ISBN (Print) 978-1-77664-397-4
ISBN (PDF) 978-1-77664-396-7

NZS 4223.4:2008

GLAZING IN BUILDINGS – PART 4: WIND, DEAD, SNOW, AND LIVE ACTIONS

AMENDMENT NO. 1

29 February 2016

REVISED TEXT

EXPLANATORY NOTE

The amendment to NZS 4223.4 is part of an update to the NZS 4223 series, which also includes the addition of a new Part 2 on insulating glass units (IGUs).

This amendment incorporates changes that have come through from Amendments No. 1 and 2 of AS 1288 *Glass in buildings – Selection and installation* and corrects errors that had been identified within the current standard.

New clauses 1.1 and C8 have been added. The Foreword, Scope, clause 3.2, Tables 1, 4, 5, 6, 10, 12, 13, 14, and 15, Appendix B, and Appendix D have been revised.

APPROVAL

Amendment No. 1 was approved on 19 February 2016 by the Standards Council to be an amendment to NZS 4223.4.

CONTENTS (page 5)

Delete Appendix D heading and **substitute**:

Delete Table 4 heading and **substitute**:

Delete Table 6 heading and **substitute**:

Delete Table 13 heading and **substitute**:

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Delete Table 14 heading and **substitute**:

Delete Table 15 heading and substitute:

Delete Figure 36 heading and **substitute**:

Delete Figure D1 heading and **substitute**:

(Amendment No.1, February 2016)

REFERENCED DOCUMENTS (page 7)

Under NEW ZEALAND STANDARDS

Add:	NZS 3504:1979	Specification for aluminium windows
	NZS 3619:1979	Specification for timber windows
Add under:	NZS 4223	Glazing in buildings:
	Part 2:2016	Insulating glass units
Delete:	Part 3:1999	Human impact safety requirements
And **substitute:**	Part 3:2016	Human impact safety requirements

Add new reference after NZS 4229:1999:

NZS 4232	Performance criteria for fire resisting enclosures
Part 2:1988	Fire resisting glazing systems

Under JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

Delete:	AS/NZS 4666:2000	Insulating glass units
And **substitute**:	AS/NZS 4666:2012	Insulating glass units

(Amendment No.1, February 2016)

FOREWORD (page 8)

Delete Foreword and **substitute**:

FOREWORD

NZS 4223 applies to glazing in buildings.

The Standard comprises four parts:

- Part 1:2008 – Glass selection and glazing;
- Part 2:2016 – Insulating glass units;
- Part 3:2016 – Human impact safety requirements;
- Part 4:2008 – Wind, dead, snow, and live actions.

This Standard applies to glazing in all buildings and applications other than those excluded in the scope.

This Standard, including Amendment No. 1, provides a methodology for determining the minimum glass thickness for vertical and sloped overhead glazing to resist limit state actions. This methodology is deemed to provide solutions that meet the glass thickness requirements set out in NZS 4223.1.

The sections have been amended and revised to update the Standard and allow for New Zealand-specific considerations.

(Amendment No.1, February 2016)

1.1 Scope (page 9)

Delete clause and **substitute**:

NZS 4223.4 provides a method for the determination of minimum glass thickness for vertical and sloped overhead glazing in New Zealand to resist limit state actions.

The following are excluded from the scope of NZS 4223 Parts 1, 2, 3, and 4:

(a) Glazing in lift cars and liftwells (refer to NZS 4223.1, Appendix A for guidance);
(b) Furniture glass, cabinet glass, vanities, glass basins, refrigeration units, internal glass fitments and glass wall linings, framed internal wall mirrors, and mirrors not specifically covered by these parts;
(c) Buildings and structures with no public access intended for non-habitable building structures for horticultural or agricultural use;
(d) Restoration or repairs to existing decorated glass;
(e) Glazing applications that might fail due to stresses other than tensile stresses, such as glass floors;
(f) Plastic glazing materials;
(g) The construction and installation of windows (refer to NZS 3504, NZS 3619, and NZS 4232.2);
(h) Glass blocks, pavers, slumped, formed, or cast glass;
(i) Point-fixed or point-supported systems, used for glazing, cladding, signage, and the like, not specifically covered by these parts (refer to Part 1 for design criteria and guidance for specific design).

(Amendment No.1, February 2016)

1.5 Definitions (page 9)

Delete paragraph 1 and **substitute**:

For the purposes of this Standard the following definitions apply. Refer to AS/NZS 4668 for additional definitions.

Delete the following definitions and **substitute:**

GLAZING	Glazing consists of: (a) The installation of glass in prepared openings in windows, door panels, partitions, and the like; and (b) Glass panes for installation into a building.
HEAT-STRENGTHENED GLASS	Glass that has been strengthened by a special heat treatment, so that the residual stresses lie between those for ordinary annealed glass and toughened glass. Refer to NZS 4223.1 for allowable surface compressive stress.
LAMINATED GLASS	A composite material consisting of two or more sheets of glass permanently bonded together by a plastic interlayer material to form a stock sheet or pane.
SLENDERNESS FACTOR	Span-to-thickness ratio (span divided by the minimum thickness).
TOUGHENED GLASS	Glass that is subjected to special heat or chemical treatment so that the residual surface compression stress and the edge compression stress is greater than heat-strengthened glass (refer to NZS 4223.1 for allowable surface compressive stress). NOTE – 1. Toughened glass is not necessarily toughened safety glass. 2. In general, the heat treatment or chemical treatment process greatly reduces the tendency of glass to fracture under the action of external forces and changes of temperature. 3. After being toughened, the glass cannot be cut, drilled, ground, or otherwise reworked. Etched, sandblasted, engraved, or otherwise worked surfaces should have such surface working carried out prior to toughening. 4. Surface treatments should be kept as shallow as possible to ensure that the glass can be adequately toughened. These can reduce the design capacity (refer to NZS 4223.1). 5. Toughened glass is also known as ‘tempered glass’.
TOUGHENED LAMINATED SAFETY GLASS	Laminated safety glass utilising two or more panes of toughened glass in the make-up that satisfies the relevant requirements of a safety glazing material standard (refer to AS/NZS 2208).

