NZS 4223.3:1993

New Zealand Standard

Code of practice for glazing in buildings

Part 3: Human impact safety requirements

NZS 4223.3:1993

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COMMITTEE REPRESENTATION

This Part of the Standard was prepared under the direction of the Building and Civil Engineering Board (30/-) for the Standards Council established under the Standards Act 1988. The committee consisted of representatives of the following organizations:

Accident Compensation Corporation
Architectural Aluminium Association of New Zealand
Building Research Association of New Zealand
New Zealand Institute of Architects
New Zealand Institute of Building Inspectors
New Zealand Manufacturers Federation
New Zealand Safety Glass Association
Occupational Safety and Health
Plastics Institute of New Zealand

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STANDARDS NEW ZEALAND
6TH FLOOR, WELLINGTON TRADE CENTRE,
181 – 187 VICTORIA STREET, WELLINGTON 6001.
(Private Bag 2439, Wellington 6020)
Telephone: 0-4-384 2108 Fax: 0-4-384 3938

AMENDMENTS

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RELATED DOCUMENTS

Reference is made in this document to the following:

NEW ZEALAND STANDARDS

NZS 4203:1992	General structural design and design loadings for buildings
NZS 4211:1985	Specification for performance of windows

AMERICAN NATIONAL STANDARD

ANSI Z97.1 - 1984	Glazing materials used in buildings – safety performance, specifications and methods of test

AUSTRALIAN STANDARD

AS 2208:1978	Safety glazing materials for use in buildings (human impact considerations)

BRITISH STANDARD

BS 6206:1981	Specification for impact performance requirements for flat safety glass and safety plastics for use in buildings

Other related documents not referred to in this Standard

AS 1288:1989	Glass in buildings – selection and installation
BS 952: Part 1:1978	Glass for glazing Classification
BS 6262:1982	Code of practice for glazing for buildings

The users of this Standard should ensure that their copies of the abovementioned New Zealand Standards and referenced overseas Standards are the latest revisions or include the latest amendments. Such amendments are listed in the annual New Zealand Standards *Catalogue* which is supplemented by lists contained in the monthly magazine *Standards* issued free of charge to committee and subscribing members of Standards New Zealand.

FOREWORD

This Standard, NZS 4223 *Code of practice for glazing in buildings* Part 3:1993 *Human impact safety requirements*, supersedes clauses 103.4.3 and 103.5 of NZS 4223:1985 *Glazing in buildings*.

As with the previous edition of the Standard, preparation of this part revision was undertaken by a Standards New Zealand committee representative of manufacturers, Government departments and agencies, research organizations and users.

The significance of human safety requirements in relation to glazing materials determined the need to produce a separate Part to the existing Standard, NZS 4223. During the preparation of this Part of the Standard, surveys of Accident Compensation Corporation glass-related injuries claimants for the year ending June 1992 and a Postal Survey of Glass Injuries by the University of Auckland's Department of Architecture were received by the committee. The Building Research Association of New Zealand also conducted tests on glass breakage at various designated impact levels.

This Standard provides for more realistic human impact safety requirements than those in NZS 4223:1985. In particular, a determination of risk level has been assigned for locations where high proportions of glazing-related injuries in buildings are known to occur, and the maximum permissible area of annealed glass in specific locations has also been reduced.

The application of the requirements of Part 3 of NZS 4223:1993 will reduce the risk of injury from glazing in buildings.

REVIEW OF STANDARDS

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6020.

NEW ZEALAND STANDARD

Code of practice for GLAZING IN BUILDINGS

PART 3
HUMAN IMPACT SAFETY REQUIREMENTS

301 SCOPE

301.1
This Part of this Standard specifies minimum requirements for glazing in locations where it is likely to be subject to human impact.

NOTE –
(1) Only glazing within 2000 mm of the floor level is normally likely to be subject to human impact.
(2) In some circumstances the requirements of other Parts of the Standard can exceed the requirements of this Part.
(3) Glass or plastics installed at greater than 15° from the vertical is not covered by this Part (refer 103.11 – Sloped and overhead glazing).
(4) Risk – the application of the requirements of this Part will reduce the risk of injury.

302 DEFINITIONS

302.1
The definitions set out in section 2 of NZS 4223 shall apply to this Part and in addition the following shall apply:

AREA (when it refers to glazing) means the actual size of a piece of glazing material.

CRASH RAIL means a rail, together with its fixings, capable of withstanding a load of 750 N per metre length acting in any direction without contact with the glazing material.

FRAMING ELEMENT means any perimeter element supporting the edge of the glazing material and including transoms, mullions, fixed glazing bars and the like.

GLAZING MATERIAL means glass and/or plastics used in prepared openings such as windows, door panels, screens and partitions.

SAFETY GLAZING MATERIAL means any material scheduled in Appendix 3.A that has been tested and complies with the relevant requirements of AS 2208 or BS 6206 or ANSI Z97.1. The classification of safety glazing materials according to behaviour on impact is detailed in Appendix 3.B. References in this part to Grade A and Grade B safety glazing material refer to those grades as specified in AS 2208.

303 GENERAL

303.1 Manifestation (making glass visible)

303.1.1
Where transparent glazing material is used in doors or side panels or is located such that it may be mistaken for a doorway or an unimpeded path of travel, the presence of glazing shall be made apparent either by the provision of an opaque band complying with 303.1.2 and 303.1.3 across

the full width of the glazed opening or by a motif or other decorative treatment (e.g. colonial bars). Such markings are not a substitute for the use of safety glazing where this is required by this Part.

