1,0	0,5
	(viii)	All retail areas	1,5	1,5
C5 (including sub-categories in Table NA.2)	(ix)	Footways or pavements less than 3 m wide adjacent to sunken areas	1,5	1,5
	(x)	Theatres, cinemas, discotheques, bars, auditoria, shopping malls, assembly areas, studios. Footways or pavements greater than 3 m wide adjacent to sunken areas	1.5	1,5
	(xi)	Grandstands and stadia	See requirements of the appropriate certifying authority	
E (including sub-categories in Table NA.4)	(xii)	Industrial; and storage buildings except as given by (xiii) and (xiv)	1,0	0,5
	(xiii)	Light pedestrian traffic routes in industrial and storage buildings except designated escape routes	0,5	0,25
	(xiv)	Light access stairs and gangways not more than 600 mm wide	N/A	N/A
F and G	(xv)	Pedestrian areas in car parks including stairs, landings, ramps, edges or internal floors, footways, edges of roofs	1,5	1,5
	(xvi)	Horizontal loads imposed by vehicles	See BS EN 1991-1-1:2002, Annex B	

A) For areas where large crowds might occur, see C5.

Barrier Glazing

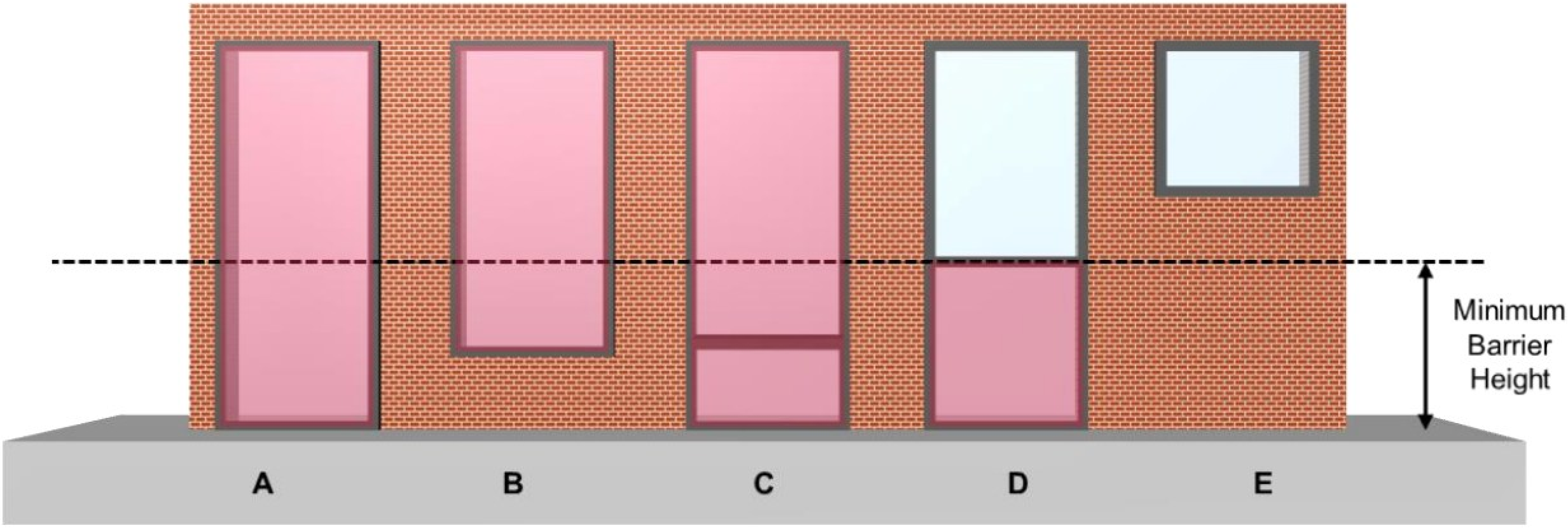


Figure 1 – Areas acting as full-height barriers

https://www.saint-gobain-glass.co.uk/wp-content/uploads/2024/02/Guards-Barriers-3A-Full-Height-Barriers-18-09-2018.pdf

Barrier Glazing

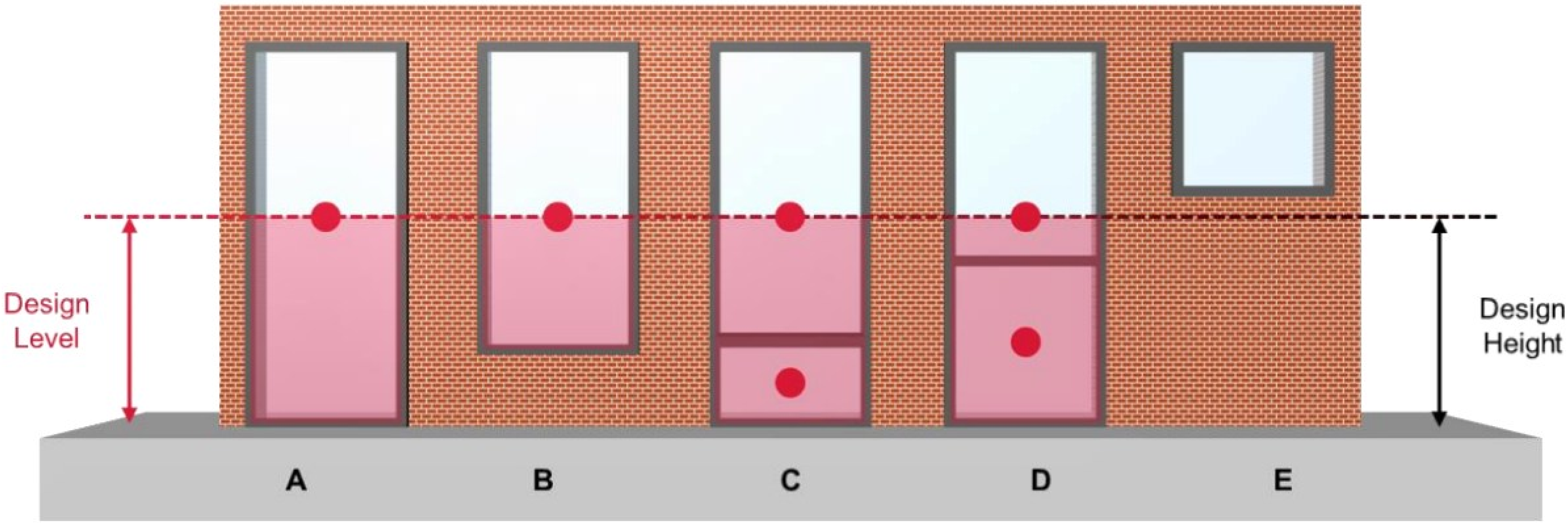


Figure 3 – Load locations based on design level equalling design height

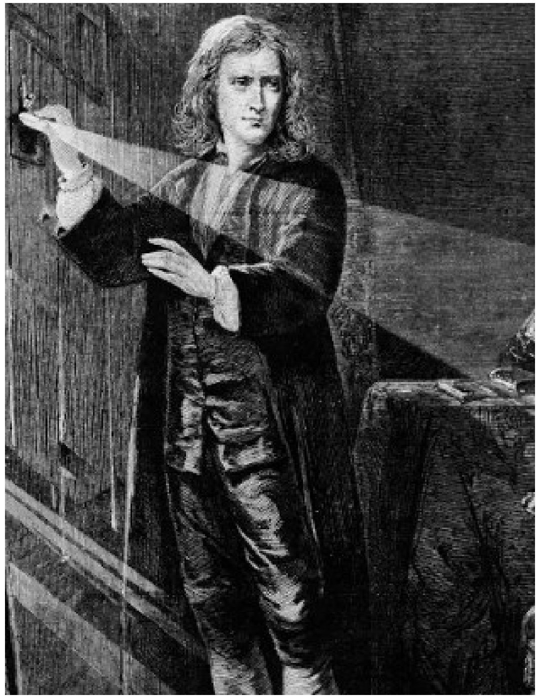
https://www.saint-gobain-glass.co.uk/wp-content/uploads/2024/02/Guards-Barriers-3A-Full-Height-Barriers-18-09-2018.pdf

Document A Barrier Load

Imposed Load

Barrier 1.0 kN/m^2

100kg/m^2

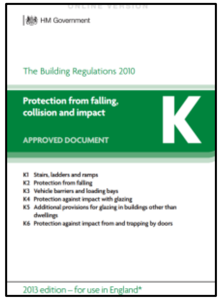


Issac Newton

1643-1727

Approved Document ADK2 requires guarding to resist, as a minimum, the loads given in **BS EN1991-1-1** with its UK National Annex **PD6688-1-1**.

In addition to barrier where glazing is used in the guarding refer to section 5 from ADK Protection from impact with glazing. This requires glass to break safe to BS EN 122600. The glass supplier should be able to verify the glazing meets ADK.



Strength Calculations (Ixx Value)

Document A Resistance to Wind

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Strength Flexural Rigidity

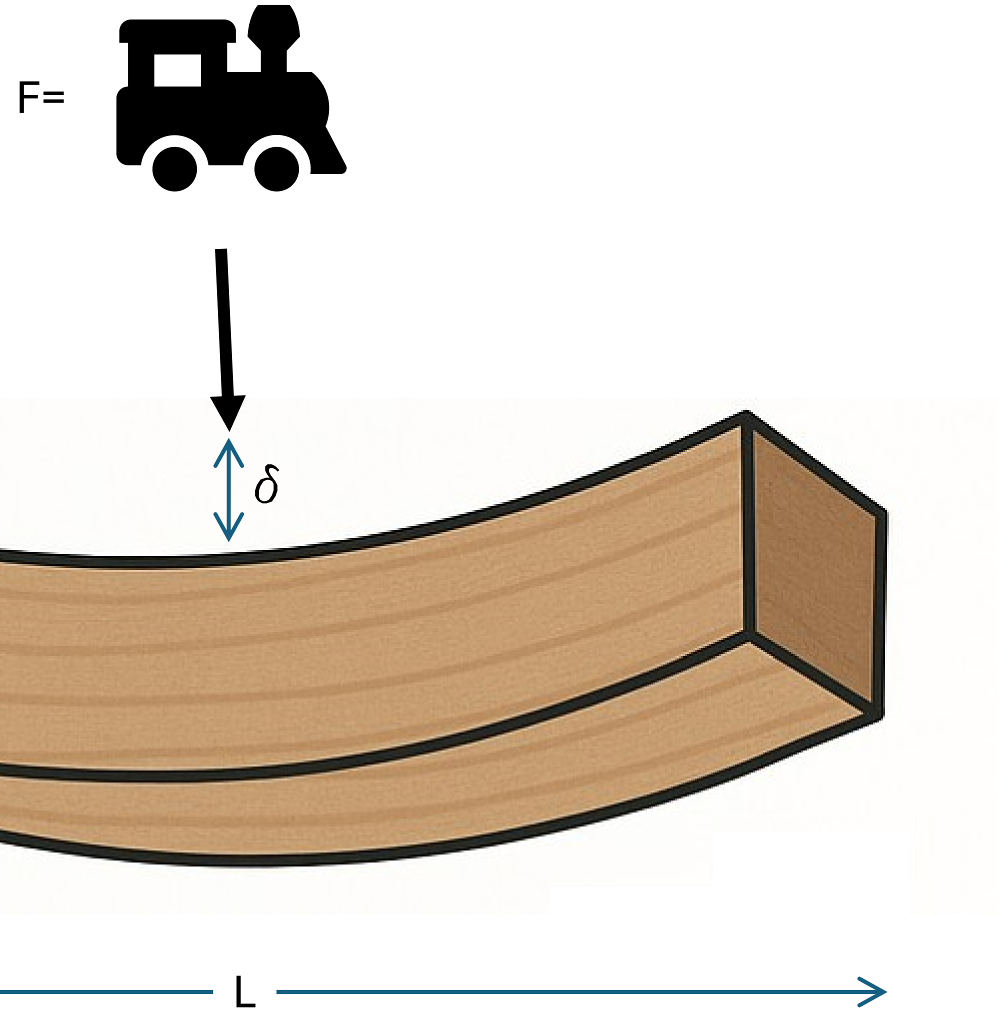
The transmission of load using this approach assumes a uniform distribution of load is taken by the mullions from the cladding panels. The mid-span deflection (δ) of a simply supported, single-spanning member subject to a uniformly distributed load is given by equation '1':

$$\delta = \frac{5FL^3}{384\boxed{EI}} \qquad (1)$$

where:

- δ is the deflection of the member (mm)
- F is the total load on member (N)
- L is the span between fixing points of the members (mm)
- E is Young's Modulus of the material (N/mm^2)
- I is the second moment of area of the member's cross-section (mm^4)

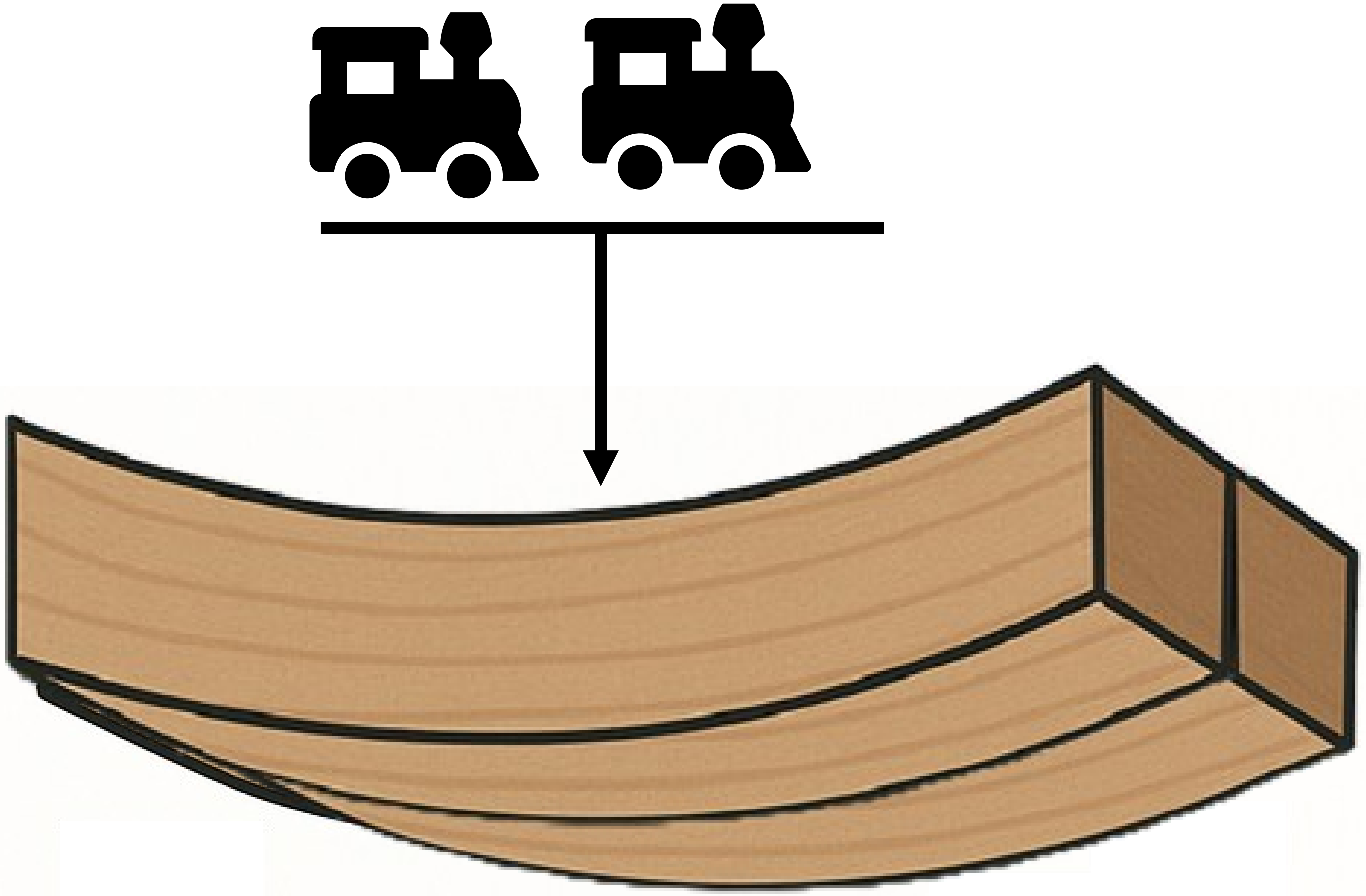
Second Moment of area Ixx Value



$$\delta = \frac{5FL^3}{384EI}$$

I=1cm4

Second Moment of area Ixx Value



I=2cm4

Second Moment of area Ixx Value

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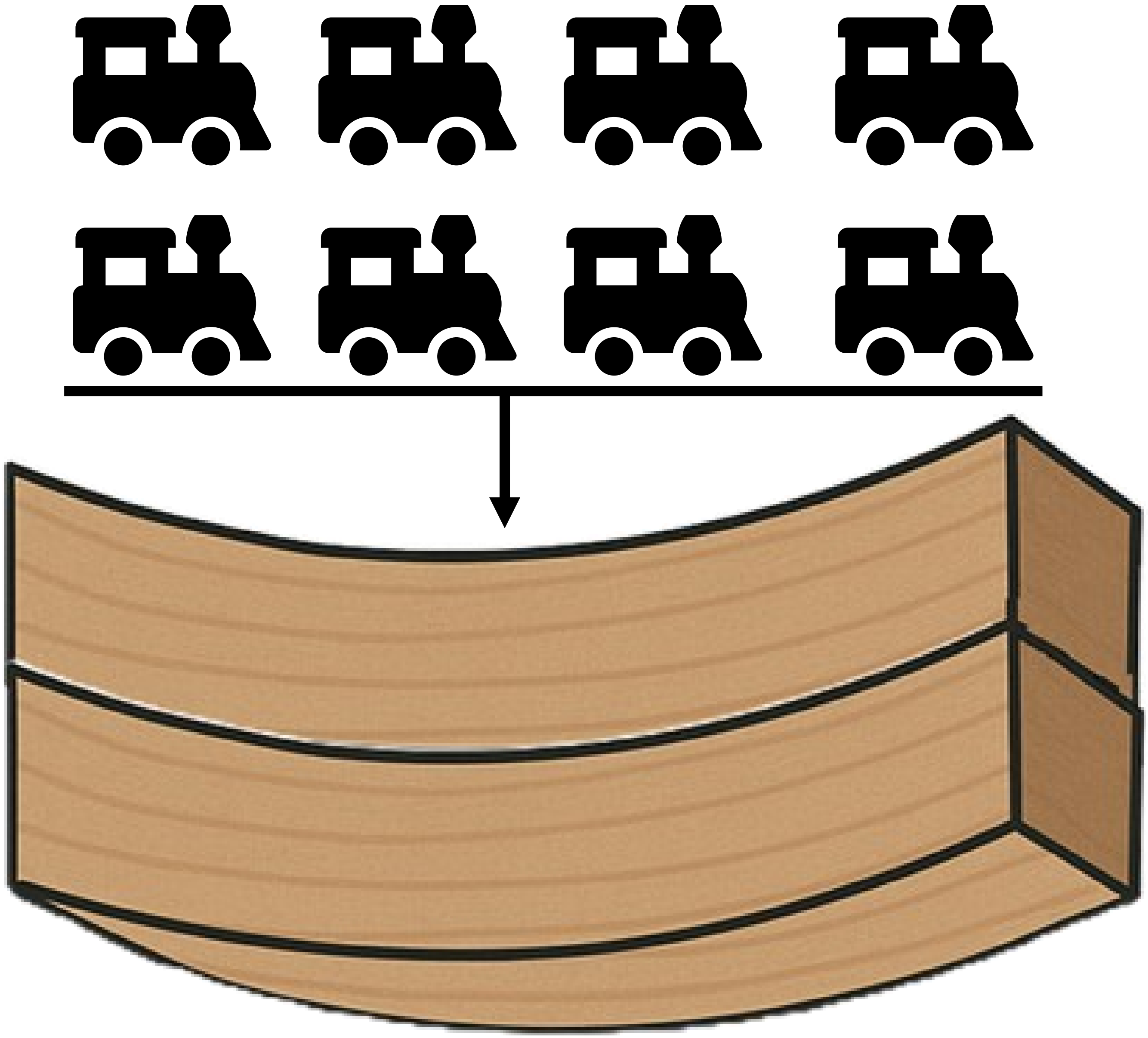

I=8cm4

Second Moment of area Ixx Value

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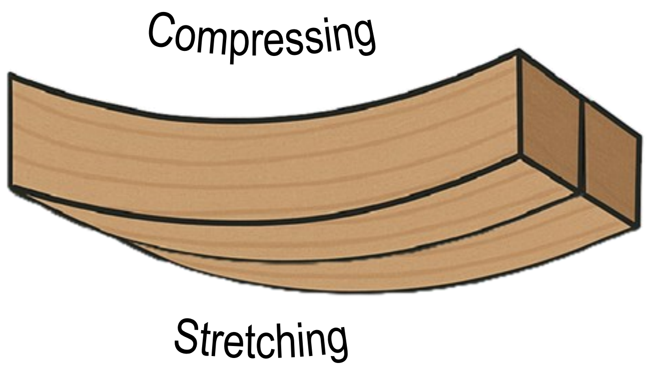
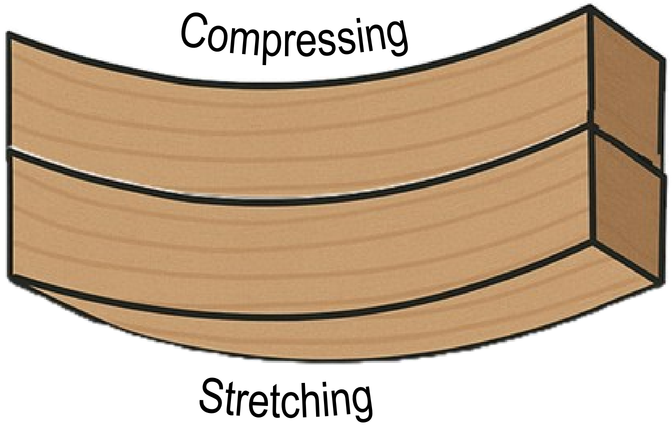
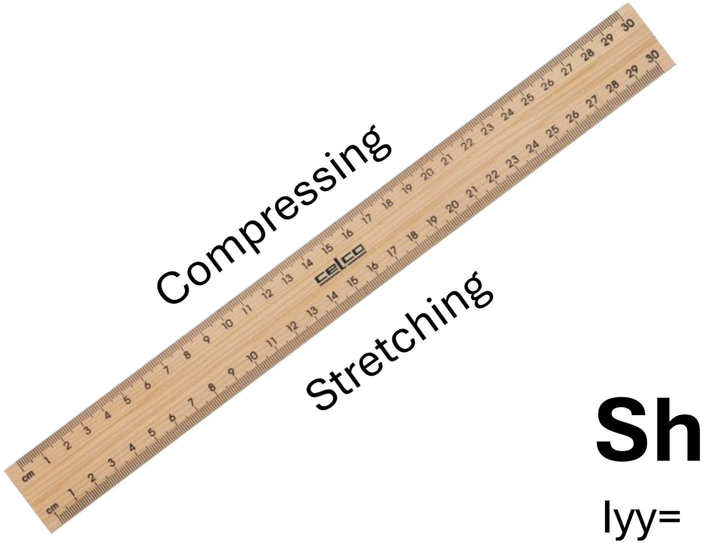