(Amendment No.1, February 2016)

2.2 Design wind pressure (page 12)

Add note after (c):

NOTE – These Standards are for non-specific design of importance level 2 buildings up to 10 m high.

(Amendment No.1, February 2016)

Table 1 – Wind pressures for NZS 3604 and NZS 4229 structures (page 12)

Add new row to table:

Extra high	2.13	2.34

Delete note at the end of the table.

(Amendment No.1, February 2016)

2.4.6 Serviceability checks (page 16)

Add after second paragraph:

NOTE – These Standards are for non-specific design of importance level 2 buildings up to 10 m high.

Delete Table 4 and **substitute**:

Table 4 – Serviceability limit state wind pressures for NZS 3604 and NZS 4229 structures

Wind zone	**Serviceability limit state design wind pressure – general** (kPa)	**Serviceability limit state design wind pressure – within 2.4 m of corners** (kPa)
Low	0.51	0.57
Medium	0.68	0.76
High	0.97	1.08
Very high	1.25	1.38
Extra high	1.51	1.67

(Amendment No.1, February 2016)

Figure 8 – Maximum span for monolithic 15 mm annealed glass (page 25)

Delete the number for AR=3 and k_2 in the table and **substitute:** –0.22059

(Amendment No.1, February 2016)

Figure 10 – Maximum span for monolithic 25 mm annealed glass (page 27)

Delete the number for AR = 1 and k_2 in the table and **substitute**: 0.164398

Delete the number for 'Two-edge supported' and k_1 in the table and **substitute**: 3985.3

(Amendment No.1, February 2016)

3.2 Design criteria (page 55)

Delete clause and **substitute:**

All single-sloped overhead glazing shall be laminated safety glass, except where the highest part of the glazing is less than 5 m from the finished floor level (FFL), in which case toughened safety glass may be used.

All insulating glass units (IGUs) in sloped overhead glazing shall have safety glass in the upper and lower panes (see Appendix D).

Where the highest part of the glazing is more than 5 m above the FFL, laminated safety glass shall be used for the lower pane.

NOTE – Laminated safety glass plies can be a combination of annealed, heat-strengthened or toughened glass.

The glazing and its component members and connections shall be designed in accordance with NZS 4223.1.

(Amendment No.1, February 2016)

3.4.2 Wind loads (page 56)

Add note after last paragraph:

NOTE – The serviceability limit state design load will be used to check deflection.

(Amendment No.1, February 2016)

3.4.3 Dead loads (page 56)

Add sentence to end of the first paragraph:

For glass angles that fall between the angles in the table, the row with the next lower angle from Table 5 shall be used for the maximum dead load determination.

(Amendment No.1, February 2016)

Table 5 – Loads perpendicular to the glass due to self (dead) weight and snow (page 57)

Delete Table 5 and **substitute**:

Table 5 – Loads perpendicular to the glass due to self (dead) weight and snow

Angle of glass to horizontal (deg.)	**Single glazing** (annealed)		**Single glazing** (heat strengthened and toughened)		**IGUs** (annealed or laminated)		**IGUs** (heat strengthened and toughened)		**Snow loading**		
	Dead (Max) (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**Dead (Max)** (kPa)	**1.0 kPa NZS 3604 (Max)**	**1.5 kPa NZS 3604 (Max)**	**2.0 kPa NZS 3604 (Max)**
0	0.57	0.13	0.35	0.13	1.14	0.26	0.71	0.26	3.23	4.84	6.45
5	0.57	0.13	0.35	0.13	1.13	0.26	0.70	0.26	3.21	4.82	6.43
10	0.56	0.13	0.35	0.13	1.12	0.26	0.70	0.26	3.18	4.77	6.35
15	0.55	0.13	0.34	0.13	1.10	0.26	0.68	0.26	3.12	4.67	6.23
20	0.54	0.12	0.33	0.12	1.07	0.25	0.66	0.25	3.03	4.55	6.06
25	0.52	0.12	0.32	0.12	1.03	0.24	0.64	0.24	2.92	4.39	5.85
30	0.49	0.11	0.31	0.11	0.99	0.23	0.61	0.23	2.79	4.19	5.59
35	0.47	0.11	0.29	0.11	0.93	0.22	0.58	0.22	2.64	3.96	5.28
40	0.44	0.10	0.27	0.10	0.87	0.20	0.54	0.20	2.47	3.71	4.94
45	0.40	0.09	0.25	0.09	0.81	0.19	0.50	0.19	2.28	3.42	4.56
50	0.37	0.09	0.23	0.09	0.73	0.17	0.45	0.17	2.07	3.11	4.15
55	0.33	0.08	0.20	0.08	0.65	0.15	0.41	0.15	1.85	2.78	3.70
60	0.28	0.07	0.18	0.07	0.57	0.13	0.35	0.13	0.00	0.00	0.00
65	0.24	0.06	0.15	0.06	0.48	0.11	0.30	0.11	0.00	0.00	0.00
70	0.19	0.05	0.12	0.05	0.39	0.09	0.24	0.09	0.00	0.00	0.00
75	0.15	0.03	0.09	0.03	0.29	0.07	0.18	0.07	0.00	0.00	0.00