Iyy=2mm4



Ixx=8mm4



Shape

Iyy= 2.5mm4
Ixx=2225mm4

- I is the second moment of area of the member's cross-section (mm^4)

Young Modulus E Value

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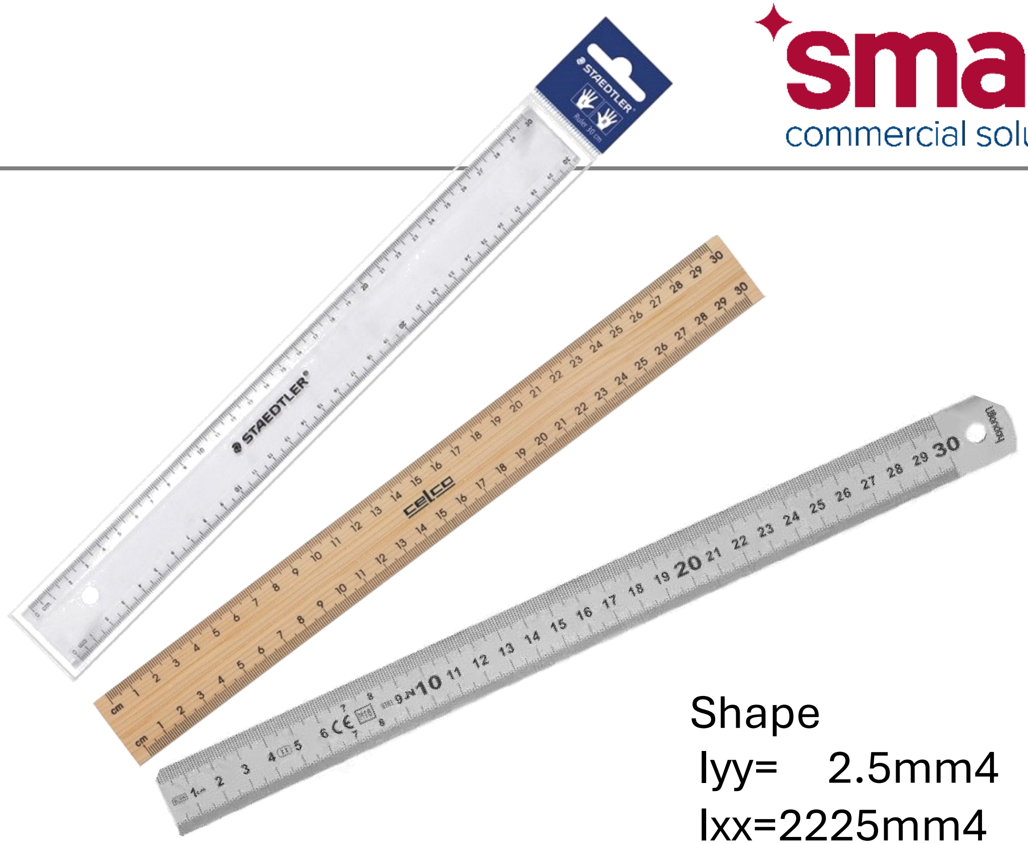
Material	GPa
PVC/Plastic	2
Timber	16
Aluminium	70
Steel	210



Shape
Iyy= 2.5mm4
Ixx=2225mm4

- E is Young's Modulus of the material (N/mm^2)

- I is the second moment of area of the member's cross-section (mm^4)

Document A Resistance to Wind

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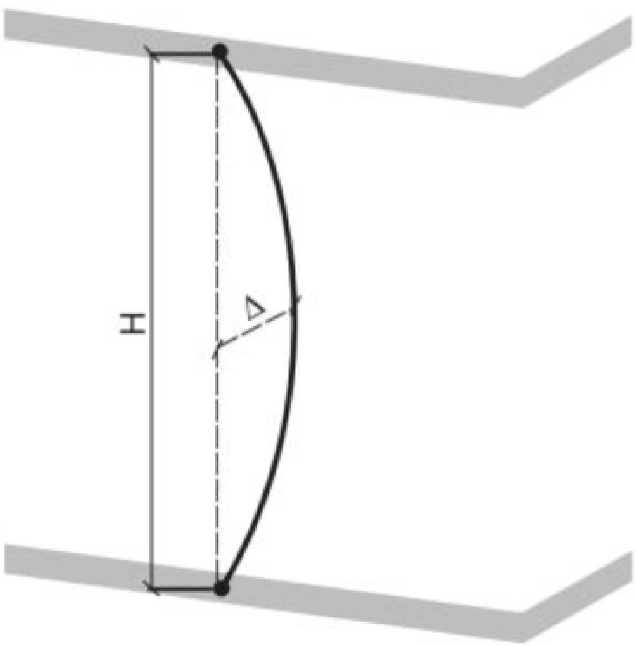
commercial solutions

Framing members generally
At both positive and negative applications of the peak test pressure, the maximum normal-to-plane deflection shall not exceed:



Length	Allowable deflection
H ≤ 3000	Δ ≤ H/200
3000 < H < 7500	Δ ≤ 5 + H/300
7500 ≤ H	Δ ≤ H/250

All dimensions are given in mm

Figure 3.3 Overall deflection of framing members

A lower value may be required to ensure curvature and rotations are less than those obtained in a previous test, Clause 1.5.5.

Document A Combined Loads...

The profile strength must satisfy the **greater of the two loads**

- wind load
- barrier load

When calculating strength, the Wind Load and the Barrier Load should not be combined. According to BS 6180:2011, these are treated as separate load cases and must be assessed independently.

This approach is based on the principle that maximum wind pressure and maximum occupancy (barrier) loading are unlikely to occur simultaneously. Combining by adding the two values would result in an overly conservative design that does not reflect realistic conditions.

Document A Resistance to Wind

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Strength Required

Ixx Value 250cm^3

125mm curtainwall box

Thomas Young
1773-1829

Deflection **Load** **Span**

$$\delta = \frac{5FL^3}{384EI}$$

E Value
Youngs Modulus

Ixx Value
Second Moment of Area

Building Regulations

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The profile strength must satisfy the **greater of the two loads....**

Wind Load

Wind Load 2,400 Pascal

240kg/m^2
or 146mph

Imposed Load

Barrier 1.0 kN/m^2

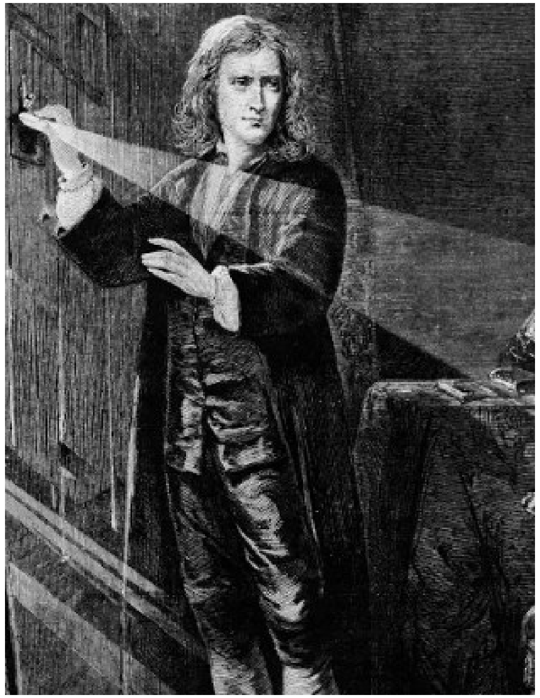
100kg/m^2

Strength Required

Ixx Value 250cm^3

125mm curtainwall box

Blaise Pascal
1623 1662



Issac Newton
1643-1727

Thomas Young
1773-1829

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smart designs for strength

Heritage windows

Youngs Modulus E Value

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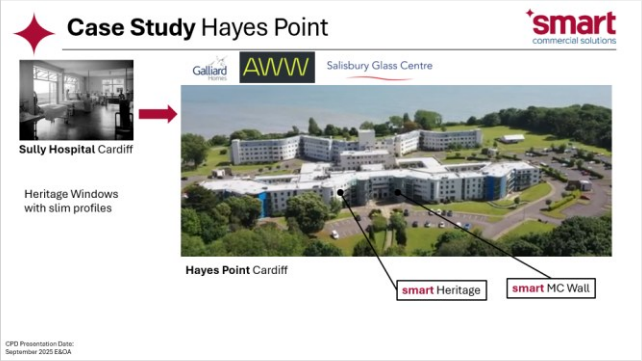
	GPa
PVC/Plastic	2
Timber	16
Aluminium	70
Cast Iron/Bronze	100
Steel	210

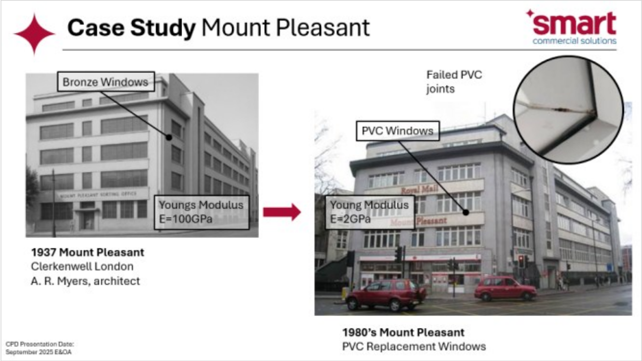
Timber
style joint
From cast
iron

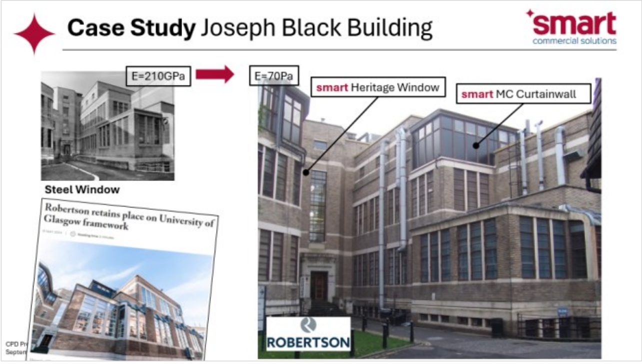
1777 Iron Bridge Coalbrookdale
Abraham Darby