Delete note 8 and **substitute**:

8. Snow is not expected to accumulate on roof slopes greater than or equal to 60° to the horizontal (AS/NZS 1170.3).

(Amendment No.1, 26 February 2016)

3.4.4 Snow loads (page 58)

Delete 3.4.4 (b) and **substitute**:

(b) Figure 36 for buildings for the 1.0 kPa, 1.5 kPa and 2.0 kPa snow load in NZS 3604 and Table 6.

Add new paragraph after clause (b):

For the snow load determination it is permissible to linearly interpolate between the snow load value in Table 5 for the roof slope above and below the actual slope.

(Amendment No.1, February 2016)

Table 6 – Maximum altitudes (m) for the application of 0.5 kPa and 1.0 kPa snow loads for each snow zone (page 58)

Delete Table 6 and **substitute**:

Table 6 – Maximum altitudes (m) for the application of 1.0 kPa, 1.5 kPa and 2.0 kPa snow loads on the sloping roof for each snow region

Roof Slope (Degrees)	Region N1			Region N2			Region N3			Region N4			Region N5		
	1.0 kPa	1.5 kPa	2.0 kPa	1.0 kPa	1.5 kPa	2.0 kPa	1.0 kPa	1.5 kPa	2.0 kPa	1.0 kPa	1.5 kPa	2.0 kPa	1.0 kPa	1.5 kPa	2.0 kPa
Up to 10	720	960	1200	570	780	860	530	720	850	210	440	600	420	660	900
20	950	1140	1260	680	840	940	620	830	940	300	540	940	550	820	940
30	1040	1230	1350	820	970	1070	790	940	1070	440	940	1070	740	940	1070
40	1260	1390	1480	940	1120	1270	940	1120	1270	940	1120	1270	940	1120	1270
50	1480	1630	1740	1270	1510	1690	1270	1510	1690	1270	1510	1690	1270	1510	1690
≥ 60	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit

NOTE – Snow loads need not be considered below the following altitudes:

(a) 400 m in Region N1;

(b) 200 m in Region N2;

(c) 150 m in Region N3.

(Amendment No.1, February 2016)

Figure 36 – Snow zones (page 59)

Delete heading and **substitute**:

Figure 36 – Snow regions

(Amendment No.1, February 2016)

Table 10 – Maximum span of monolithic toughened glass (page 62)

Delete Table 10 and **substitute**:

Table 10 – Maximum span of monolithic toughened glass

Live load (kN)	**Nominal thickness** (mm)	**Maximum span** mm)			
		Four-edge support			**Two-edge support**
		AR=1	**AR=2**	**AR=3**	
0.5 (Flat or pitched)	4	1800	1300	1100	250
	5	2000	1450	1300	450
	6	2000	1700	1500	700
	8	2000	2000	1900	1400
	10	2000	2000	2000	1800
	12	2000	2000	2000	2000

(Amendment No.1, February 2016)

APPENDIX A – Table 12 – Ultimate and serviceability limit state design wind pressures for glazing in walls of buildings with limitations as detailed in Table 11 (page 64)

Delete table in note 3(ii) and **substitute**:

Terrain category	All wind regions	Description
Terrain category 1	1.12	Very exposed open terrain with few or no obstructions and enclosed, limited-sized water surfaces at serviceability and ultimate wind speeds in all wind regions, for example flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10 km in the wind direction.
Terrain category 2	1.0	Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare, for example farmland and cleared subdivisions with isolated trees and uncut grass.
Terrain category 3	0.83	Terrain with numerous closely-spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10-house size obstructions per hectare, for example suburban housing or light industrial estates.
Terrain category 4	0.75	Terrain with numerous large, high (10 m to 30 m tall) and closely-spaced obstructions, such as large city centres and well-developed industrial complexes.

(Amendment No.1, February 2016)

APPENDIX B
CALCULATION EXAMPLES
(NORMATIVE) (page 66)

Delete Appendix B and **substitute**:

APPENDIX B – CALCULATION EXAMPLES
(INFORMATIVE)

B1 Example calculations for vertical glazing thickness selection

B1.1 Four-edge support

The building is an importance level 2 structure. It is desired to find the nominal thickness of toughened glass, 2050 mm × 1500 mm, supported along all four edges, required to be used with an ultimate limit state design wind pressure of 3.2 kPa (with a corresponding serviceability design wind pressure of 2.1 kPa).