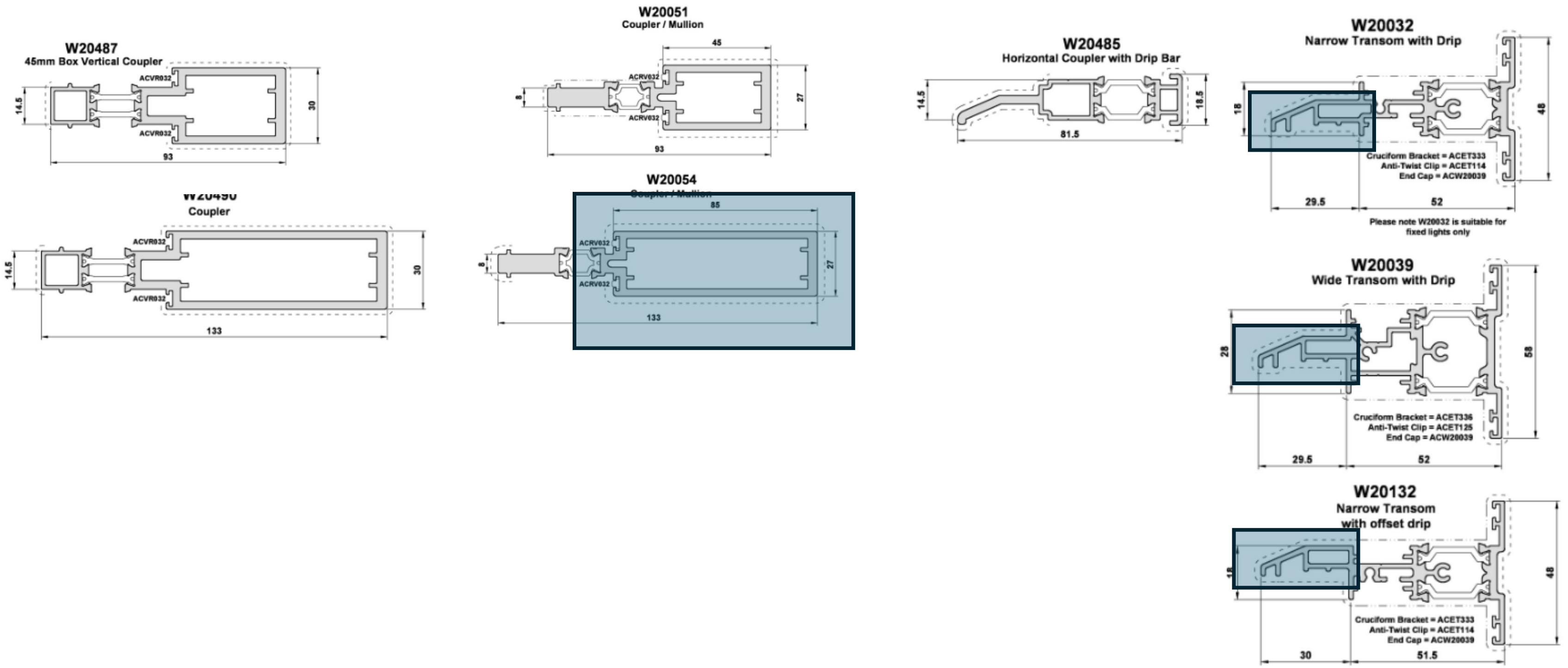
Case Study Designing for strength

smart designs for strength









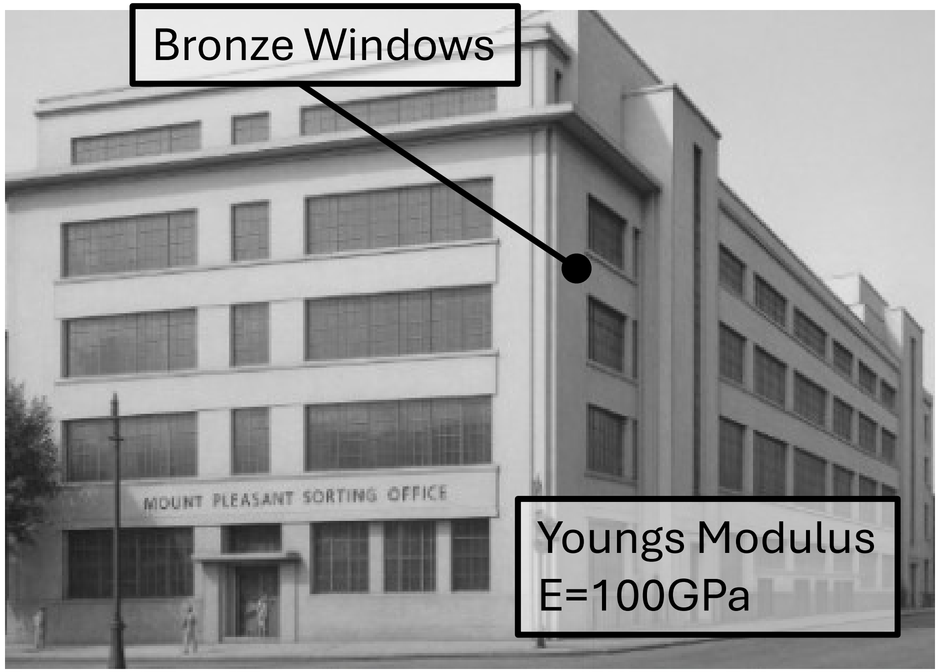
Case Study Hayes Point

Sully Hospital Cardiff

Heritage Windows
with slim profiles

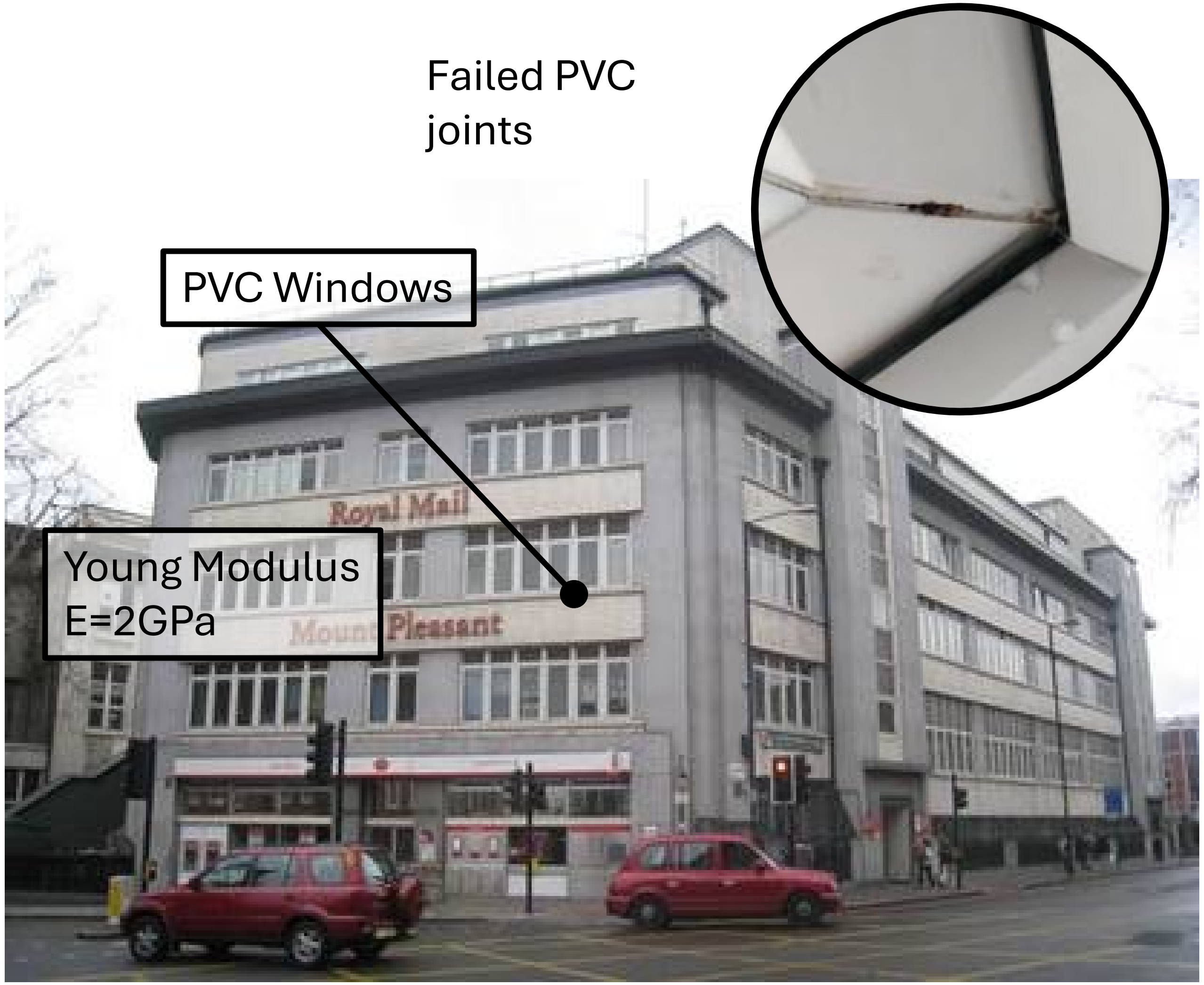
Hayes Point Cardiff

Case Study Mount Pleasant



1937 Mount Pleasant
Clerkenwell London
A. R. Myers, architect

Failed PVC joints

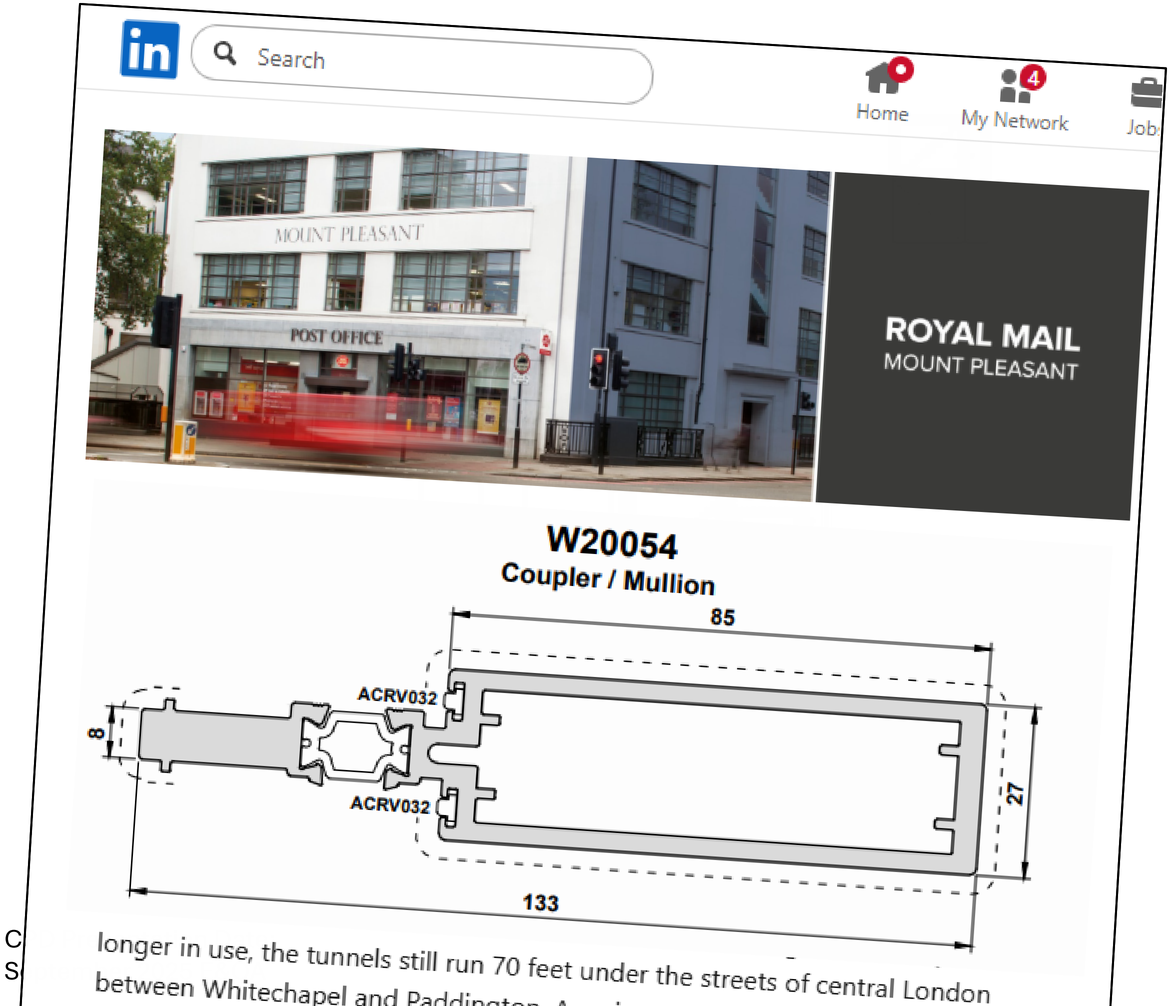


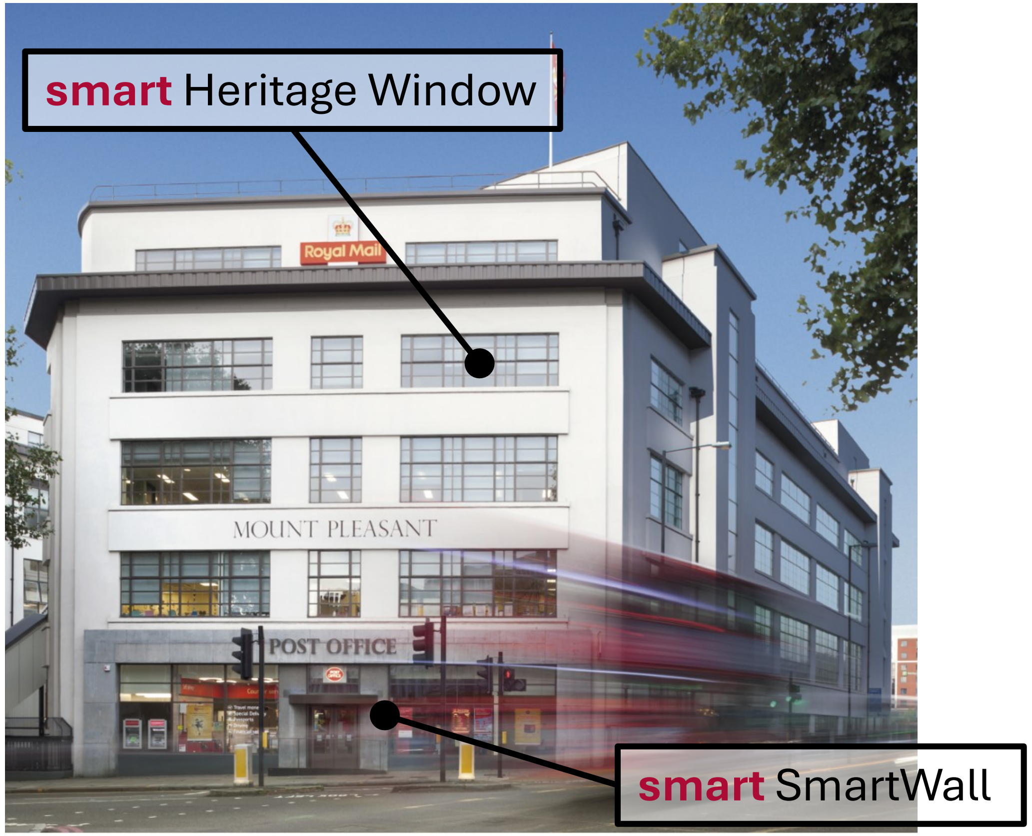
1980's Mount Pleasant
PVC Replacement Windows

Case Study Mount Pleasant

smart commercial solutions

mace MultiFab glassolutions SAINT-GOBAIN





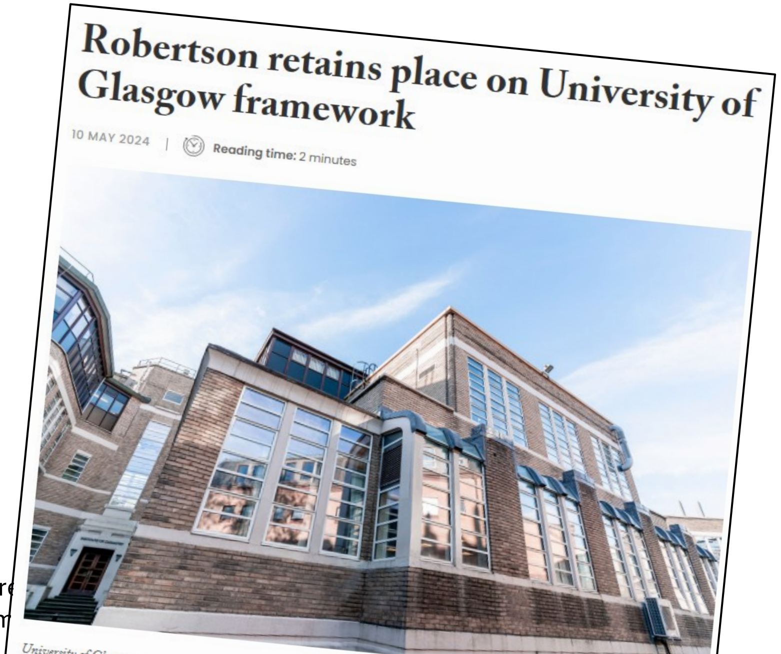
Mount Pleasant Clerkenwell London
Smart Alitherm Heritage

Case Study Joseph Black Building

smart commercial solutions

E=210GPa

Steel Window



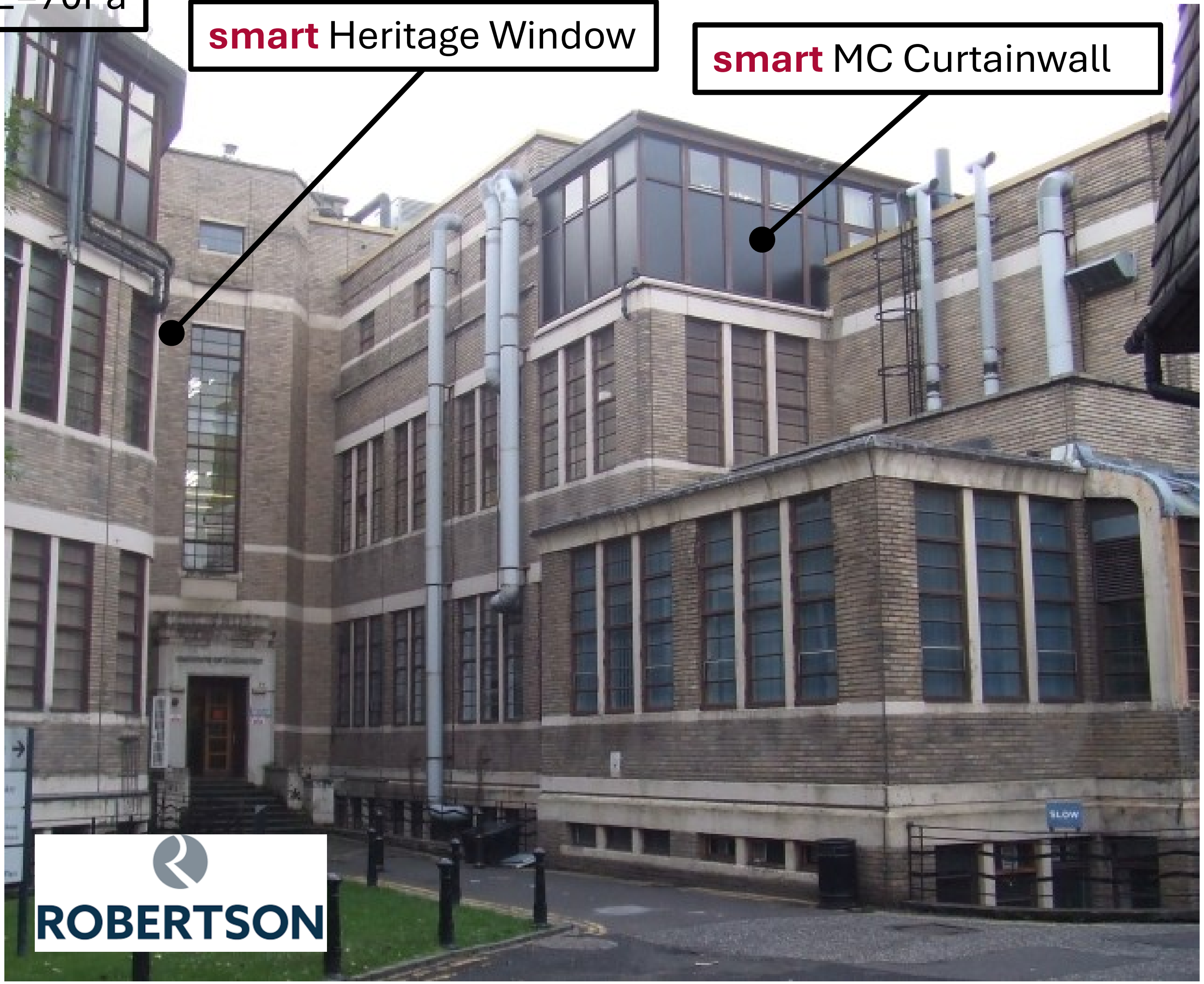
Robertson retains place on University of Glasgow framework

10 MAY 2024 | Reading time: 2 minutes

E=70Pa

smart Heritage Window

smart MC Curtainwall



Case Study Joseph Black Building

CASE STUDY:

JOSEPH BLACK **BUILDING**

Univesity of Glasgow

Client: University of Glasgow

Smart Systems: Alitherm Heritage

Innovation: New transom detail; new EPDM gaskets; new window couplers

Project Background

Smart Architectural Aluminium worked as part of the project team on a major refurbishment programme for the University of Glasgow. The £34 million refurbishment of this iconic, listed building was designed to give it a completely new lease of life, preserving the design heritage of the building while introducing modern, high-performance, high-quality materials.

The work was commissioned to upgrade the fabric of the building, improve its efficiency and performance and make it a better research, learning and teaching environment for staff and students. The scheme incorporates Smart's Alitherm Heritage window and door systems, which provide a like-for-like aesthetic replacement for traditional steel windows, but with the thermal and insulation performance qualities of a modern aluminium system.

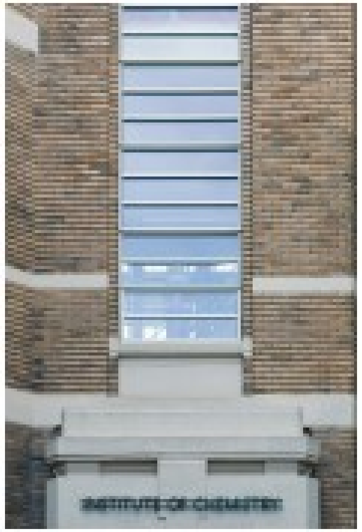
Product Innovation

In addition to the main fenestration, the project featured a less obvious, but no less important innovation in the form of a new transom shadow detail, developed specifically by Smart's technical team to mimic a window bead with a groove on the transom. A new slim-line "drip" transom was also developed to be used above opening vents which matched the sight-lines of the existing 48mm transoms.

This elegant and effective solution was designed, sample profiles were extruded and fabricated and samples were prepared for approval in just eight weeks. This fast turnaround included the production and approval of two sample transoms and the manufacture of three new extrusion dies, with the detailed design also including the provision for new EPDM gaskets to be used, to ensure that none of the gasket was visible from the unusual drip detail above the window hinges.

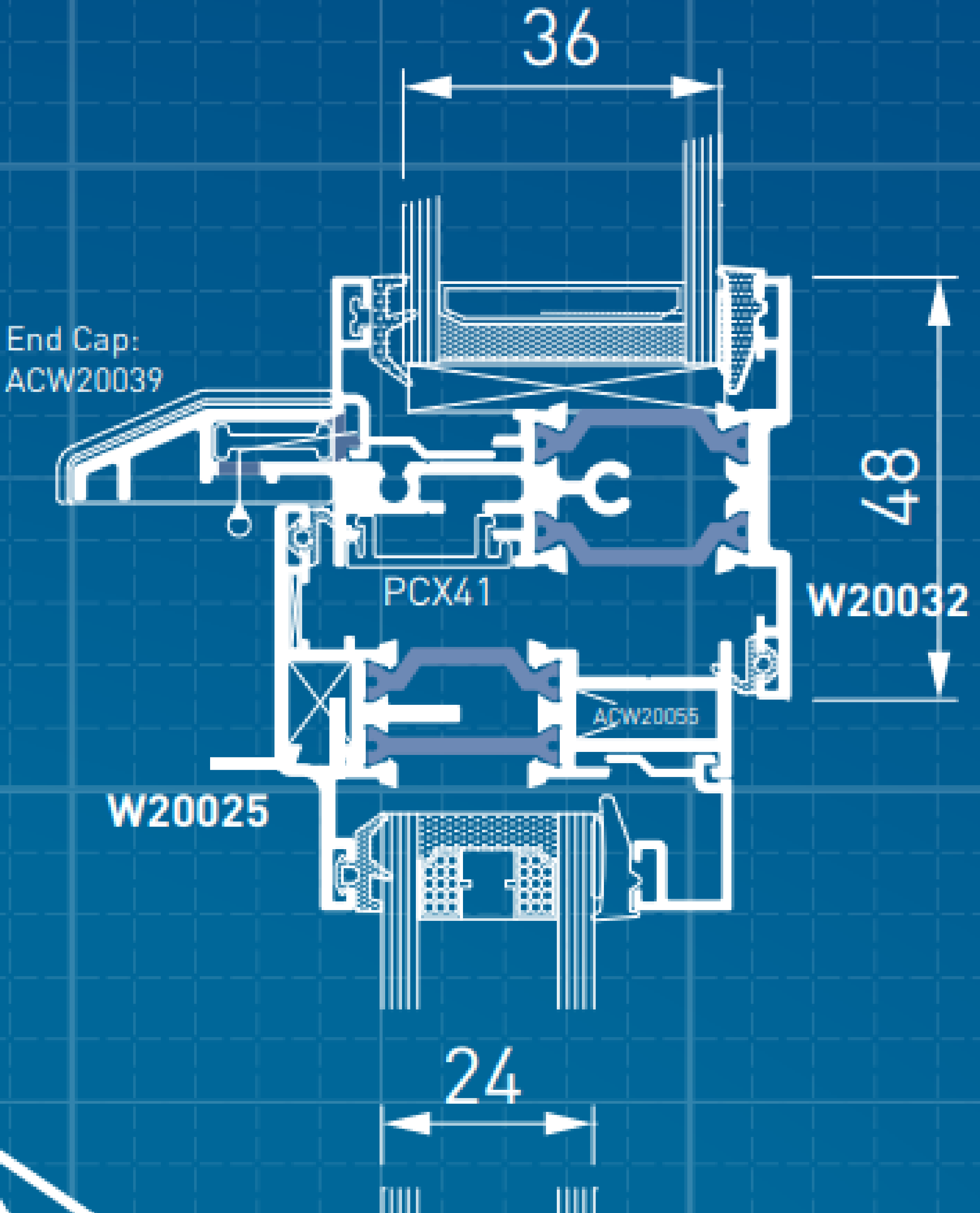
The project's design team also developed new window couplers at four metres to enable eleven metre vertical runs of windows to be installed above the main reception and stairwells, faithfully recreating the original curtain walling design.

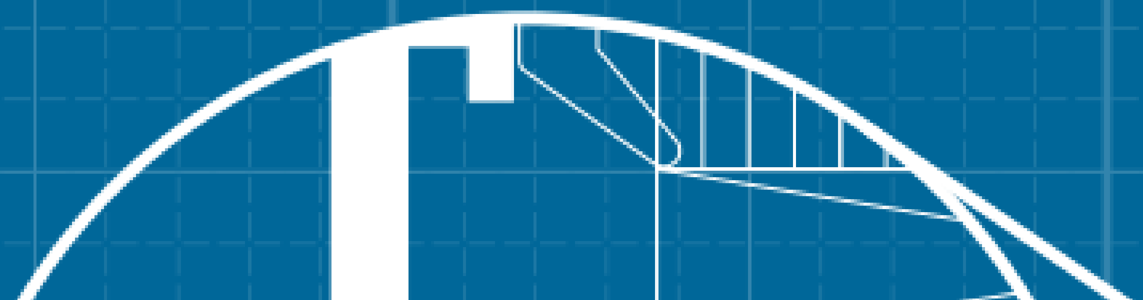
Ian McDonald, Managing Director of Albann, the company responsible for the fabrication and installation of the fenestration, said: "In terms of matching the original window profiles, it was critical that we maintained the essence of the building's 'art-moderne' design and replicated the lines of 1930's steel windows. We therefore worked closely with Smart's technical team to design the new cill and gasket details to ensure that we achieved an almost exact match to the original design."



Reinforced dip box to meet Ixx with concealed drainage

New drip transom created 48mm wide to match fixed-light transom whilst allowing room for an opening vent to close against.





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Sliding Doors

Case Studies Visoglide Sliding Door


smart
architectural aluminium
Proud members of
MADE IN BRITAIN
FEATURING SMART'S NEW
QUICK GLAZE BEAD

Introducing...
VISOGLIDE SERIES

The Visoglide range of high-quality sliding doors combines contemporary styling with outstanding performance.

Visoglide doors are perfect for sliding commercial entrances where large opening apertures are required, or as a statement sliding door for residential properties, where the doors maximise light and provide unimpeded panoramic views.

All the system's main sections feature an extended polyamide thermal break that allows Visoglide doors to achieve U values from 1.6 to 1.4 W/m²K with a 1.0 centre pane (dependent on profiles selected).

Building on the proven success of the established Visoglide system, the range has now been expanded, opening up even more aesthetic and performance options.

DESIGNING PRODUCT SOLUTIONS FOR

- Inline sliding and lift & slide options
- Slim interlock option
- Available in single and dual colour formats in a wide choice of finishes
- Option of colour matched accessories
- Suitable for use with auto slide opening mechanisms
- PAS24:2022 compliant multipoint locking options
- British Standard Kitemarked system achieving: KM 530838 PAS 24:2022
- Long life, low maintenance

Cranford Cliffs Poole

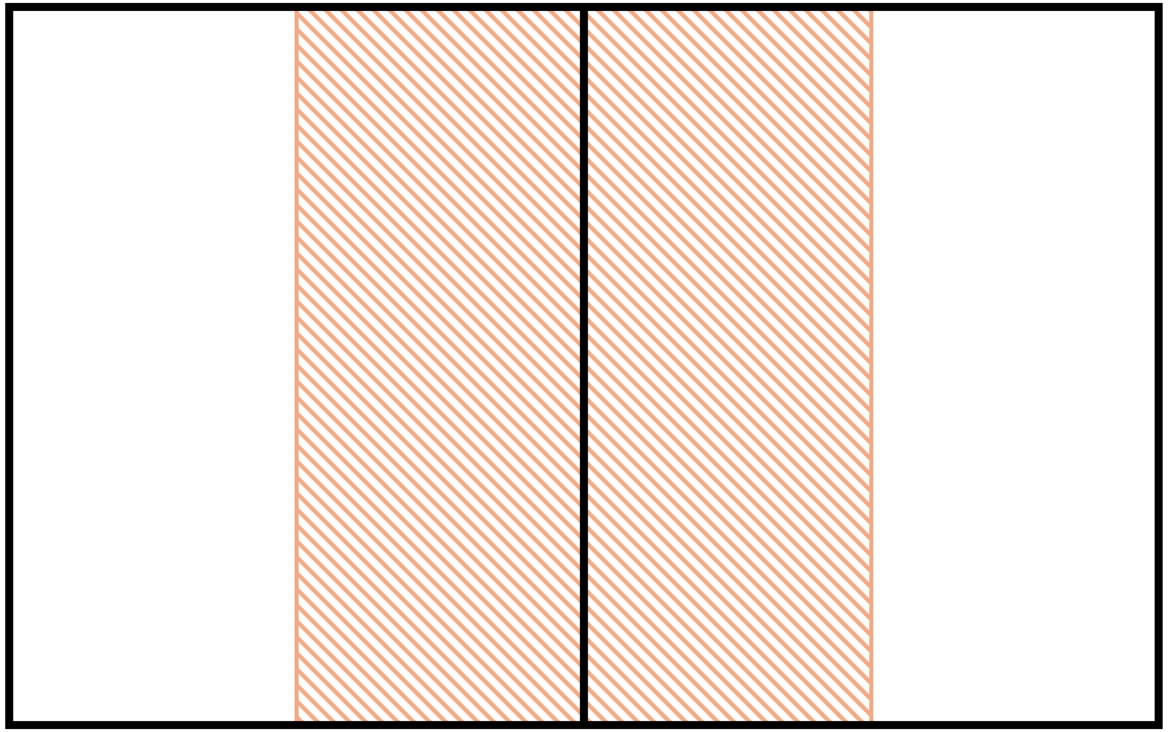
smart Visoglide Doors

Light House Croyde

Abbey Sands Torquay

CPD Presentation Date:
September 2025 E&OA

Wind Rectangular Load - Doors



2.5m

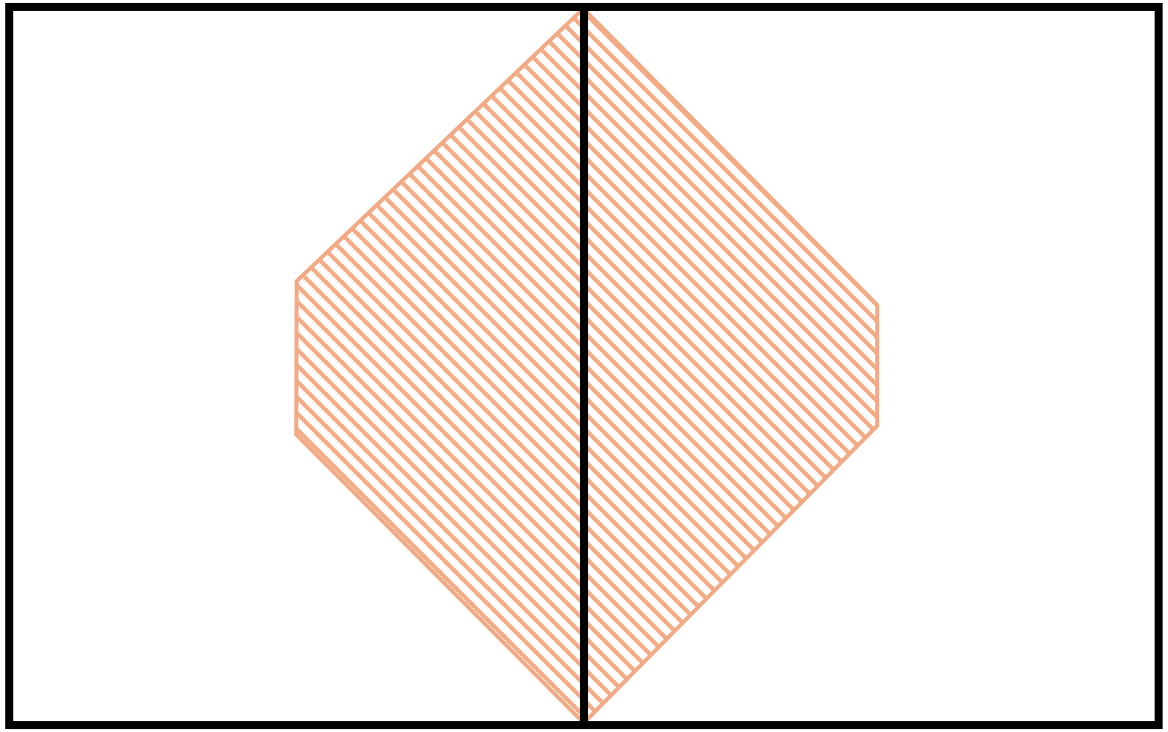
4.0m

1900 Pa

Ixx= 220cm4

Wind Trapizoidal Load - Doors

2.5m



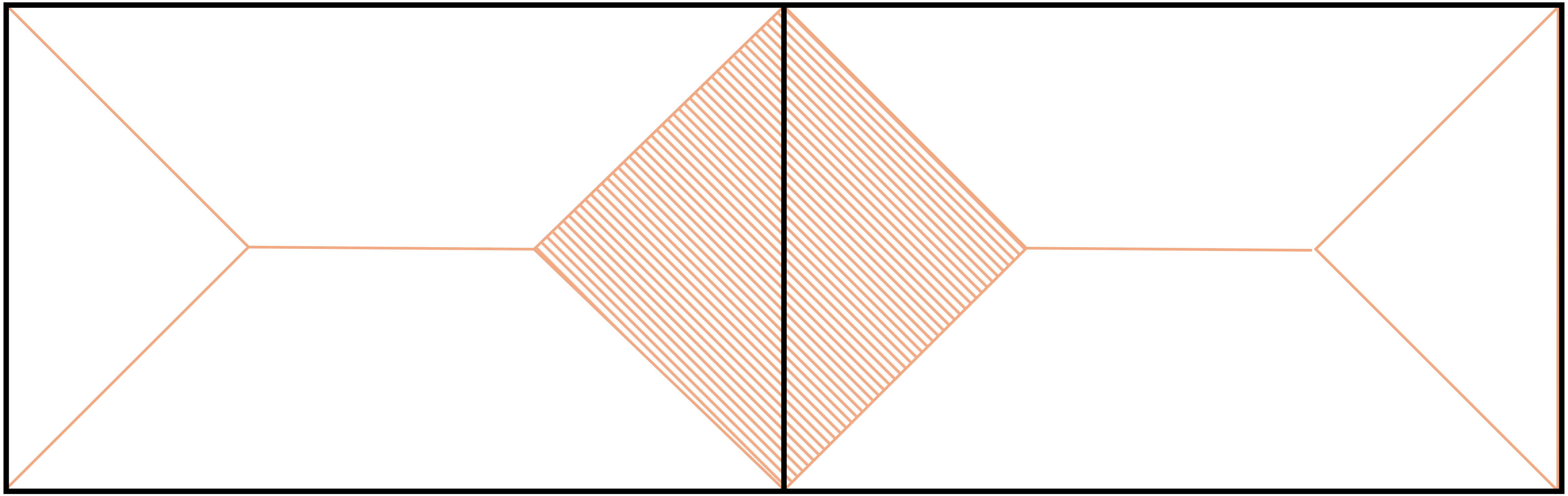
4.0m

1900 Pa

Ixx= 168cm4

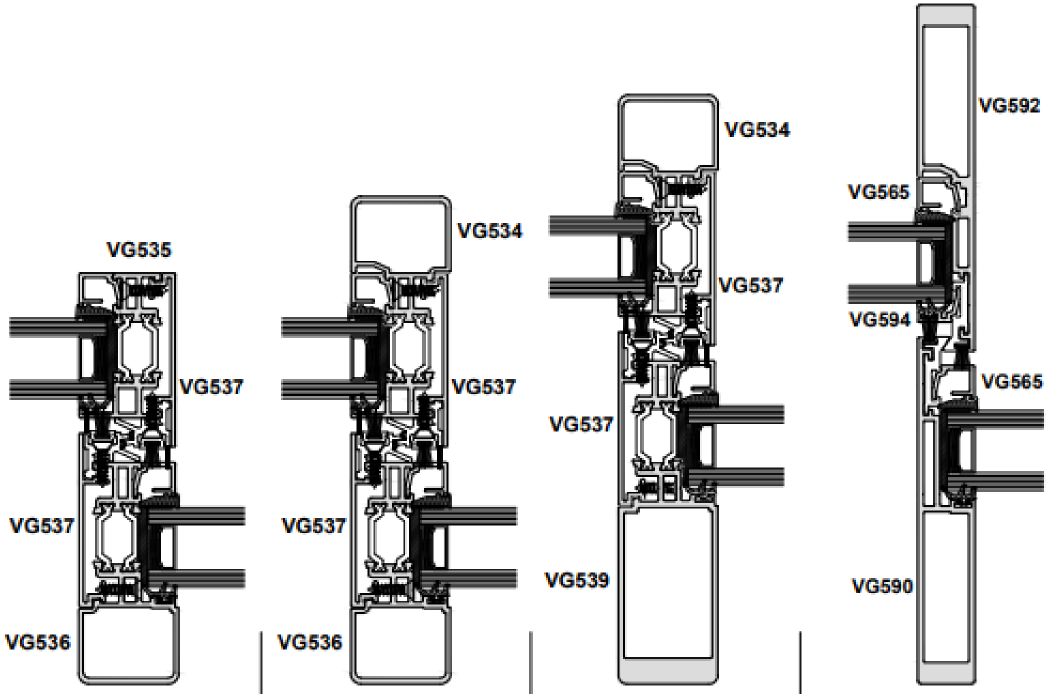
CPD Presentation Date:
September 2025 E&OA

Wind Trapizoidal Load - Doors



Wider door wind load on interlock does not increase

Wind Trapizoidal Load - Doors



49 cm4	73 cm4	182 cm4	155 cm4 *

Slim Interlock Solutions
designing for strength

Visoglide Ixx Values Interlock

smart
commercial solutions

Standard Interlock Solutions
designing for strength

	VG630, VG620, VG551R	VG532, VG630, VG533, VG620, VG551R	UN500, VG630, UN510, VG620, VG551R	UN500, UTL080, VG630, UN510, VG620, VG551R
VG551R, VG520, VG530	92 cm4	156 cm4	191 cm4	253 cm4
VG551R, VG520, VG530, VG533, VG532	128 cm4	192 cm4	227 cm4	289 cm4
VG551R, VG520, VG530, UN510, UN500	151 cm4	215 cm4	251 cm4	312 cm4
VG551R, VG520, VG530, UN510, UTL080, UN500	187 cm4	251 cm4	286 cm4	348 cm4

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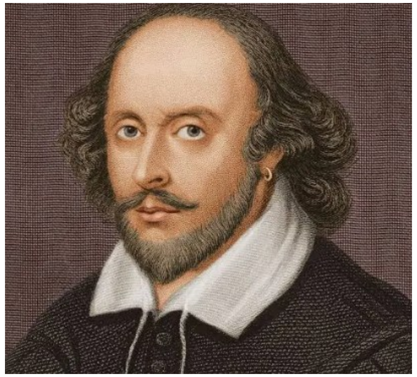
smart **designs for strength**

Juliet Balcony



William Shakespeare

1564-1616

Juliet Balcony

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BCA Technical Guidance Note 1	Rev 0 Jan 2011

Building Control Alliance

Glass guarding and restrictors to low level windows above ground floor level in dwellings

Purpose

BCA technical guidance notes are for the benefit of it's members and the construction industry, to provide information, promote good practice and encourage consistency of interpretation for the benefit of our clients. They are advisory in nature, and in all cases the responsibility for determining compliance with the Building Regulations remains with the building control body concerned.
This guidance note is based upon information available at the time of issue and may be subject to change. The Approved Documents should be consulted for full details in any particular case.

Introduction

Part N of the Building Regulations seeks to ensure that where people are likely to come into contact with glass it is unlikely to cause injury or the glazing will resist impact or be shielded or protected from impact.
However, glass is increasingly being used in locations that require it to act as guarding from falling. In these cases the glazing needs to comply with the requirement and guidance in Part K2 of the Building Regulations – protection from falling (more than 600mm).

Key Issues

Where balconies, landings and stairs within a dwelling require guarding, any glazing used as part or all of that guarding should not only comply with the requirements of Part N but also the requirements of Part K. As in all parts of the Regulations, the most onerous requirement would apply. The Approved Document to Part K provides guidance on the height above floor level at which guarding should be provided and any glazing acting as guarding should be designed to resist the forces and impact as laid down in BS 6399 and BS 6180, even where the glass is in a critical location as defined in the Approved Document to Part N. Therefore, glazing that protects people from falling must meet these requirements .

Balconies, Landings and Stairs.

Where balconies, landings and stairs within a dwelling require guarding, any glazing used as part or all of that guarding should not only comply with the requirements of Part N but also the requirements of Part K. As in all parts of the Regulations, the most onerous requirement would apply. The Approved Document to Part K provides guidance on the height above floor level at which guarding should be provided and any glazing acting as guarding should be designed to resist the forces and impact as laid down in BS 6399 and BS 6180, even where the glass is in a critical location as defined in the Approved Document to Part N. Therefore, glazing that protects people from falling must meet these requirements .

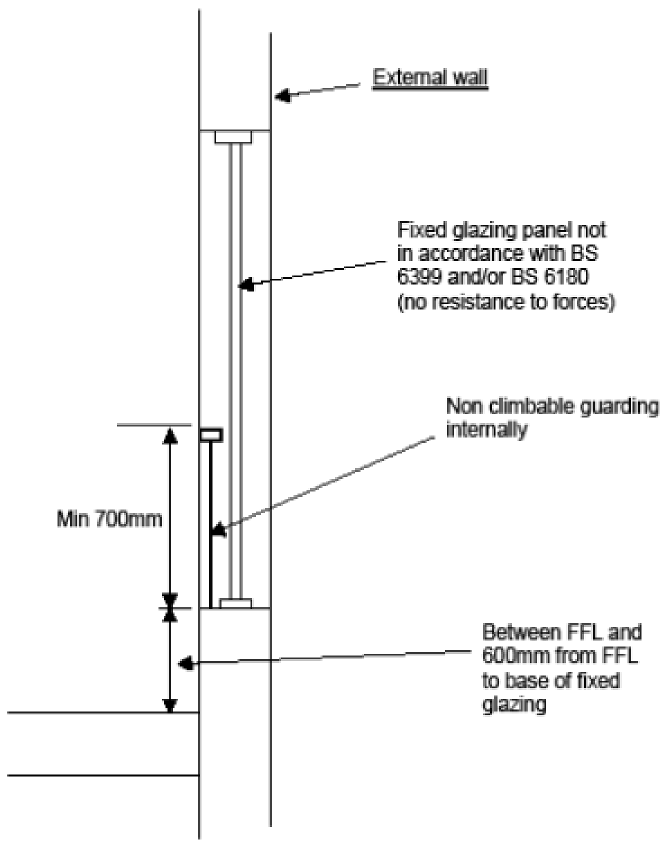
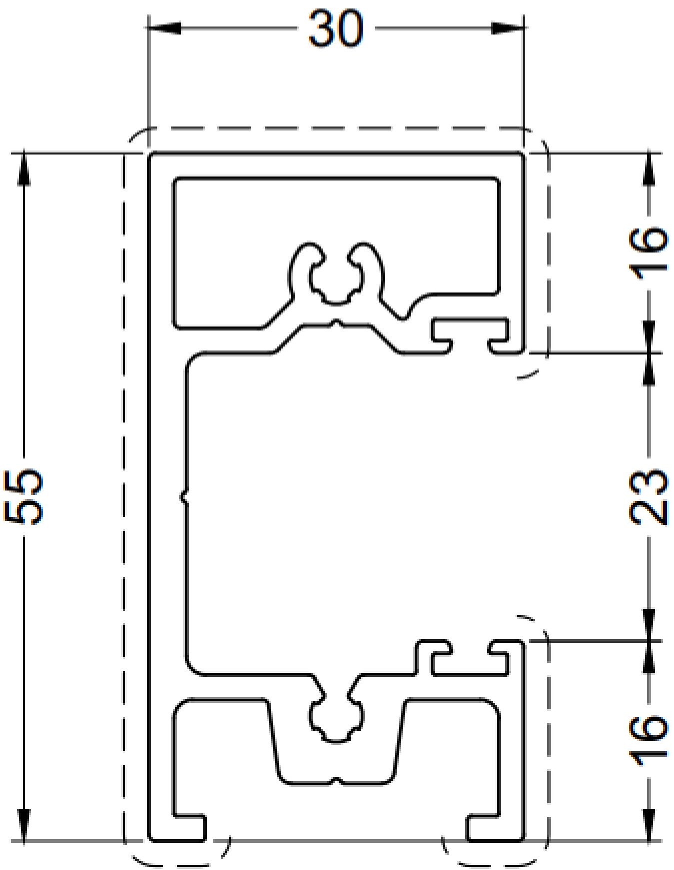


Diagram 2 – Fixed Glazing Not Required To Act As Guarding (Cill Under 600mm Above FFL)

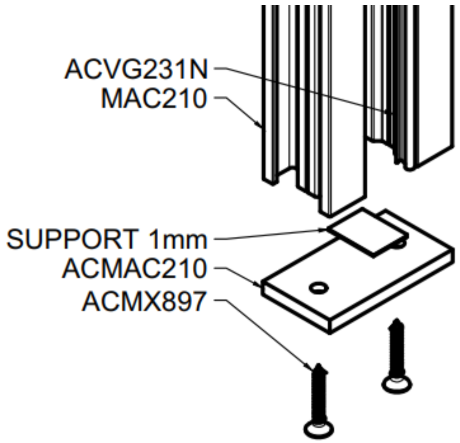
Juliet Balcony



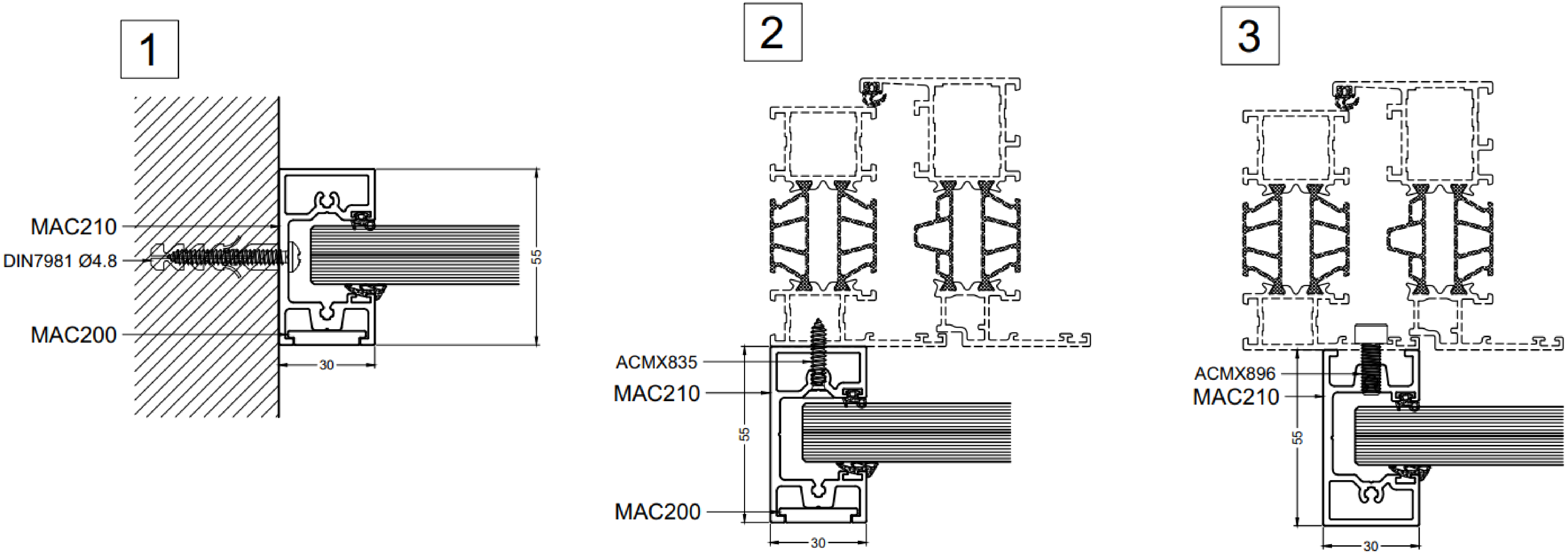
MAC210

MAC GLASS

BLAD PAGE SEITE PAGE	OMTREK PERIM. PERIM. PERIM. (MM)	MECH. MEC. MECH. MEC. (MM)	IX (CM4) ----------- WX (CM3)	IY (CM4) ----------- WY (CM3)	LENGTE LONG. LANGE LENGTH (M)
9	56	27	0.4 ----------- 0.3	0.02 ----------- 0.07	6.5



Juliet Balcony



CPD Presentation Date:
September 2025 E&OA

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ONLINE VERSION

HM Government

The Building Regulations 2010

Fire safety

APPROVED DOCUMENT

B

Volume 1: Dwellings

Requirement B1: Means of warning and escape
Requirement B2: Internal fire spread (linings)
Requirement B3: Internal fire spread (structure)
Requirement B4: External fire spread
Requirement B5: Access and facilities for the fire service
Regulations: 6(3), 7(2) and 38

Also includes: 2026 amendments 2029 amendments

2019 edition incorporating 2020, 2022 and 2025 amendments and forthcoming 2026 and 2029 changes – for use in England

ONLINE VERSION

Additional considerations

10.20 The provisions of regulation 7 apply in addition to requirement B4. Therefore, for buildings described in regulation 7(4), the potential impact of any products incorporated into or onto the external walls and specified attachments should be carefully considered with regard to their number, size, orientation and position.

10.21 Particular attention is drawn to the following points.

a. Membranes used as part of the external wall construction above ground level should achieve a minimum of class B-s3, d0. Roofing membranes do not need to achieve a minimum of class A2-s1, d0 when used as part of a roof connecting to an external wall.

b. Internal linings should comply with the guidance provided in Section 4.

c. Any part of a roof should achieve the minimum performance as detailed in Section 12.

d. As per regulation 7(3), window frames and glass (including laminated glass) are exempted from regulation 7(2). Window spandrel panels and infill panels must comply with regulation 7(2).

e. Thermal breaks are small elements used as part of the external wall construction to restrict thermal bridging. There is no minimum performance for these materials. However, they should not span two compartments and should be limited in size to the minimum required to restrict the thermal bridging (the principal insulation layer is not to be regarded as a thermal break).

f. Regulation 7(2) only applies to specified attachments. Shop front signs and similar attachments are not covered by the requirements of regulation 7(2), although attention is drawn to paragraph 10.21g.

g. While regulation 7(2) applies to materials which become part of an external wall or specified attachment, consideration should be given to other attachments to the wall which could impact on the risk of fire spread over the wall.

h. Any material achieving class A1fl or A2fl-s1 in accordance with **BS EN 13501-1** is exempted when it meets both of the following conditions.

   i. It forms the top horizontal floor layer of a balcony.

   ii. It is provided with an imperforate substrate under it which extends to the full size of the class A1fl or A2fl-s1 material.