The steps are as follows:

1. First select the appropriate graphs to use. In this case Figure 11 to Figure 19 'Curves for allowable span for monolithic toughened glass';
2. Calculate the Aspect Ratio, AR = 2050/1500 = 1.37;

   NOTE – There is no curve for AR = 1.37. We must therefore interpolate between the next highest AR (AR = 1.5) and the next lowest AR (AR = 1.25).
3. Starting with Figure 11, draw a vertical line at ULS design wind pressure = 3.2 kPa (see Figure B1);
4. Draw 2 horizontal lines. One at the intersection of AR = 1.5 and ULS = 3.2 kPa, and the other at the intersection of AR = 1.25 and ULS = 3.2 kPa (see Figure B1);
5. Reading the spans, *B* from the left-hand side of the graph (or by using the formula below the graphs) gives:

   For AR = 1.25, *B* = 1428 mm, For AR = 1.5, *B* = 1316 mm;
6. Interpolating between these 2 values gives Span:

   B = 1316 + ((1.5 – 1.37) / (1.50 – 1.25)) × (1428 − 1316) = 1374 mm;

   As the required span is 1500 mm, then 4 mm toughened glass cannot be used for this size and design pressure and, therefore, it is necessary to repeat the process on the next chart for thicker glass;
7. From Figure 12, the horizontal lines drawn at the intersection of the vertical line at 3.2 kPa with the AR = 1.25 and AR = 1.5 curves (see Figure B2) gives (by using the formula below the graphs):

   For AR = 1.25, *B* = 1766 mm, For AR = 1.5, *B* = 1625 mm

   Interpolating between these two values gives:

   Span, *B* = 1625 + ((1.5 – 1.37) / (1.50 – 1.25)) × (1766 – 1625) = 1698 mm.

   Therefore, as the required span is less than this, the minimum nominal thickness of toughened glass required is 5 mm to satisfy the strength requirements;

8. Finally, by using Figure 35, check that the deflection limits are not exceeded. Draw a vertical line at the serviceability design wind pressure = 2.1 kPa. Then draw two horizontal lines. One at the intersection of AR = 1.5 and 2.1 kPa, and the other at the intersection of AR = 1.25 and 2.1 kPa. Then, reading the slenderness factors, *B*/*t* from the left hand side of the graph (or by using the formula below the graphs) gives:

   For AR = 1.25, *B*/*t* = 326.4, For AR = 1.5, *B*/*t* = 260.5

   Interpolating between these two values gives the maximum allowable slenderness factor;

   B/*t* = 260.5 + ((1.5 – 1.37) / (1.50 – 1.25)) × (326.4 − 260.5) = 294.8 mm

   For 5 mm glass (4.8 mm minimum thickness) and a span of 1500 mm, the slenderness factor (*B*/*t*) is 312.5. Therefore, 5 mm toughened glass cannot be used in this case as the deflection would be excessive. The next highest thickness (6 mm) has a minimum thickness of 5.8 mm and thus the slenderness ratio would be 1500/5.8 = 258.6 and therefore the deflection criteria would not be exceeded using 6 mm toughened glass for this panel;

9. Therefore, the nominal thickness of toughened glass required in order to meet both the deflection and strength criteria for this glass size is 6 mm.

B2 Example calculations for sloping glazing thickness selection

B2.1 Four-edge support

Consider a pane of laminated glass on a 45° slope and 5 m above the ground. The building is an importance level 2 structure. The opening area is 1 m × 1 m and the glass is supported on all four edges. The site of the building is on the flat with a Terrain Category 3 in wind region A7. The AS/NZS 1170.3 snow loading is 1.0 kPa.

1. Select the loads perpendicular to the glass due to the dead weight of the glass from Table 5.

   Dead (maximum) = 0.40 kPa

   Dead (minimum) = 0.09 kPa

2. From Table 13, the basic ultimate limit state wind pressure is 0.84 kPa and the serviceability limit state wind pressure is 0.57 kPa.

3. Using Table 15 at this pressure in Column 1, read off the Wind (↑) and Wind (↓) for the 45° roof slope (interpolation between pressures is acceptable).

   ULS Wind (↑) = – 1.18 kPa SLS Wind (↑) = – 0.80 kPa
   ULS Wind (↓) = 1.28 kPa SLS Wind (↓) = 0.87 kPa

4. From Table 5, the 1.0 kPa Snow (maximum) loading perpendicular to the glass = 2.28 kPa.

5. The ULS load combinations are:

Case 1	Dead (maximum)	+	Wind (↓)	=	0.40	+	1.28	=	1.68 kPa
Case 2	Dead (minimum)	+	Wind (↑)	=	0.09	+	– 1.18	=	– 1.09 kPa
Case 3	Dead (maximum)	+	Snow (maximum)	=	0.40	+	2.28	=	2.68 kPa (governs)

6. Using the figures (Figure 27 to Figure 34) for annealed laminated glass at a design wind pressure of 2.68 kPa and an AR = 1. Check that the maximum span of 5 mm annealed laminated glass is acceptable to resist the uniform loads (see Figure 27).

7. Check the thickness for the concentrated live load. From Table 7, a minimum glass thickness of 8 mm is required to resist the 0.5 kN concentrated load.

8. Therefore, the required glass thickness is the greater of 5 mm and 8 mm = 8 mm

9. Check the serviceability limit state.

10. The SLS load combinations are:

Case 1	Dead	+	Wind (↓)	=	0.33	+	0.87	=	1.20 kPa (governs)
Case 2	Dead	+	Wind (↑)	=	0.33	+	– 0.80	=	– 0.47 kPa
Case 3	Dead	+	Snow	=	0.33	+	0.71	=	1.04 kPa

11. Note that Dead (SLS) is Dead (maximum) divided by 1.2, and Snow is Snow (maximum) multiplied by 0.31.

12. Using Figure 35, determine the slenderness factor, *B/t*, at a pressure of 1.20 kPa and AR = 1.0. This is 575, which means for a glass thickness of 8 mm, *B* = 4600 mm which is greater than 1000 mm. Therefore, the ultimate limit state loading condition governs.

B2.2 Two-edge support

Consider a pane of laminated glass on a 45° slope and 5 m above the ground. The building is an importance level 2 structure. The opening area is 2000 mm × 1000 mm and the glass is supported on the two long edges only. The site of the building is on the flat with a Terrain Category 3 in wind region A7. The AS/NZS 1170.3 snow loading is 1.0 kPa.

1. Select the loads perpendicular to the glass due to the dead weight of the glass from Table 5.
   Dead (maximum) = 0.40 kPa
   Dead (minimum) = 0.09 kPa

2. From Table 13, the basic ultimate limit state wind pressure = 0.84 kPa, and the serviceability limit state wind pressure is 0.57 kPa.

3. Using Table 15 at this pressure in column 1, read off the Wind (↑) and Wind (↓) for the 45° roof slope (interpolation between pressures is acceptable).
   ULS Wind (↑) = –1.18 kPa SLS Wind (↑) = –0.80 kPa
   ULS Wind (↓) = 1.28 kPa SLS Wind (↓) = 0.87 kPa

4. From Table 5, the 1.0 kPa Snow (maximum) loading perpendicular to the glass = 2.28 kPa.

5. The ULS load combinations are:

Case 1	Dead (maximum)	+	Wind (↓)	=	0.40	+	1.28	=	1.68 kPa
Case 2	Dead (minimum)	+	Wind (↑)	=	0.09	+	–1.18	=	–1.09 kPa
Case 3	Dead (maximum)	+	Snow (maximum)	=	0.40	+	2.28	=	2.68 kPa (governs)

6. Use the figures for annealed laminated glass (Figure 27 to Figure 34) at a design wind pressure of 2.68 kPa and two-edge support and check the maximum span. From Figure 30, annealed laminated glass of 10 mm thickness is acceptable to resist the uniform loads at 1000 mm span.

7. Check the thickness for the concentrated live load on laminated annealed glass. From Table 7, a minimum glass thickness of 16 mm is required to resist the 0.5 kN concentrated load for two edge support, at 1000 mm span.

8. Therefore the required glass thickness is the greater of 10 mm and 16 mm = 16 mm.

9. Alternatively try another glass type and repeat the process. From Table 8, 10 mm laminated heat strengthened glass may be used.

10. Check the serviceability limit state.

11. The SLS load combinations are:

Case 1	Dead	+	Wind (↓)	=	0.33	+	0.87	=	1.20 kPa (governs)
Case 2	Dead	+	Wind (↑)	=	0.33	+	– 0.80	=	– 0.47 kPa
Case 3	Dead	+	Snow	=	0.33	+	0.71	=	1.04 kPa

12. Note that Dead (SLS) is Dead (maximum) divided by 1.2, and Snow is Snow (maximum) multiplied by 0.31.

13. Using Figure 35, determine the slenderness factor, *B*/t, at a pressure of 1.20 kPa and two edge supported. This is 180, which means for a glass thickness of 16 mm, *B* = 2880 mm which is greater than 1000 mm. Therefore, the ultimate limit state loading condition governs.