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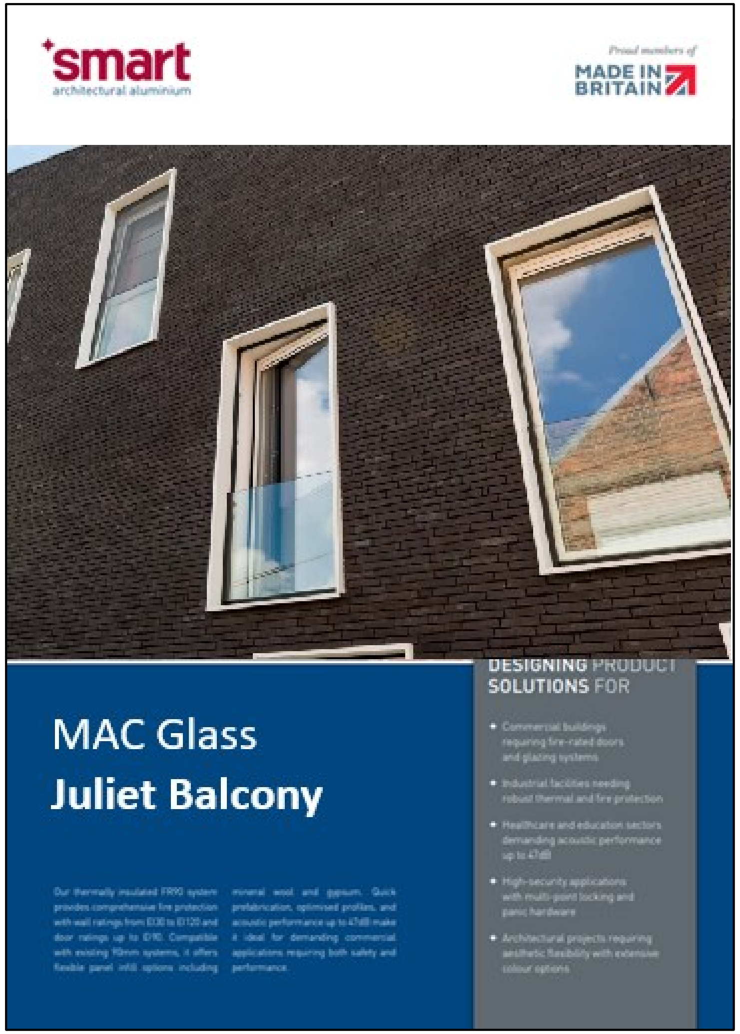
Fire Rating
Class E30
Class EI30
Class EI120

vs

Reaction to Fire
EuroClass
Combustion Rating
e.g.
Class A1
Class A2,s1,d0
Class B
Class C

Juliet Balcony



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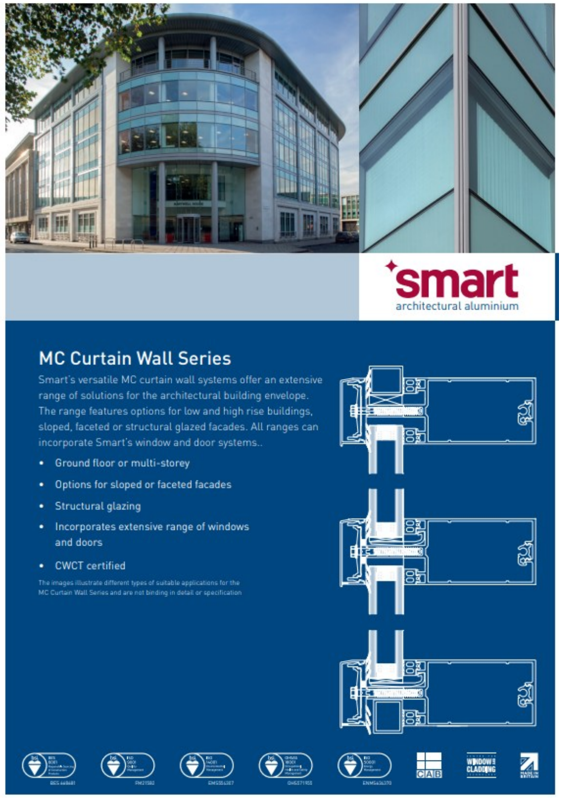
Curtain wall Systems

Case Study Brook House

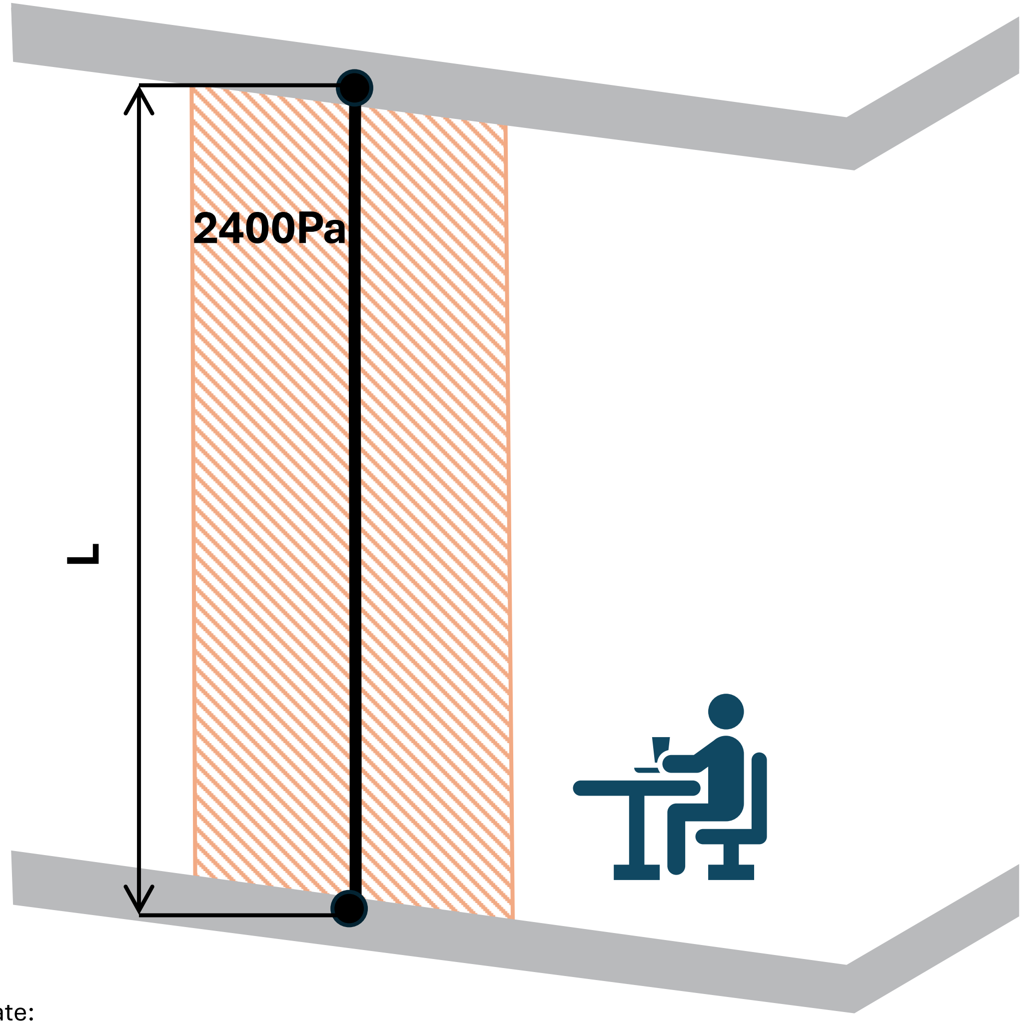


Brook House Tottenham 21 Story Residential Tower

Case Study The Landmark

The Landmark - Canary Wharf

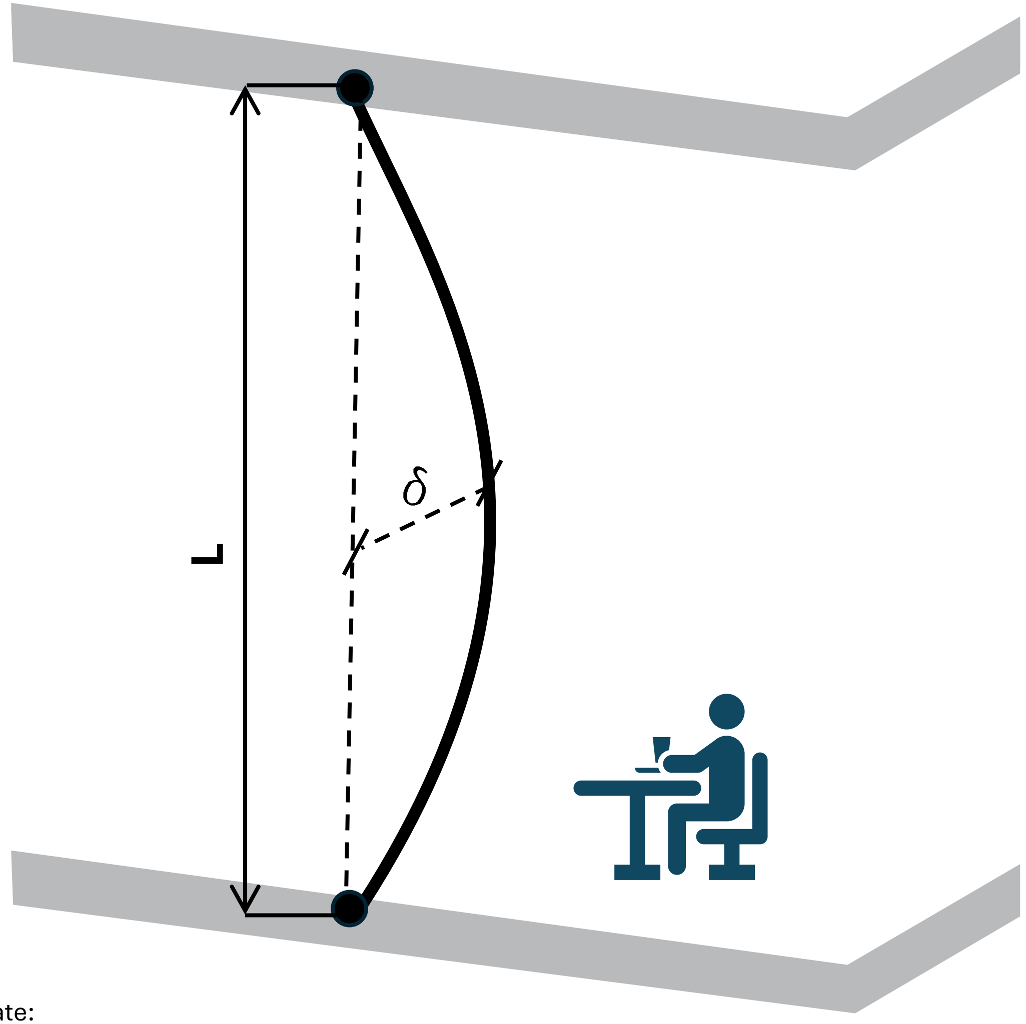
Curtainwall Mullion Deflection



The transmission of load using this approach assumes a uniform distribution of load is taken by the mullions from the cladding panels. The mid-span deflection (δ) of a simply supported, single-spanning member subject to a uniformly distributed load is given by equation '1':

$$\delta = \frac{5FL^3}{384EI} \tag{1}$$

Curtainwall Mullion Deflection

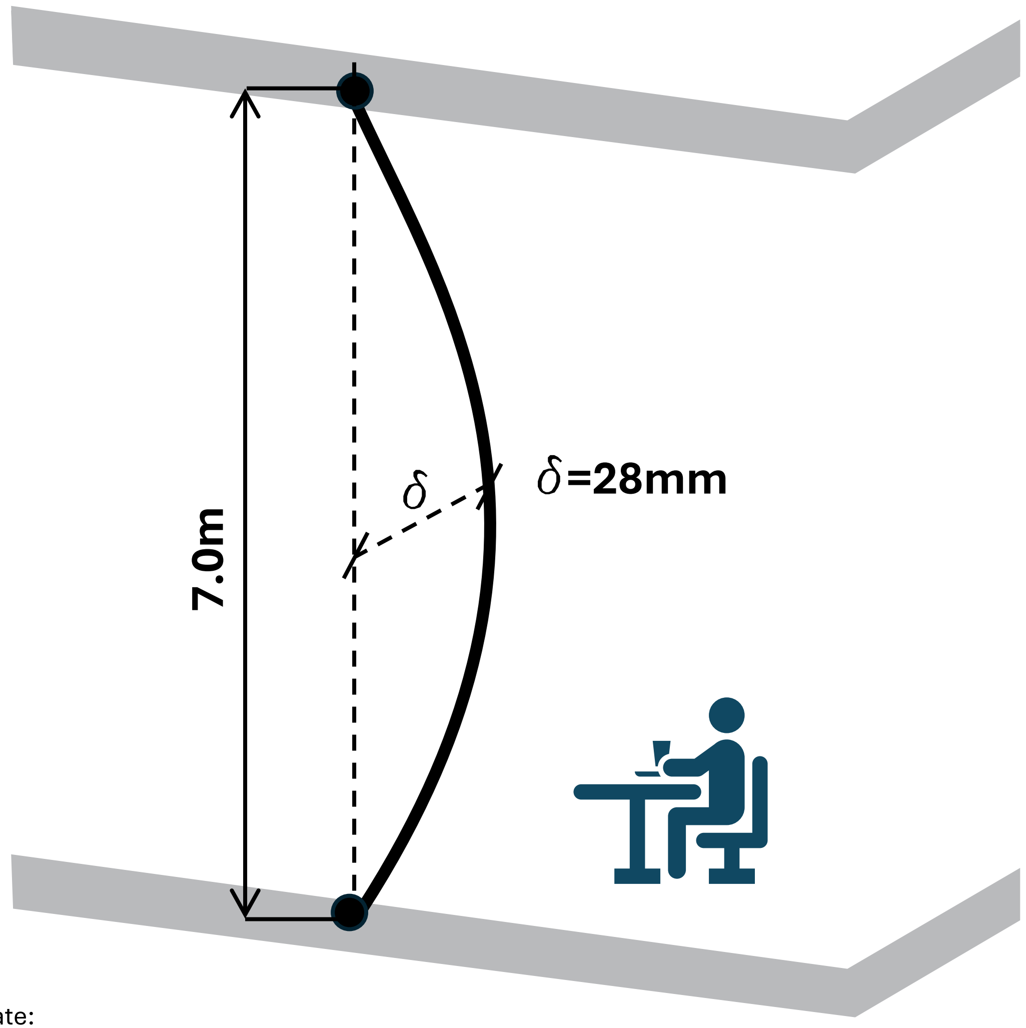


The transmission of load using this approach assumes a uniform distribution of load is taken by the mullions from the cladding panels. The mid-span deflection (δ) of a simply supported, single-spanning member subject to a uniformly distributed load is given by equation ‘1’:

$$\delta = \frac{5FL^3}{384EI} \qquad (1)$$

Length	Allowable deflection
H ≤ 3000	Δ ≤ H/200
3000 < H < 7500	Δ ≤ 5 + H/300
7500 ≤ H	Δ ≤ H/250