Figure B1 – Example monolithic 4 mm toughened glass

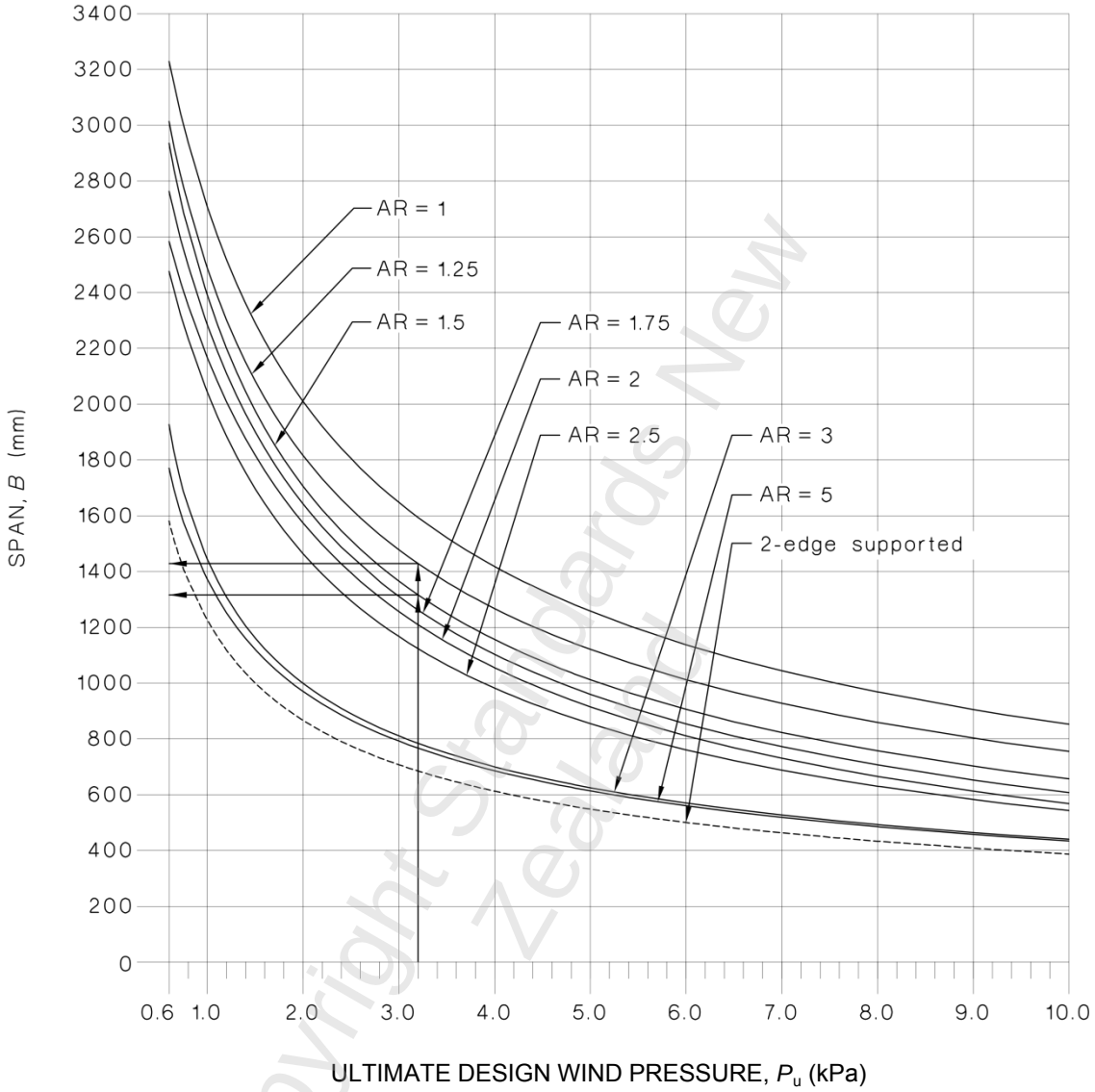
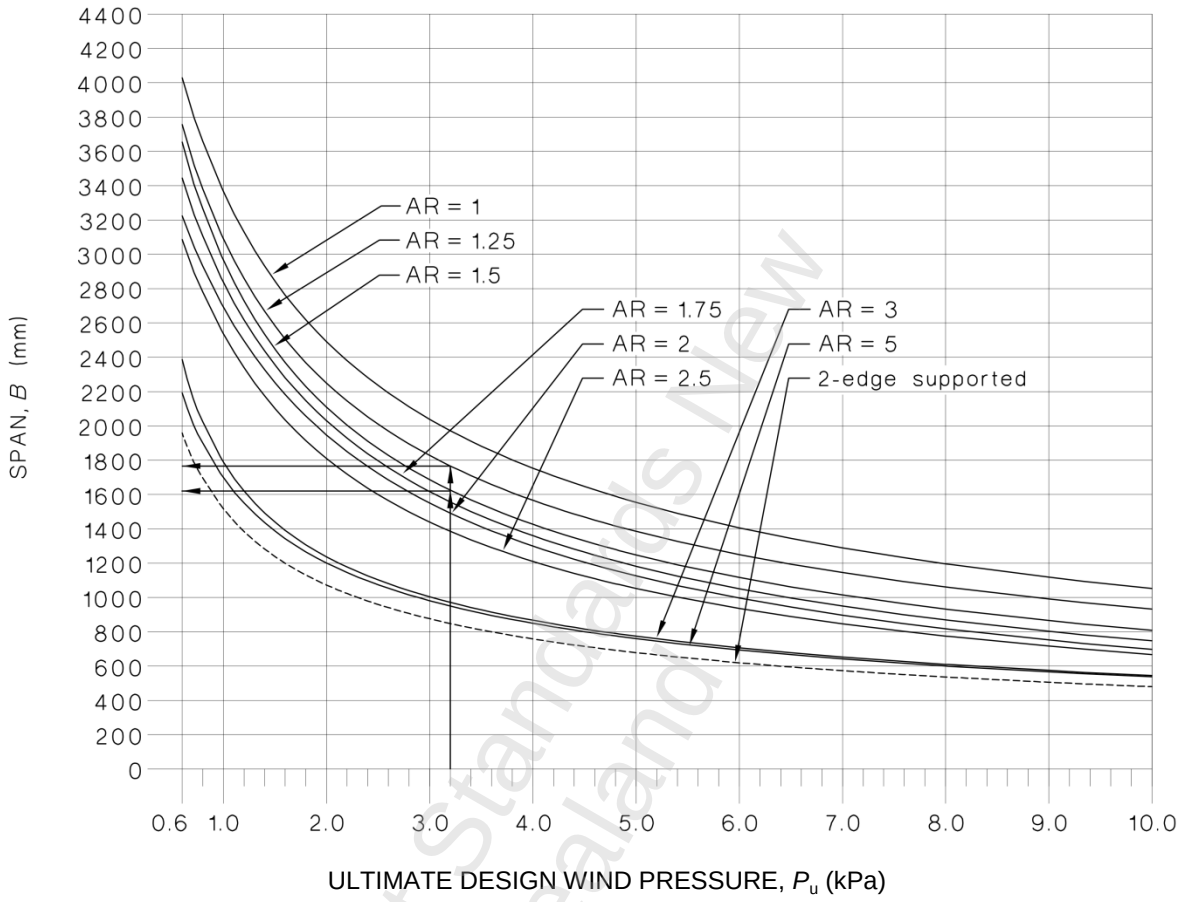


Figure B2 – Example monolithic 5 mm toughened glass



(Amendment No.1, February 2016)

APPENDIX C – SLOPED OVERHEAD GLAZING FRACTURE CHARACTERISTICS (INFORMATIVE) (page 71)

Add new C8:

C8 Special combinations and applications

Complex laminated combinations of annealed, heat-strengthened and toughened glass can be used with a range of interlayers to provide special breakage characteristics, and these can also be combined into IGUs.