Curtainwall Mullion 7m



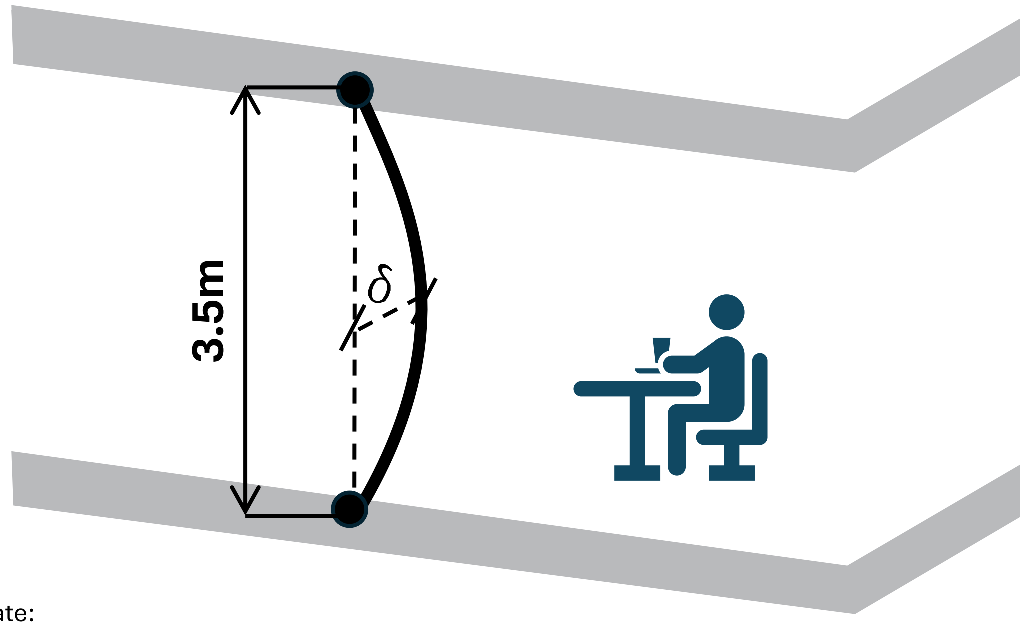
7.0m Span
Ixx=3,783cm4

3.5m Span
Ixx= 402.0cm4

3.5m + 3.5m Span
Ixx= 167.2cm4

5.0m + 2.0m Span
Ixx= 710.4cm4

Curtainwall Mullion 3.5m



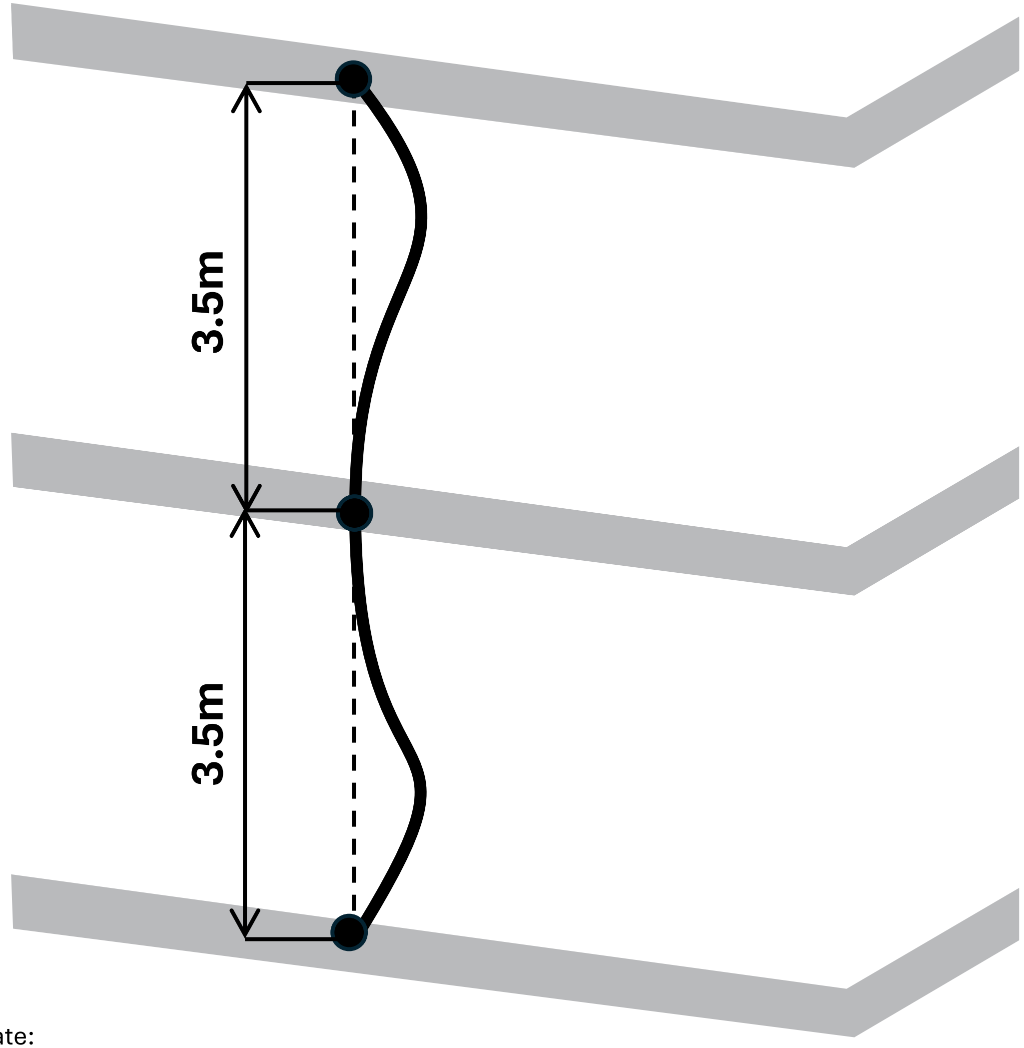
7.0m Span
Ixx=3,783cm4

3.5m Span
Ixx= 402cm4

3.5m + 3.5m Span
Ixx= 167.2cm4

5.0m + 2.0m Span
Ixx= 710.4cm4

Curtainwall Mid point tie back



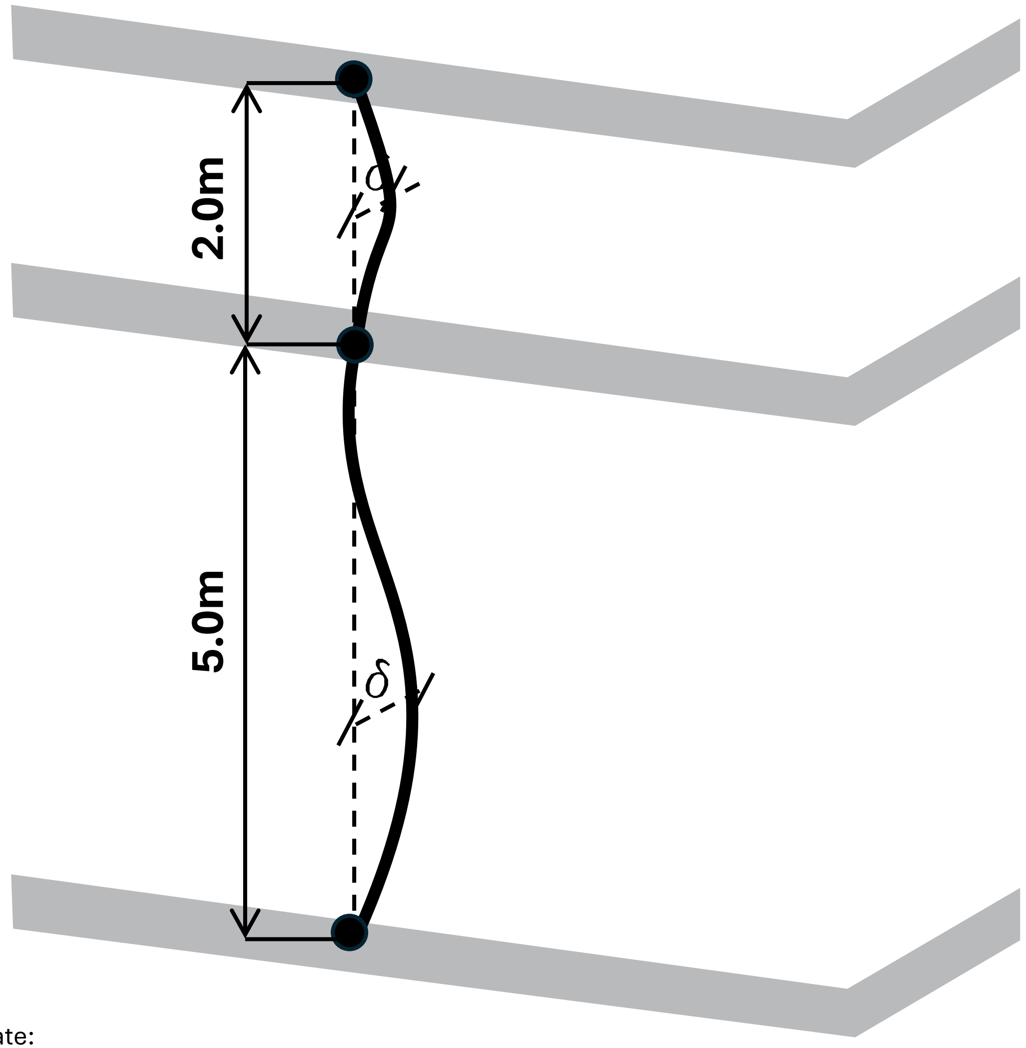
7.0m Span
Ixx=3,783.1cm4

3.5m Span
Ixx= 402.0cm4

3.5m + 3.5m Span
Ixx= 167.2cm4

5.0m + 2.0m Span
Ixx= 710.4cm4

Curtainwall Offset Tie Back



7.0m Span
Ixx=3,783.1cm4

3.5m Span
Ixx= 402.0cm4

3.5m + 3.5m Span
Ixx= 167.2cm4

5.0m + 2.0m Span
Ixx= 710.4cm4

Case Study The Landmark

smart MC Curtainwall

smart Smart Wall

The Landmark - Canary Wharf

Transom Ixx Resistance to Windload

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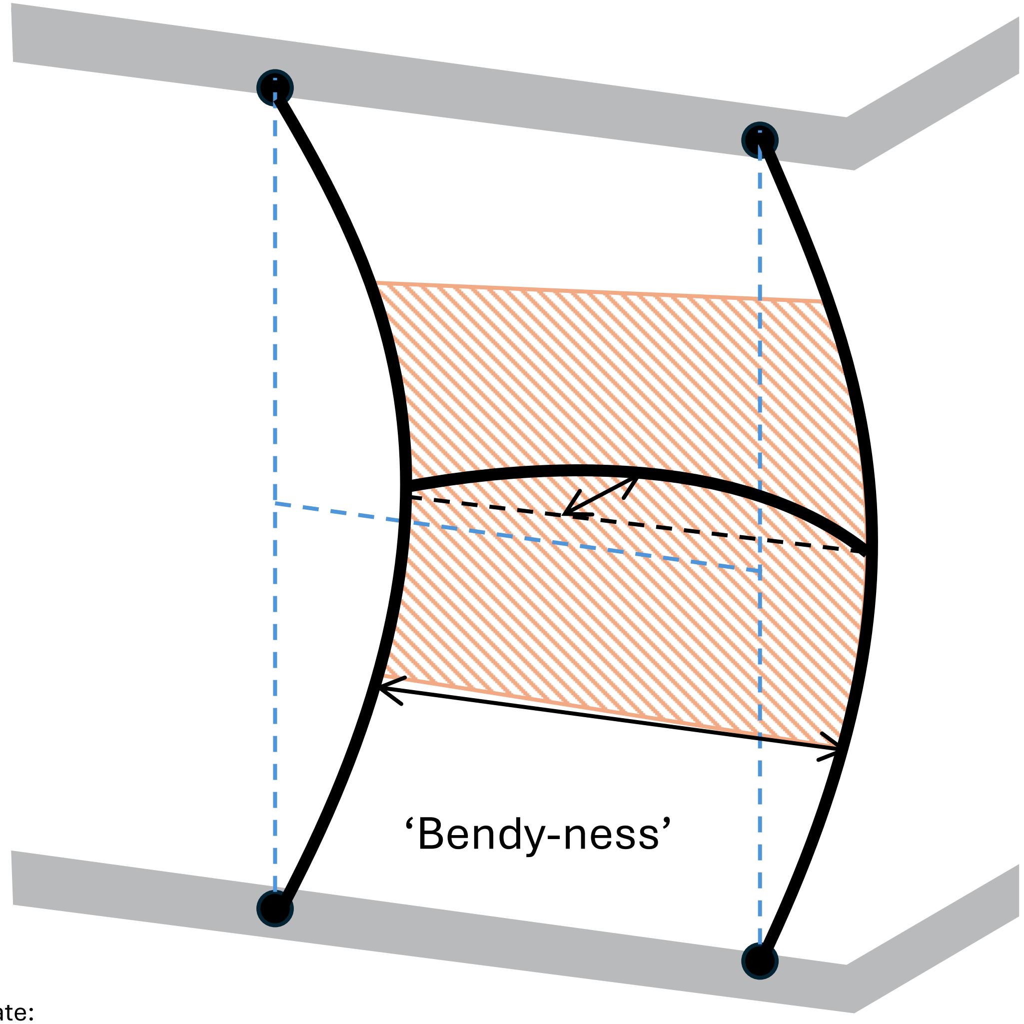
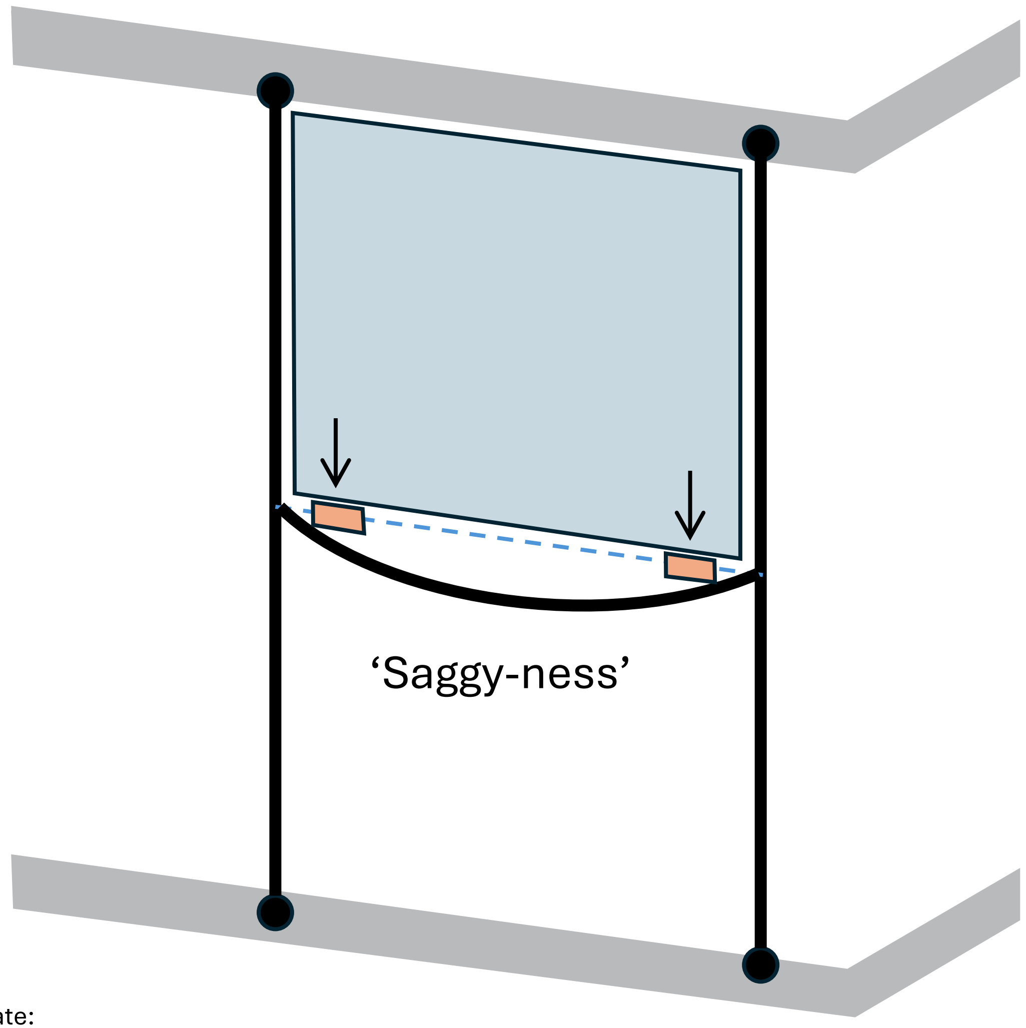


Ixx deflection to due to

- Design Wind load
- Transom centres
- Transom Length

Transom Iyy Support Glass Weight



Iyy deflection due to glass weight

Deflection based in glass weight and support locations

Case Study The Landmark

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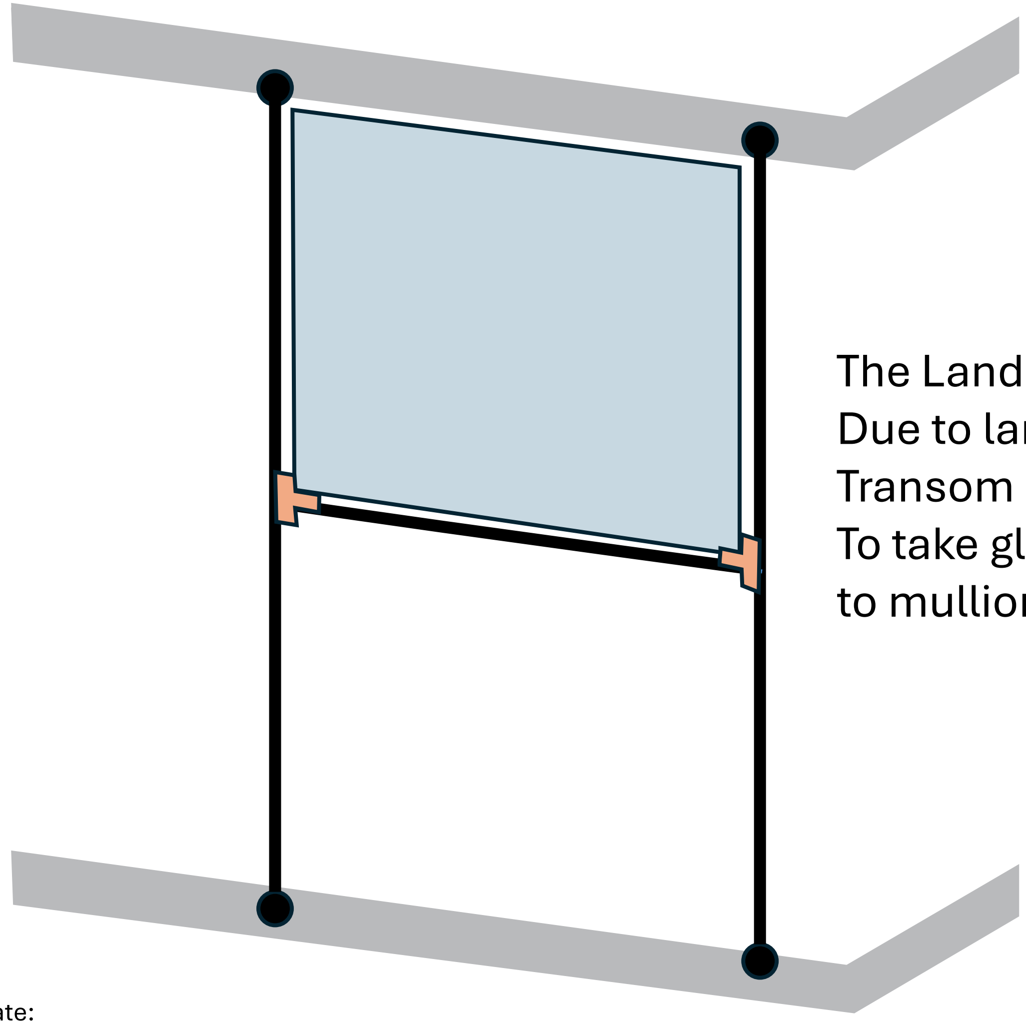

The Landmark – Canary Wharf
Due to large unit bespoke
Transom brackets designed
To take glass load direct
to mullion rather than onto transom

Wind Rectangular Load

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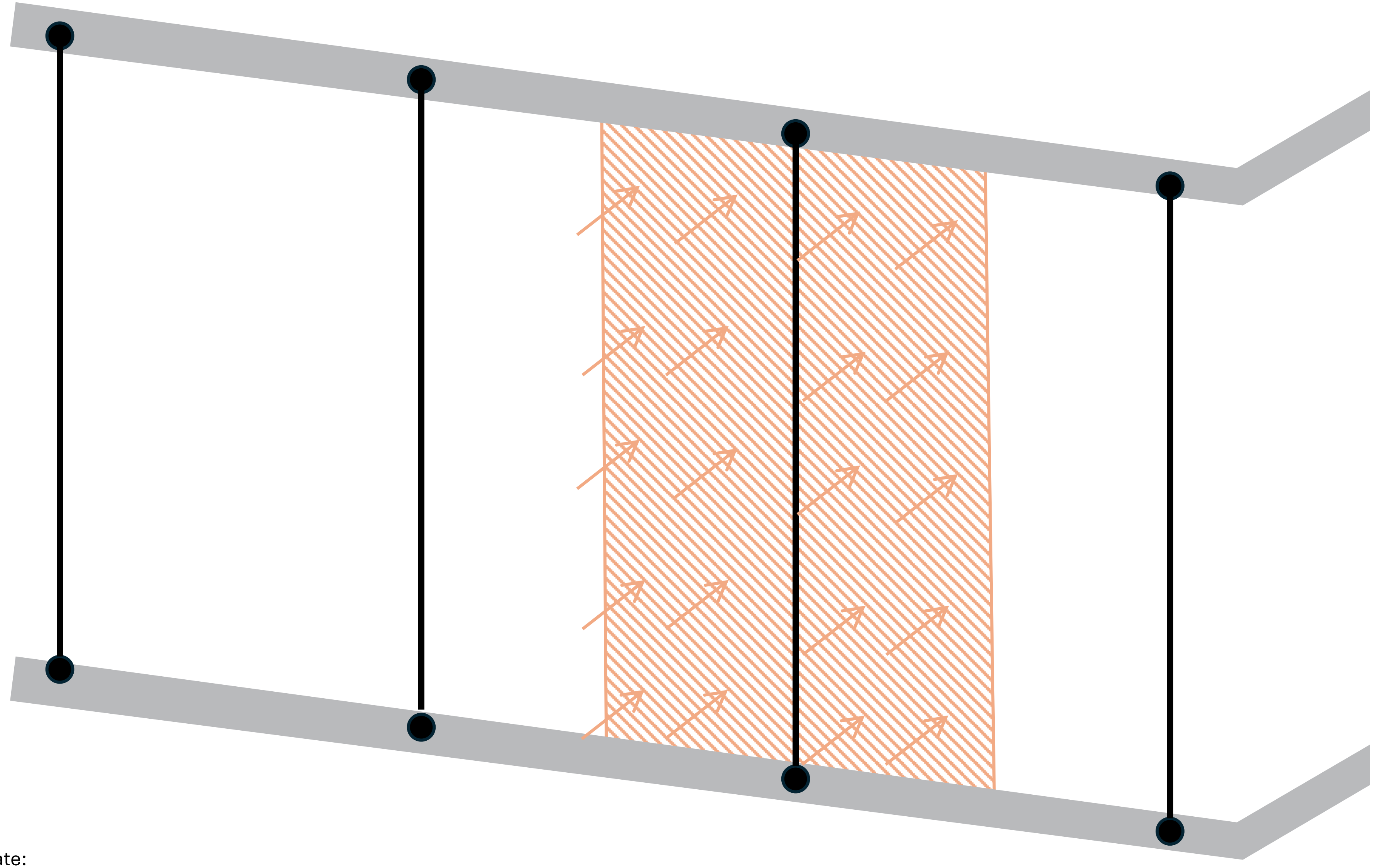

CPD Presentation Date:
September 2025 E&OA

Wind Trapizoidal Load

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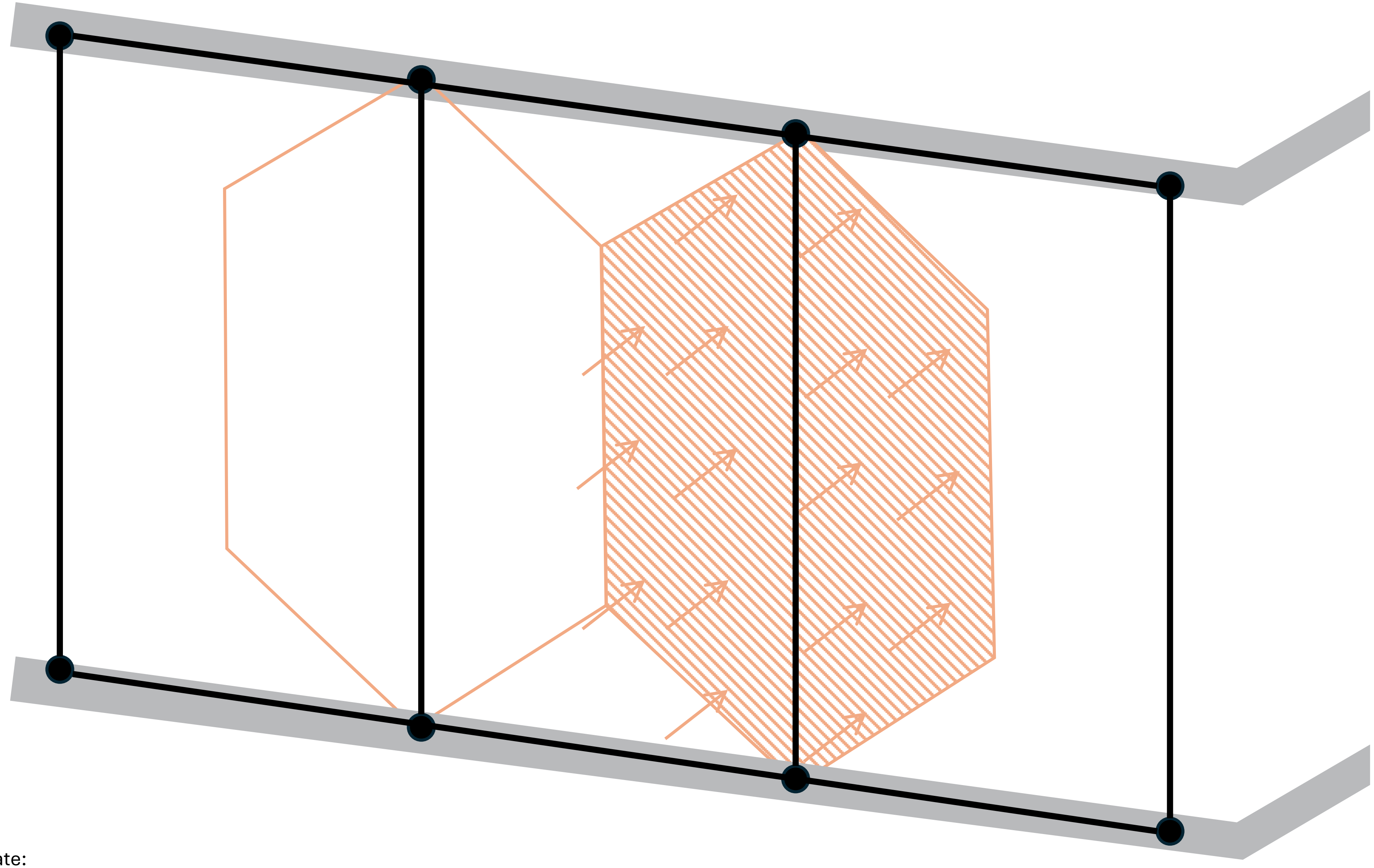

CPD Presentation Date:
September 2025 E&OA

Curtainwall Bracket Design

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TN29	Design of curtain wall brackets (7 pp)
TN28	Performance requirements for curtain wall brackets - replaced by TN90

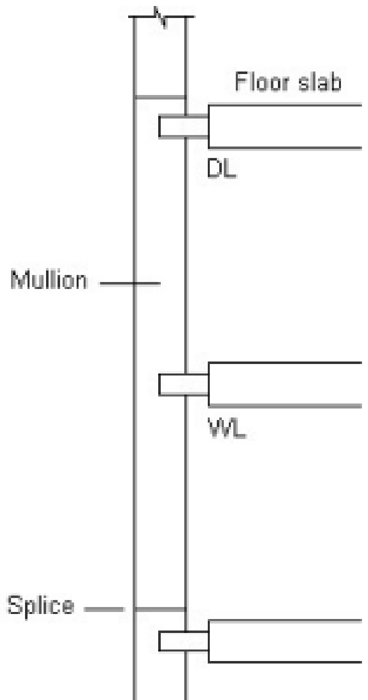
Technical Note No. 29
DESIGN OF CURTAIN WALL BRACKETS

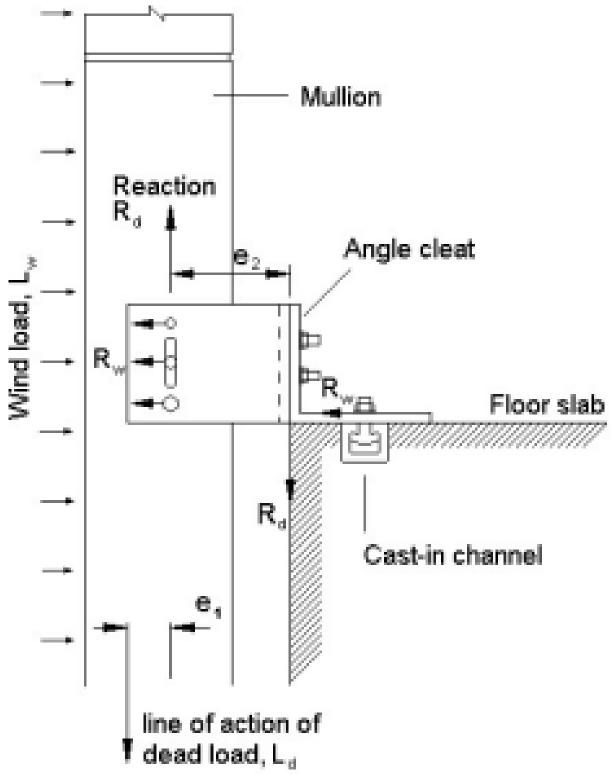
Introduction

Brackets form the link between the curtain wall and the frame. They are of critical importance to the safety of the wall and also have a profound effect on its buildability. Bracket design is normally undertaken by the system fabricator; bespoke connections can account for around 20 per cent of the cost of a curtain walling system when full account is taken of design costs, or the same proportion as the framing members themselves.

Little or no specific guidance exists on the design of curtain walling connections. Technical Note 28 *Performance requirements for curtain wall brackets* describes the overall requirements for brackets. This Technical Note gives guidance on load bearing aspects of brackets.

Structural systems

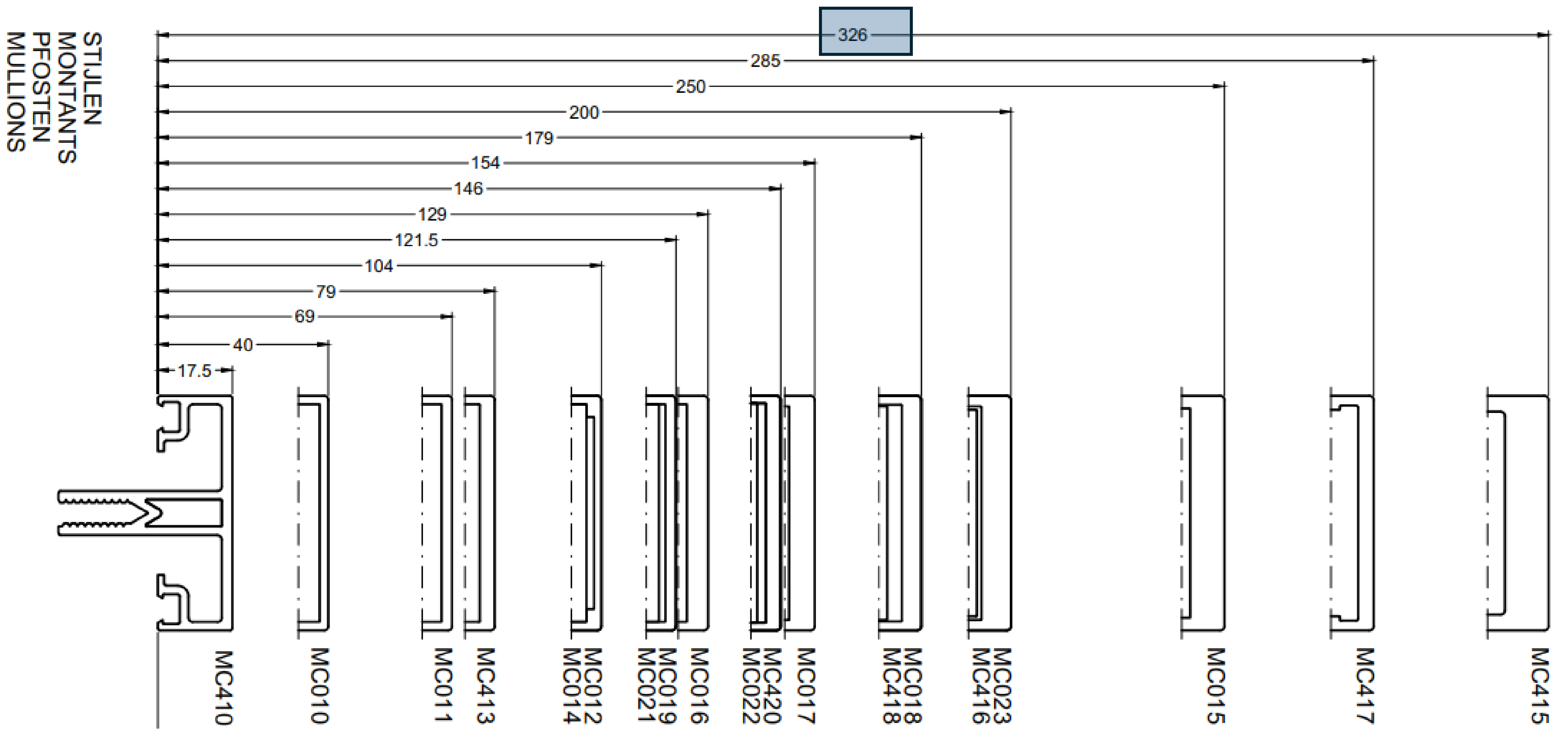




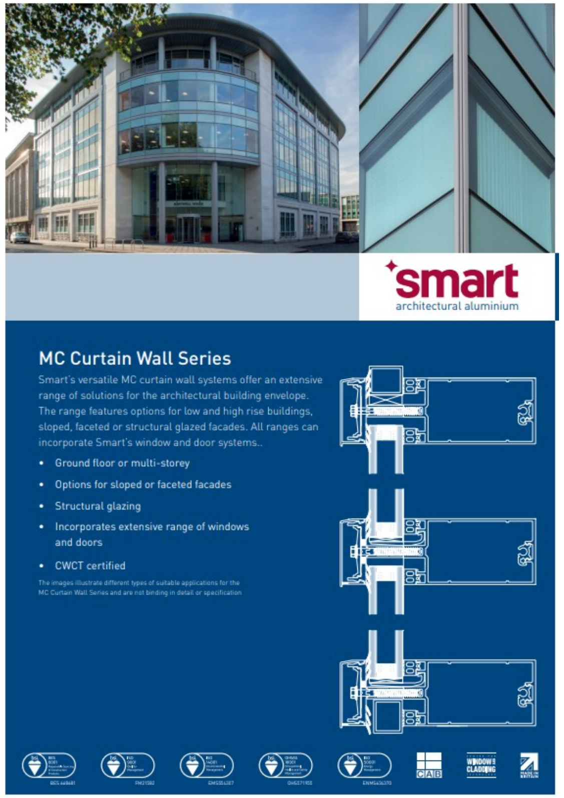
R_d = Reaction to dead load
R_w = Reaction to wind load

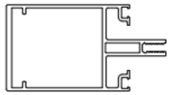
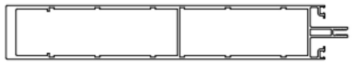
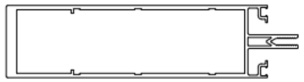
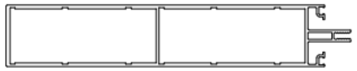
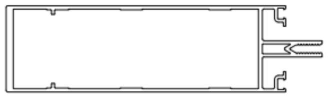
Figure 2 Typical curtain wall gravity connection

CurtainWall Ixx Values



CurtainWall Ixx Values



NUMMER NUMERO NUMMER NUMBER	AFBEELDING IMAGE BILD PICTURE	OMSCHRIJVING DESCRIPTION BESCHREIBUNG DESCRIPTION	BLAD PAGE SEITE PAGE	OMTREK PERIM. PERIM. PERIM. (MM)	MECH. MEC. MECH. MEC. (MM)	IX (CM4) ----------- WX (CM3)	IY (CM4) ----------- WY (CM3)	LENGTE LONG. LANGE LENGTH (M)
MC413		STIJL MONTANT PFOSTEN MULLION H = 79mm	23	473.8	212.7	92.08 ----------- 16.47	32.23 ----------- 11.72	7.0
MC415		STIJL MONTANT PFOSTEN MULLION H = 326mm	31	972.2	706.7	4092.13 ----------- 210.45	167.57 ----------- 60.93	7.0
MC416		STIJL MONTANT PFOSTEN MULLION H = 200mm	29	731.5	454.7	1121.98 ----------- 89.36	97.44 ----------- 35.43	7.0
MC417		STIJL MONTANT PFOSTEN MULLION H = 285mm	31	473.8	212.7	2200 ----------- 139.93	130.55 ----------- 47.47	7.0
MC418		STIJL MONTANT PFOSTEN MULLION H = 179mm	27	689.5	412.7	668.67 ----------- 63.97	65.48 ----------- 23.81	7.0

Curtainwalling - Caution

Curtain walling calculation may look simple — but it’s **complex and high-risk**, especially for those unfamiliar with its technical demands. Knowing the section size is only a small part of the challenge....

Brackets and fixings:	These must be carefully selected and positioned to handle loads and movement.
Movement and interfaces:	Thermal expansion, building sway, and differential movement all need to be accounted for.
Weathering:	Proper detailing is essential to prevent water ingress and ensure long-term durability.
Structural calculations:	Load paths, wind resistance, and deflection must be accurately assessed.
Design liability:	Errors can lead to costly failures and legal consequences.
Detailed drawings:	Precision and coordination with other trades is key — vague or incomplete drawings can cause major issues on site especially when interfacing with cladding and built up walls.

If in doubt, ask

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Questions and answers

Weather forecasts are always wrong...

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Q: How can we predict the wind load for the life of a building when we can’t even forecast what’s happening next weekend?

Weather in the UK is notoriously **unpredictable in the short term**. However, BS EN 1991-1-4 (Eurocode 1: Actions on structures – Wind actions) is based on decades of meteorological data and scientific research from across Europe. This allows engineers to make statistically reliable predictions about extreme wind events over the lifespan of a building.

While wind conditions can vary significantly day-to-day or week-to-week, the maximum wind pressures used in design are based on long-term averages and probabilistic models. These models help determine the characteristic wind load — the load that has a defined probability of being exceeded during the building’s design life (e.g. 50 years).

So, although we can't say when a peak wind event will occur, we can confidently design for the worst-case scenario based on historical data and proven statistical methods.

I only do windows and doors

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Q: Isn’t wind load just a concern for curtain walling?

Not at all — wind load should be considered for all types of glazing, including windows and doors. While curtain walling often gets the attention due to its scale and exposure, the same principles apply to all systems.

Several factors make **wind load critical across all glazing types**:
Modern design trends favour minimal framing, which can reduce structural capacity. With taller and wider openings increase surface area and spans. The variation of site exposure across the UK some project experience higher wind speeds. Even standard windows and doors must be assessed for wind load to ensure performance, safety, and compliance. Underspecifying wind resistance can lead to deflection, water ingress, and long-term damage — regardless of the system type.

Wind load isn’t just a curtain walling issue — it’s required for all types glazing. Selecting the right mullion, interlock, meeting style or coupler ensures the product is fit for purpose.

Curtain-walling looks easy

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Q: Why is curtain walling not recommended for those without experience?

Curtain walling calculation may look simple — but it’s **complex and high-risk**, especially for those unfamiliar with its technical demands. Knowing the section size is only a small part of the challenge.

Brackets and fixings: These must be carefully selected and positioned to handle loads and movement.
Movement and interfaces: Thermal expansion, building sway, and differential movement all need to be accounted for.
Weathering: Proper detailing is essential to prevent water ingress and ensure long-term durability.
Structural calculations: Load paths, wind resistance, and deflection must be accurately assessed.
Design liability: Errors can lead to costly failures and legal consequences.
Detailed drawings and CAD services: Precision and coordination with other trades is key — vague or incomplete drawings can cause major issues on site especially when interfacing with cladding and built up walls.

Curtain walling is often used on high-risk buildings, where performance and compliance are critical. That’s why it’s essential to seek specialist advice and training before taking on such work.

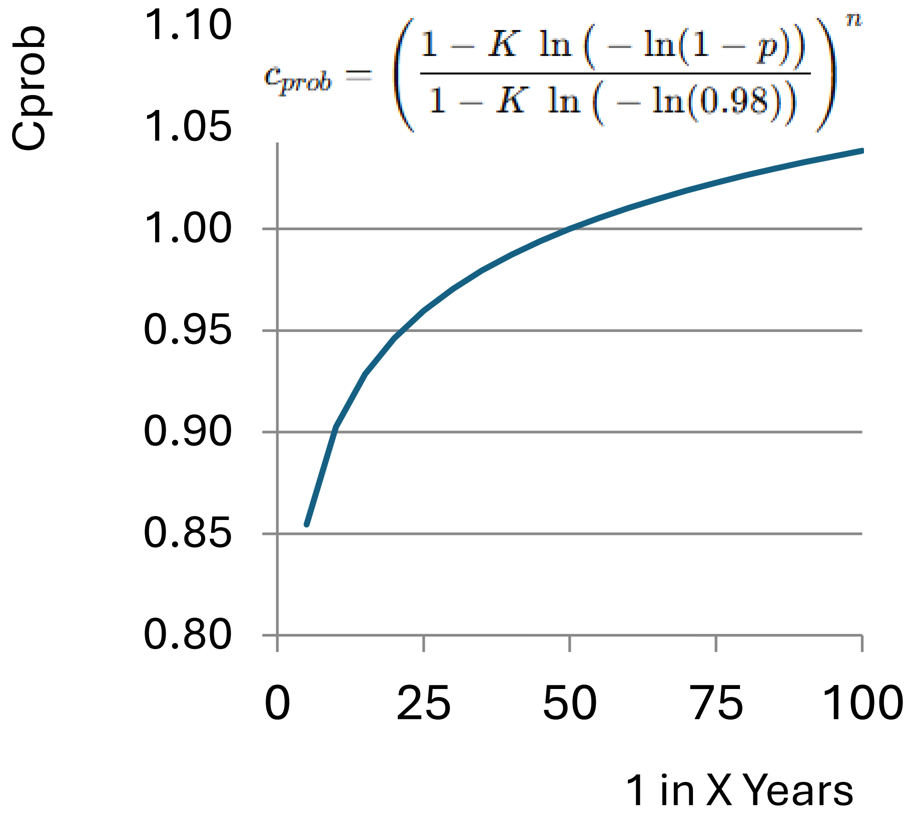
In short: curtain walling is not just about profiles — it’s about precision, responsibility, and risk management.

What only once in fifty year....

Q: If the chance of a peak wind is only once in 50 years, why should I care? I'll take the risk.

The 1-in-50-year wind event is a statistical probability, not a schedule — it could happen next week or in 49 years. That's why it's used as a design standard in construction, to ensure buildings are safe throughout their expected life.

The standard is adjusted using Cprob, which modifies wind speed based on the building's design life. For example, a bridge designed for 100 years would use a wind speed only 4% higher than one designed for 50 years.



Also, storms reaching 85% of the design wind load are expected every 5 years, and the full design wind load could occur tomorrow. So even if the risk seems distant, the consequences of underestimating it can be immediate and severe.

Slightly underspecified, so what

Q: What happens if the wind load is underspecified?

If the wind load is underestimated or incorrectly specified, the product may be **unfit for its intended application** — especially for facades, which are exposed to significant wind pressures due to their large surface area and the desire for slimist framing sections.

The consequences can be serious:
Structural issues such as excessive deflection, movement, failure of fixings or joints.
Water ingress due to joint fatigue or sealant breakdown. Long-term degradation of materials and connections. Legal and compliance risks, as the installation may not meet building regulations or warranty conditions.
Even if a catastrophic failure is avoided, the performance and durability of the façade can be compromised. That's why accurate wind load calculation is essential — and products are rated to withstand the specified loads.

Underspecifying wind load doesn't just risk performance — it risks safety, liability, and long-term integrity.

Big box, little box...

Q: Why does a slight increase in height increase the Ixx so much?

Bigger spans need bigger sections because of how deflection increases with length. When a beam or frame spans a longer distance, it becomes more flexible and can bend more under the same load.

When you double the length, the deflection increases by a factor of 16 — not just 2.

Think of it like a ruler — a short one barely bends, but a long one flexes easily.

The wind load is not provided

Q: What should a manufacturer do if the wind load for a site is unknown?

When the site-specific wind load hasn't been provided, it's important to understand the roles and responsibilities: The surveyor or specifier is responsible for determining the design wind load for the building and location. The manufacturer, however, is responsible for confirming the wind resistance performance of the product being supplied. EN 14351-1 allow the manufacturer to calculate the permissible wind load of the proposed system based on the product's size and sectional properties.

In the absence of a defined wind load, the manufacturer can use a conservative minimum value and confirm this to the surveyor — ensuring the product is suitable or prompting further clarification. As a baseline, industry standards like CWCT and BS 6375-1 recommend a minimum wind resistance of 800 Pa, with 1000 Pa being typical for many inland/city applications. Exposed location are normally up to 2400Pa, but some site can be even higher.

Barrier Load and wind load…

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Q: If the wind load is 750 Pa on a domestic full-height window that also requires barrier loading, should the wind load be combined with the imposed (barrier) load?

No, the wind load and the imposed (barrier) load **should not be combined**. According to BS 6180:2011, these loads are considered separate load cases and should be assessed independently.

This approach is based on the principle that maximum wind pressure and maximum occupancy (barrier) loading are unlikely to occur simultaneously. Therefore, combining them would result in an overly conservative design that may not reflect realistic conditions.

Frequently the wind load will be higher than the Barrier Load but this will depend on the location and building use. Additionally, Clause 6.3.1 of BS 6180 confirms that:

- Horizontal line loads,
- Uniformly distributed loads on infill,
- Point loads on infill

are not additive and should be treated as individual load cases.

Starbuck wants to expand upstairs

Q: If the wind load is 750 Pa on a domestic full-height window that also requires barrier loading. Depending on uptake of the housing the developer want the option to change the use of the property to commercial as this unit is above a restaurant.

In this case, the barrier loading must be upgraded to reflect the potential commercial use.

According to BS 6180:2011, the imposed load for a barrier in a bar or **restaurant setting is 1.0 kN/m2** — higher than the 0.5 kN/m required for domestic single occupancy. The wind load is 750 Pa (equivalent to 0.75 kN/m^2), the barrier load for commercial governs because it exceeds the wind load.

BS 6180 states that wind and imposed loads should be treated as separate load cases, as they are unlikely to occur simultaneously.

Spinning turbines on hills....

Q: Why is it windier on the top of a hill?

It’s windier on the top of a hill because of how the landscape — or orography (hilly - ness)— affects the flow of air. When wind approaches a steep hill, it’s forced to rise and accelerate over the top. This creates higher wind speeds compared to flat ground.

The steeper and higher the hill, the faster the wind blows at the top — so we adjust our calculations by upto 1.85 to make sure buildings can handle it safely.

Material effects

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Q: Why can metal windows be so much slimmer than plastic or timber windows?

Metal windows — especially aluminium and steel — can be made slimmer because the material is much stronger and stiffer than plastic or timber. Metal have a high Young's Modulus, meaning it can support loads with less material.

This strength is measured by something called Young's Modulus (Bendiness), which tells us how much a material resists bending or stretching. When replacing windows and the framing materials changes this may needs careful considerations because of the different strengths.

Fins on my Interlocks

Q: Why do slim interlocks on large doors or exposed door have projecting fins?

Slim interlocks on large doors often have **projecting fins** to add strength and stiffness — without making the profile bulky. These fins work like the **box sections in curtain walling**, where we use the **second moment of area (Ixx)** to place material where it resists bending most effectively.

The **Ixx value** tells us how well a shape resists bending in a particular direction. By adding fins, we increase the Ixx without increasing the visible width of the interlock. This means the door can handle **wind loads and deflection** better, while still looking sleek and minimal.

It's not lazy design it all about putting the strength where it matters — in the right direction and location — to meet the structural demands.

The fins aren't just decorative — they're a smart way to make slim profiles strong enough for big openings or exposed locations.

Glass is strong

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Q: Can we not use the strength of the glass to support the loads?

In most cases, **no** — we can't rely on the glass alone to carry structural loads. Glass is strong in compression but vulnerable to perpendicular loads. That's why it usually needs to be **supported on all four sides** to distribute these loads safely to the strcuture.

We use the glass for strength by bonding for in plane compression but this does not support the larger wind load forces acting on the face of the glass. While it's technically possible to design **two-edge supported glass** (e.g. cantilevered or frameless systems), doing so would require the glass to be **much thicker and stronger**, which makes it **prohibitively expensive** and heavy.

So, although glass has strength, we typically rely on the frame — not the glass — to carry wind and barrier loads.

Lets talk about UK Weather...

Q: The weather in the UK is one of the most varied across Europe?

As Michael Fish puts it the UK’s wind is famously unpredictable— and yes, we talk about it a lot! That’s because the UK sits between the Atlantic Ocean and continental Europe, right where weather fronts constantly clash. Add in our hilly terrain and long coastline, and you get big differences in wind speed from place to place. A bungalow in Oxford can be a fraction of the wind load required for a block of apartments in Torquay.

Base wind speeds range from 20 to 30 m/s, which is a greater range than many European countries. It’s this mix of geography and fast-changing weather systems that makes UK wind so varied — and such a popular topic of conversation!

Regulations v Approved Documents

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Q: What's the difference between Building Regulations and Approved Documents?

Building Regulations are the statutory legal requirements — they're the actual laws that must be followed when carrying out building work in England and Wales. These are set out under the Building Act 1984 and the Building Regulations 2010.

Approved Documents, on the other hand, are guidance published by the Secretary of State for Housing. They explain how you can meet the regulations in practice. The green text within the Approved Documents highlights the statutory parts, but the rest is not mandatory — it's just one way of complying.

Building Regulations are written in law
Approved Documents is the UK governments approved guidance on how to follow the law

You don't have to follow the Approved Documents exactly — but if you do, your work will normally be accepted as compliant by Building Control.

The changing climate

Q: BS EN 1991-1-4 is based on current scientific research — but what about the effects of climate change?

BS EN 1991-1-4 (Eurocode 1: Wind Actions) is built on decades of meteorological data and statistical modelling from across Europe. It provides a reliable basis for designing buildings to withstand wind loads over their expected lifespan.

However, it's important to recognise that climate change is altering wind patterns, storm frequency, and intensity. While the standard uses a 1-in-50-year event as a design benchmark, this is based on historical data — and may not fully reflect future extremes.

BS EN 1991-1-4 is currently robust, but future updates to the standard or changes in common practice of once in fifty years may need to be adjusted to reflect climate changes.

Two sections are stronger than one

Q: How do I calculate the combined Ixx of multiple sections?

When combining multiple sections, the total Ixx (second moment of area about the x-axis) will always be **equal to or greater than** the sum of the individual Ixx values.

Side-by-side alignment (e.g., in a flush coupler between two windows): The combined Ixx will be **close to the sum** of the individual sections.

Offset alignment (e.g., a reinforced bolster or projecting coupler): Due to the **increase in overall depth**, the combined Ixx will be **greater than the sum** of the individual values.

Individual Ixx values are published in the profiles/statics section of the technical manuals.
For common combined values, refer to the technical manual or contact **Smart's Technical Department**.