In addition, some applications require point fixings, resulting in the fracture characteristics and retention of the glass by the fitting becoming complex and critical.

Therefore these special combinations and applications require specific design.

(Amendment No.1, February 2016)

APPENDIX D
SLOPED GLAZING – INSULATING GLASS UNITS
(INFORMATIVE) (page 73)

Delete Appendix D and **substitute**:

APPENDIX D – SLOPED AND OVERHEAD GLAZING – INSULATING GLASS UNITS (INFORMATIVE)

The information in D1 and D2 is taken from Appendix E, clause E8 of AS/NZS 4666.

D1 Definition

Sloped glazing is glazing that is inclined at up to 75 degrees to the horizontal.

D2 Design and glazing

The following should be considered for sloped and overhead glazing:

(a) Use a glazing system especially designed and engineered for sloped glazing;

(b) Use design actions and design data for sloped glazing not for vertical glazing;

(c) Provide adequate edge clearances and edge cover for the units;

(d) Support individual unit load weight with shoes or transoms;

(e) Protect all edge seals from UV and sunlight exposure if they are not silicone secondary sealed;

(f) Use only sealants that are compatible with the IGU seals, gaskets, glass and frame;

(g) Maintenance requirements such as cleaning and foot traffic;

(h) Solar control glasses to control glare and solar heat gain;

(i) Thermal stress breakage causes such as shading flashings and structure backups;

(j) The best airspace and glass type to provide the best insulation (U-value);

(k) Ventilation, condensation and the effects of air conditioning systems;

(l) Ensure rain water and condensation drain from the glazing system;

(m) The weight of the IGU when determining the size of the IGU;

(n) The effects of unit deflection on seal life and aesthetics;

(o) Glass selection (see D3).

D3 Glass selection

D3.1 Sloped glazing

All IGUs in sloped overhead glazing should have safety glass in accordance with section 3. Where the highest part of the glazing is more than 5 m above the finished floor level, laminated safety glass should be used (each ply may be a combination of annealed, heat-strengthened or toughened glass).

Consider the sloped and overhead glass fracture characteristics as detailed in Appendix C.

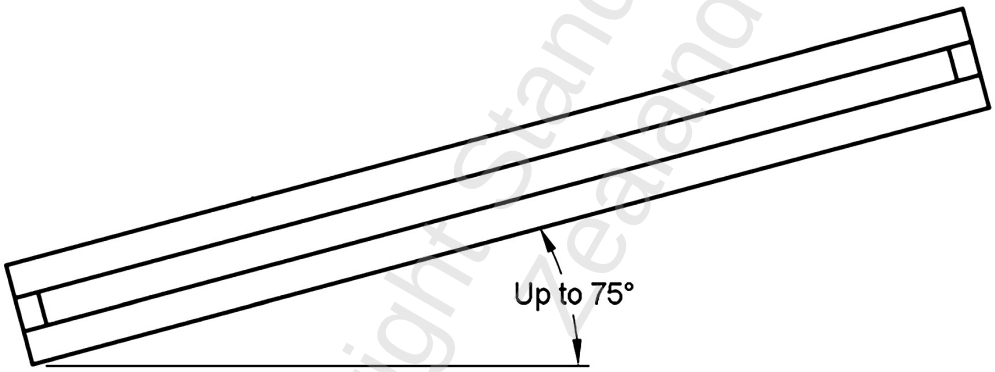
D3.2 Upper glass pane options

The following should be used:

(a) Toughened safety glass (normally used to support live loads);

(b) Laminated safety glass (each ply may be a combination of annealed, heat-strengthened or toughened glass).

Figure D1 – Insulating glass unit sloped glazing combinations



D3.3 Lower glass pane options

The following should be used:

(a) Toughened safety glass (only if the highest part is under 5 m from finished floor level);

(b) Laminated safety glass (each ply may be a combination of annealed, heat-strengthened or toughened glass).

(Amendment No.1, February 2016)

APPENDIX E – METHOD FOR THE DETERMINATION OF THE WIND PRESSURE ON SLOPED GLAZING
(NORMATIVE) (page 75)

Delete the third paragraph and note of E1 and **substitute**:

The basic pressure (either ultimate limit state or serviceability limit state) shall be determined from Table 13 or Table 14 as appropriate with reference to Figure E1 for the wind region.

NOTE – Table 13 and Table 14 are based on AS/NZS 1170.2 using the regional 500-year (ULS) or 25-year (SLS) return period wind speed and a wind direction multiplier of 1.0 (that is, covers all directions), factored by the multipliers applicable to the site and with a C_{fig} of 1.0.