If in doubt, ask

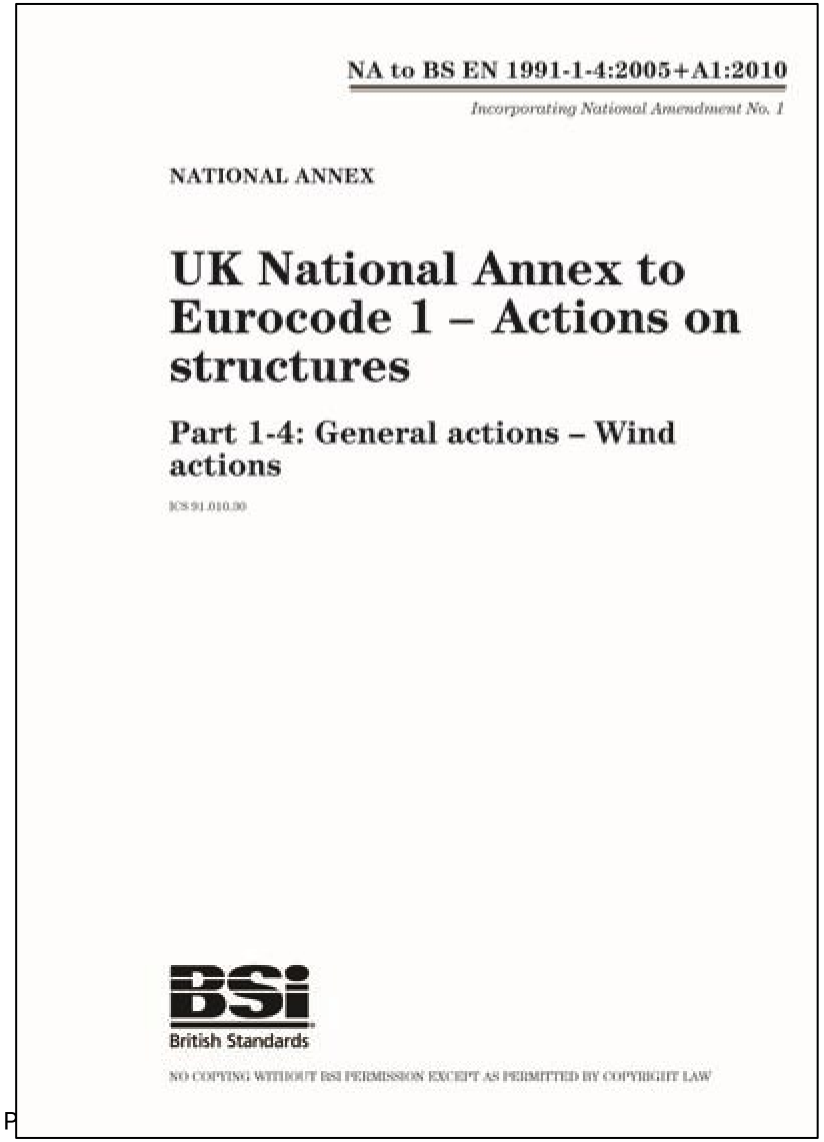
Q: What do I do if I don't know or are unsure?

Ask

References

Approved Document A	*Structure*
BS EN 1991-1-4	*General Actions – Wind Actions*
SCI Design Guide	*Wind Actions to BS EN 1991-1-4*
CWCT SBSE	*Standard for Systemised Building Envelopes*
CWCT TN02	*Introduction to wind loading on cladding*
CWCT TN28	*Design of Curtainwall Brackets*
CWCT YN29	*Perfromance requirements for curtainwall backets*
BS EN 1991-1-4	*General actions – Barrier Loads*
PD6688-1-1	*Recommendations for the design of structures to BS EN 1991-1-1*

BS EN 1991-1-4


NA to BS EN 1991-1-4:2005+A1:2010

Incorporating National Amendment No. 1

NATIONAL ANNEX

UK National Annex to Eurocode 1 – Actions on structures

Part 1-4: General actions – Wind actions

ICS 91.010.30

BSi British Standards

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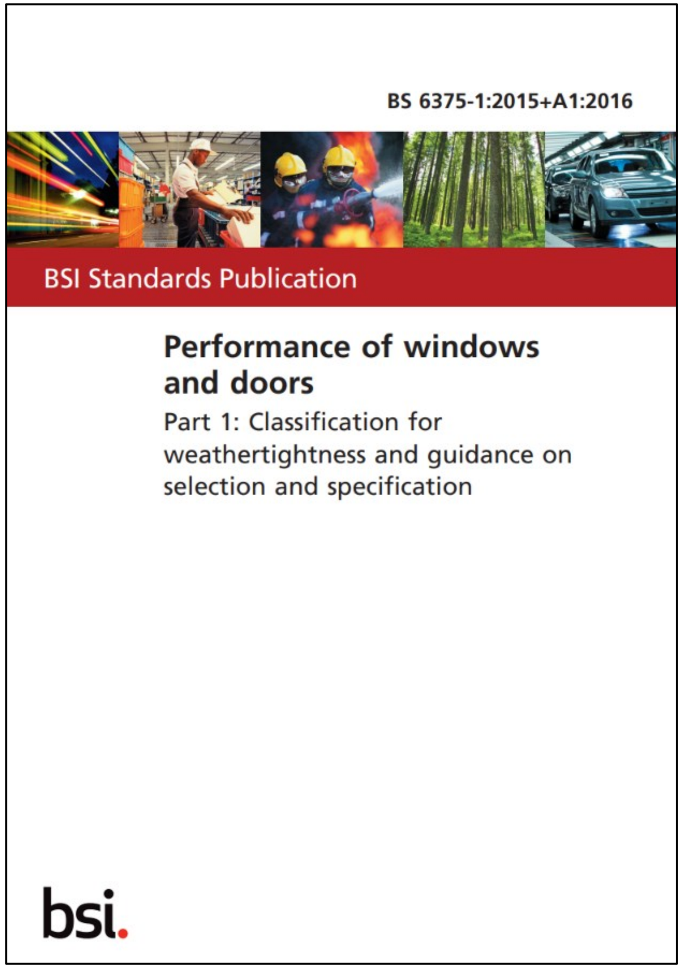
BS EN 1991-1-4 is the **European standard** for calculating wind actions on structures. Approved Document A now references **Eurocodes** in place of British Standard **BS6399 and CP3**.

The **Building Safety Regulator BSR** is conducting a review of Approved Document A with the anticipated updates to the Eurocodes.

BS6375-1 Annex A


BS 6375-1:2015+A1:2016

BSI Standards Publication

Performance of windows and doors

Part 1: Classification for weathertightness and guidance on selection and specification

bsi.

bsi.

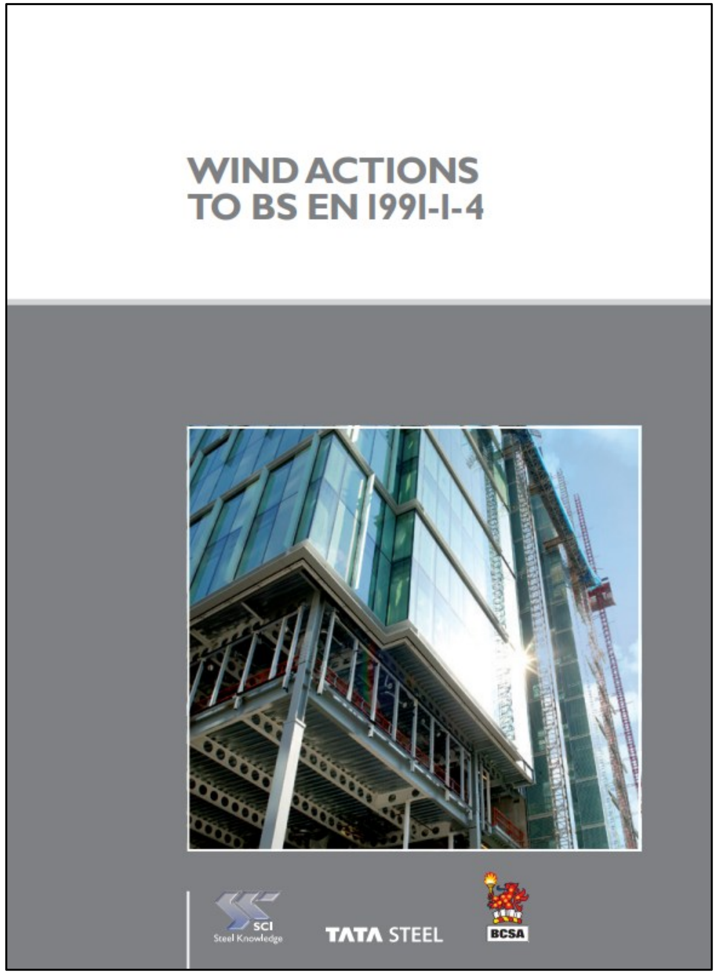
Written by BSI Working Group. Intended for surveyors to establish specifications based on building exposure. Where Annex A outlines the **abbreviated method to EN 1991-1-4** for calculating wind load on low-rise buildings in the UK.

It provides a conservative procedure using site-specific factors such as basic wind speed, terrain category, building height, altitude, **orography**, dormer presence, and funnelling effects to determine design wind pressure.

It also includes the required tables and maps for selecting appropriate exposure categories based on calculated wind loads, compliance with performance requirements for **air permeability, watertightness, and structural resistance**.

https://www.smartsystems.co.uk/survey BS6375-1 Annex A

SCI Wind Action Design Guide



The SCI Design Guide offers clear, practical guidance for calculating wind actions on UK buildings using BS EN 1991-1-4, its National Annex, and PD 6688-1-4.

It outlines a 25-step method for determining peak velocity pressure and lateral wind forces, with detailed coverage of terrain, building geometry, and dynamic effects.

It's especially valuable for **interpreting orography factors**, making complex terrain adjustments more understandable for designers.

https://steelconstruction.info/images/e/e7/SCI_P394.pdf

CWCT SBSE and TN02

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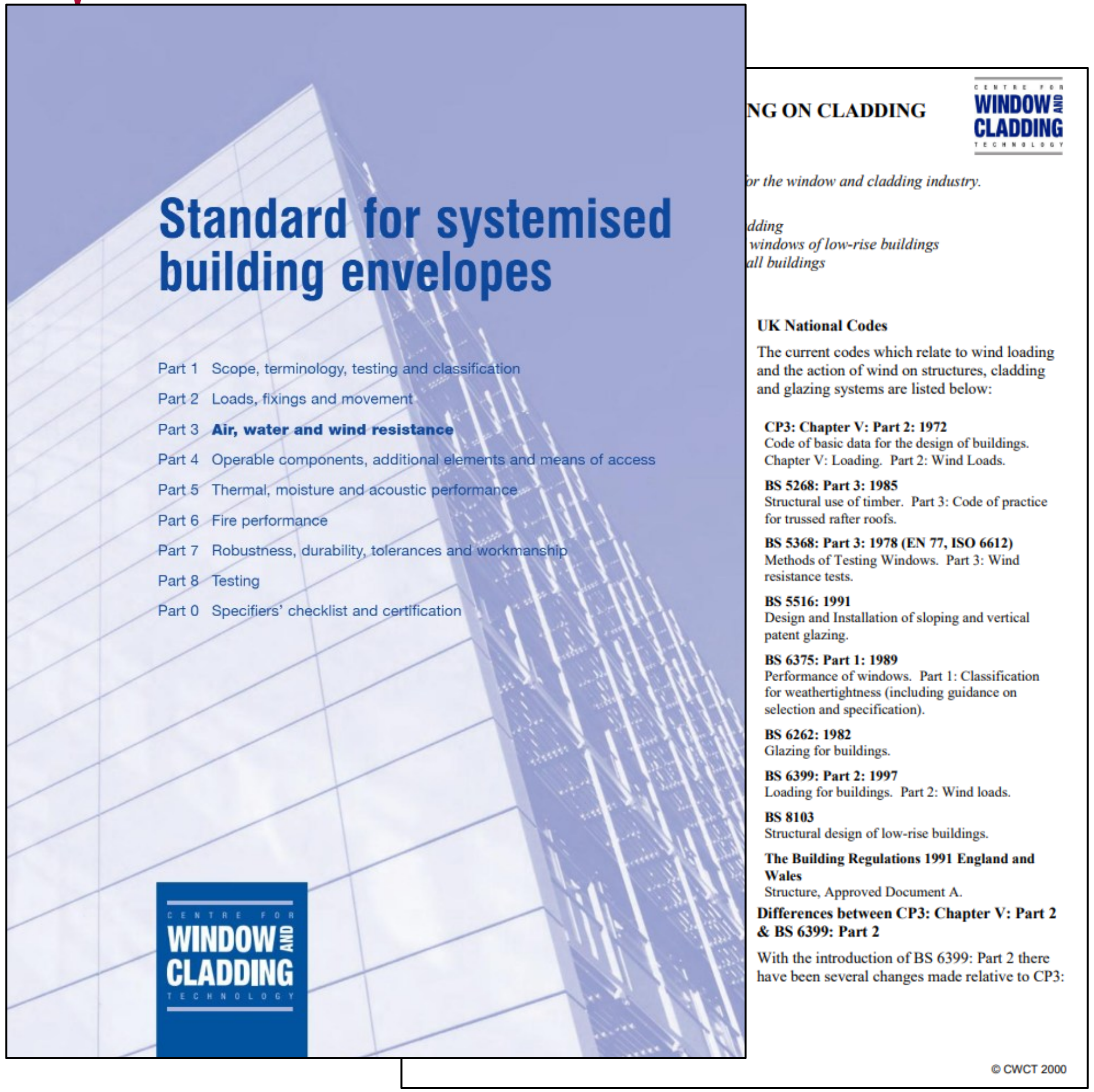


Standard for systemised building envelopes

Part 1 Scope, terminology, testing and classification
Part 2 Loads, fixings and movement
Part 3 **Air, water and wind resistance**
Part 4 Operable components, additional elements and means of access
Part 5 Thermal, moisture and acoustic performance
Part 6 Fire performance
Part 7 Robustness, durability, tolerances and workmanship
Part 8 Testing
Part 0 Specifiers' checklist and certification

CENTRE FOR WINDOW AND CLADDING TECHNOLOGY

NG ON CLADDING

CENTRE FOR WINDOW AND CLADDING TECHNOLOGY

or the window and cladding industry.

dding
windows of low-rise buildings
all buildings

UK National Codes

The current codes which relate to wind loading and the action of wind on structures, cladding and glazing systems are listed below:

CP3: Chapter V: Part 2: 1972
Code of basic data for the design of buildings. Chapter V: Loading. Part 2: Wind Loads.

BS 5268: Part 3: 1985
Structural use of timber. Part 3: Code of practice for trussed rafter roofs.

BS 5368: Part 3: 1978 (EN 77, ISO 6612)
Methods of Testing Windows. Part 3: Wind resistance tests.

BS 5516: 1991
Design and Installation of sloping and vertical patent glazing.

BS 6375: Part 1: 1989
Performance of windows. Part 1: Classification for weathertightness (including guidance on selection and specification).

BS 6262: 1982
Glazing for buildings.

BS 6399: Part 2: 1997
Loading for buildings. Part 2: Wind loads.

BS 8103
Structural design of low-rise buildings.

The Building Regulations 1991 England and Wales
Structure, Approved Document A.

Differences between CP3: Chapter V: Part 2 & BS 6399: Part 2

With the introduction of BS 6399: Part 2 there have been several changes made relative to CP3:

© CWCT 2000

The TN 02 Technical Note from CWCT introduces wind loading principles for cladding systems, comparing legacy UK codes (CP3: Chapter V: Part 2) with BS 6399-2.

Whilst it has not been recently updated to EuroCodes, it remains a valuable source—particularly for its clear explanation of how **loads are transferred through cladding systems via mullions, transoms, and fixings**.

It outlines design approaches for both standard and custom framing, discusses **load distribution assumptions**, and **highlights deflection limits**, offering foundational guidance for facade engineers and designers.

https://www.cwct.co.uk/products/technical-note-02

Structural Case Studies

Document A Structure

Twin Towers New York

September 11 2001

In 2001, the Twin Towers were struck by hijacked airplanes.

The impacts and **resulting fires** weakened the **steel structure** resulting in **structural collapse**.

Leading to the catastrophic collapse of both towers. **2,996 lives were lost**.

Ronan Point - London

Ronan Point

May 1968

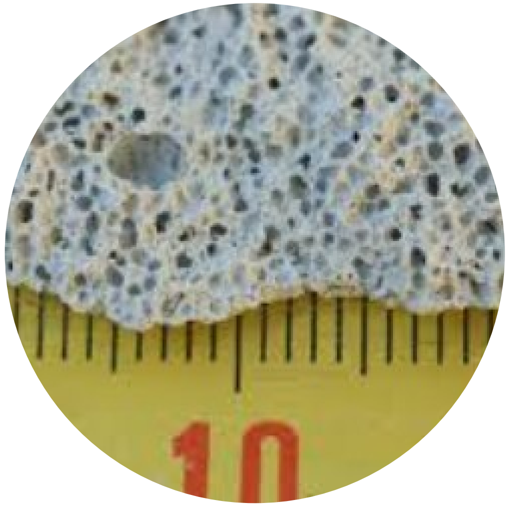
A gas explosion that blew out **load-bearing walls**, causing a progressive **disproportionate collapse** of one corner of the Ronan Point Towers.

Four people died and 17 were injured.

The incident had a profound impact on **UK building regulations**, leading to stricter standards for **Approved Document A structural integrity** and gas safety.

Singlewell School - Kent

Singlewell School



July 2018

In **July 2018**, roof at a School collapsed due failure of **RAAC** Reinforced Autoclaved **Aerated Concrete.**

Collapse can occur especially when water weakens/corrodes steel reinforcement within the concrete.

Fortunately, **no one was injured**.

RAAC was withdrawn from **British Standards in 2001** and is not included within current UK and European specification standards for concrete.

Chevron Building - Texas

Hurricane-proof skyscrapers vulnerable to less powerful windstorms, study finds

Tall buildings fare poorly in derechos, say experts, raising questions over their resilience as climate crisis worsens

Blown out windows on a high-rise downtown building in the aftermath of a severe thunderstorm in Houston, Texas, on 17 May 2024. Photograph: David J. Phillip

Skyscrapers built to withstand major hurricanes fare much more poorly in

Chevron Building

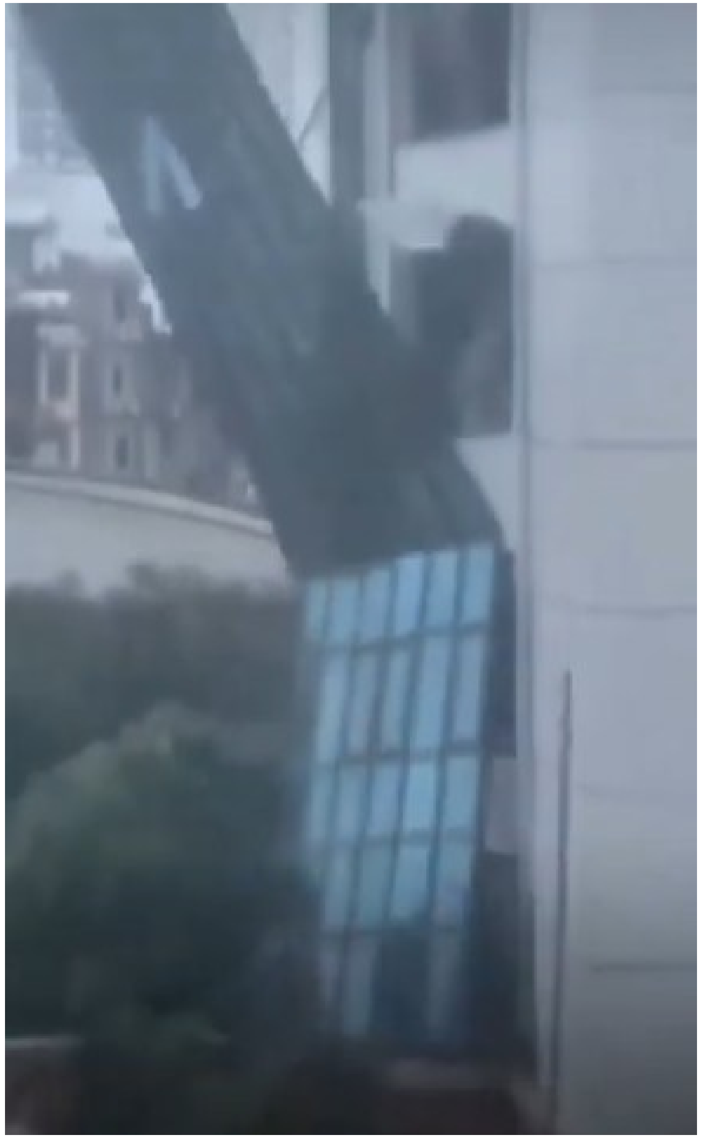
May 2024

In May 2024 a violent **Derecho** battered downtown Houston.

Strong wind ripping **curtain-wall façades** from eighteen skyscrapers, shattering over **3,000 windows.**

Stripping **cladding panels** from the 40-storey Chevron Building.

Typhoon Yagi - Vietnam



Vietnam

September 2024

In September 2024, **Typhoon Yagi** caused a curtain-wall failure on a high-rise in Vietnam.

Powerful winds **ripping curtainwalling** façade from the high rise building and sending debris onto the streets below.

Eco Building - Dublin

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Spanish firm sued for €7.4m over glazing in Exo Building

An Post's new HQ is at the EXO building on Dublin's North Wall Quay

Exo Building

July 2025

Main contractor initiated High Court proceedings over alleged defects in the façade glazing of the Exo Building in Point Village, Dublin.

The firm claimed that poor workmanship and defective glazing supplied resulted in **extensive water leaks.**

The dispute centred on costs of around **€7.4 million for remedial works**, following the installers withdrawal from the site in early 2022.

Old Broad Street - London

Construction Enquirer

£14.8m for city tower falling glass

125 Old Broad Street after most recent recladding

Old Broad Street

July 2017

Glazing failures led to a High Court ruling, after **multiple glass panes shattered** and fell from the tower's façade.

The incident, which required the building to be reclad, was traced to improperly heat-soaked glass containing **nickel sulphide inclusions.**

Though no injuries occurred, the case underscored the importance of **rigorous quality control** in high-rise glazing systems.