Delete Table 13 and **substitute**:

Table 13 – Basic limit state (ULS or SLS) wind pressure (kPa) for sloped glazing for flat land areas

Wind region	Maximum glazing height above ground (m)	Terrain category							
		1		2		3		4	
		ULS	SLS	ULS	SLS	ULS	SLS	ULS	SLS
A6–7	3	1.19	0.81	1.01	0.68	0.84	0.57	0.68	0.46
	5	1.34	0.91	1.01	0.68	0.84	0.57	0.68	0.46
	10	1.52	1.03	1.22	0.82	0.84	0.57	0.68	0.46
W	3	1.53	1.09	1.29	0.92	1.08	0.76	0.88	0.62
	5	1.72	1.22	1.29	0.92	1.08	0.76	0.88	0.62
	10	1.96	1.39	1.56	1.11	1.08	0.76	0.88	0.62
NOTE – This applies to areas of land where the undulations are less than 25 m in height and ground slopes are less than 1 to 10 (for example, plains).									

Delete terrain categories below Table 13 and **substitute**:

The terrain categories are defined as:

Category 1 Very exposed, open terrain with few or no obstructions and enclosed, limited-sized water surfaces at serviceability and ultimate wind speeds in all wind regions; for example flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10 km in the wind direction.

2 Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare; for example farmland and cleared subdivisions with isolated trees and uncut grass.

3 Terrain with numerous, closely spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10-house size obstructions per hectare; for example suburban housing or light industrial estates.

4 Terrain with numerous large, high (10 m to 30 m tall) and closely spaced obstructions, such as large city centres and well-developed industrial complexes.

(Amendment No.1, February 2016)

Delete Table 14 and **substitute**:

Table 14 – Basic limit state (ULS or SLS) wind pressure (kPa) for sloped glazing for areas other than flat land areas

Wind region	Maximum glazing height above ground (m)	Terrain category							
		1		2		3		4	
		ULS	SLS	ULS	SLS	ULS	SLS	ULS	SLS
A6–7	3	3.48	2.35	2.94	1.99	2.45	1.65	2.00	1.35
	5	3.92	2.65	2.94	1.99	2.45	1.65	2.00	1.35
	10	4.46	3.01	3.55	2.40	2.45	1.65	2.00	1.35
W	3	4.47	3.18	3.78	2.69	3.14	2.23	2.57	1.82
	5	5.03	3.58	3.78	2.69	3.14	2.23	2.57	1.82
	10	5.72	4.07	4.56	3.24	3.14	2.23	2.57	1.82

Delete terrain categories below Table 14 and **substitute**:

The terrain categories are defined as:

Category 1 Very exposed, open terrain with few or no obstructions and enclosed, limited-sized water surfaces at serviceability and ultimate wind speeds in all wind regions; for example flat, treeless, poorly grassed plains; rivers, canals and lakes; and enclosed bays extending less than 10 km in the wind direction.

2 Open terrain, including grassland, with well-scattered obstructions having heights generally from 1.5 m to 5 m, with no more than two obstructions per hectare; for example farmland and cleared subdivisions with isolated trees and uncut grass.

3 Terrain with numerous, closely spaced obstructions having heights generally from 3 m to 10 m. The minimum density of obstructions shall be at least the equivalent of 10-house size obstructions per hectare; for example suburban housing or light industrial estates.

4 Terrain with numerous large, high (10 m to 30 m tall) and closely spaced obstructions, such as large city centres and well-developed industrial complexes.

(Amendment No.1, February 2016)

Delete E2 and **substitute**:

E2

The number determined from Table 13 or Table 14 for the appropriate limit state (ULS or SLS) shall then be used in Table 15, to determine the design wind pressure for both the downward and uplift cases depending on the roof angle.

The following procedure, which applies to all glass types, shall be followed:

1. Select Table 13 or Table 14 depending on whether or not the site is flat (see 3.4).
2. From the table, read off the basic wind pressure (either ULS or SLS as appropriate) depending on the wind region the building is located in, the terrain category, and the height of the glazing under consideration.
3. Enter Table 15 with the basic wind pressure determined in the previous step.
4. For the appropriate roof slope and the next higher pressure increment in the first column in Table 15, read off the wind (↑) and the wind (↓) pressures. Linear interpolation is acceptable for more accurate determination of design wind pressures.

   For canopies and awnings of all slopes, attached to the sides of buildings, select the wind pressure (either ULS or SLS as appropriate) from the 51° – 75° glazing angle column of Table 15.
5. The determined values for the ULS pressures shall be input to the equations in 3.4.6 to determine the pressures associated with each ULS load combination.

NOTE – For serviceability checks the dead load will not be critical and in cases where snow load is included the glass curvature will be constant over time. In these circumstances, conduct the serviceability check for wind load by entering Figure 35 or Figure 36 with the value obtained from Table 15.

(Amendment No.1, February 2016)

Delete Table 15 heading and **substitute**:

Table 15 – Limit state (either ULS or SLS) design wind pressures for sloped glazing in buildings (kPa)

Delete heading in first column to Table 15 and **substitute**:

Basic pressure from Table 13 or Table 14

(Amendment No.1, February 2016)

APPENDIX F – MAXIMUM SPANS FOR 1.1 KN LIVE LOADS (INFORMATIVE) (page 79)

Delete first row of data (starting at 6 mm) in Table 17.

6	–	–	–	–

Delete first row of data (starting at 6 mm) in Table 18.

6	–	–	–	–

(Amendment No.1, February 2016)