303.1.2
Where an opaque band is provided for manifestation, it shall be not less than 20 mm in width and located so that the vertical distance from the finished floor level is:

(a) Not less than 700 mm to the upper edge of the band;

(b) Not more than 1000 mm to the lower edge of the band.

303.1.3
The band shall be readily apparent. This may be achieved either by ensuring that the band contrasts with the background or by increasing the width of the band.

NOTE – A broken line or patterns are acceptable forms of warning bands.

303.1.4
A band or marking is not required where any one of the following applies:

(a) The clear width of glazing is less than 500 mm;

(b) The lower edge of the glazing is 500 mm or more above the finished floor level;

(c) The clear opening height of glass is less than 1000 mm;

(d) Where safety glazing material is used in household units;

(e) Where a crash rail or transom is provided between 700 and 1000 mm above the finished floor level.

303.2 Containment
Where glass is used and the edge cover requirements comply with clause 105.4 and tables 25 and 27 of Part 1, then containment is deemed to be achieved. Otherwise the containment requirements of this Part shall be such that the glazing material remains in place when subjected to a mid-span impact energy level of 150 Joules using an impact bag which complies with the specification set out in AS 2208.

NOTE – For plastics and other more flexible glazing materials, the manufacturer should be consulted, as additional edge cover or positive fixing may be required.

303.3 Framing elements
Framing elements shall be sufficiently robust to support glazing which may be subjected to impact loads. The rigidity of a framing element shall be determined as set out in Appendix 3.C.

Edges of glazing material having framing which does not achieve the required stiffness shall be considered to be unframed edges and the appropriate glazing material thickness table shall be used.

303.4 Unframed edges
The edges of a panel that have no frame support shall be deemed to be unframed edges, except where they are connected to an adjacent panel, at an internal angle of 150° or less, or to a fin, which provides support equivalent to a framed member as described in 303.3.

NOTE – The edge of an unframed panel may be exposed or not exposed (i.e. covered).

303.5 Substitution of safety glazing material
Grade A or B safety glazing material may be used in circumstances where ordinary annealed glass is permitted.

303.6 Sealed insulating glass units
The maximum permitted area of sealed insulating glass units shall be 1.5 times the area permitted for a single pane of thickness equal to the thinner of the two panes of the sealed unit. Each pane of glass shall comply with the relevant clauses of this Part.

303.7 Identification of safety glazing materials

303.7.1
Each panel of safety glazing material shall be legibly marked, except as permitted by 303.7.4.

303.7.2
Where safety glazing material is cut by a distributor or installer after manufacture, the distributor or installer shall, where the cut material is not already marked, mark each piece to certify that the piece has been cut from a panel of safety glazing material. Where non-permanent marking is used, it shall be of the label type that will remain legible until examined by a person responsible for the building, and shall be of the type that is self-destroying when removed.

303.7.3
Each panel shall be marked with the following minimum requirements:

(a) The name, registered trademark or code of the manufacturer or supplier;

(b) The type of safety glazing material. This may be in the form of a code, such as T for Toughened Glass, L for Laminated Glass, as indicated by the relevant test Standard. (Refer AS 2208);

(c) The Standard to which the safety glazing material has been tested, e.g., BS 6206;

(d) The classification relating to impact test behaviour if applicable, i.e., Letter A for Grade A, B for Grade B, C for Grade C.

NOTE – Additional markings may be used at the discretion of the supplier, and may be required by the manufacturer to meet the relevant Standards requirements of AS 2208, BS 6206 or ANSI Z97.1.

303.7.4 *Compliance certificate*
As an alternative to marking the safety glazing material, the manufacturer or supplier may provide a certificate to verify that it has been tested in accordance with a relevant test Standard, and that at the time of delivery the safety glazing material complies with the requirements of this Standard.

303.8 Repairs
Where broken glazing material is being repaired, the replacement material shall where practicable meet the requirements of NZS 4223.

303.9 Glazing in buildings designed for special activities
In all areas designed or otherwise used for vigorous sporting or specialist activities in buildings, such as gymnasiums, swimming pools, schools, public viewing galleries, stadiums and the like, where there is a greater than normal risk of breakage, Grade A safety glazing material in accordance with tables 3.1 and 3.4 shall be used.

303.10 Early childhood centres
In early childhood centres, all glazing with a sill level less than 800 mm above the floor, ground or verandah deck level shall either comply with the requirements for fully framed doors given in 304.1(a), or shall be Grade A safety glazing material in accordance with table 3.1.

303.11 Summary of requirements

The most common human impact requirements for framed doors, side panels and windows set out in the following clauses are summarized in Appendix 3.D.

304 DOORS

304.1

Glazing in doors shall be Grade A safety glazing material in accordance with table 3.1 with the following exceptions:

(a) *Fully framed hinged doors, revolving doors and hinged and/or sliding bi-fold doors.* Annealed glass is permitted up to a maximum area of 0.5 m² in accordance with column 1 of table 3.2.

(b) *Fully framed sliding doors with transoms.* Annealed glass is permitted with a minimum thickness of 5 mm in accordance with column 2 of table 3.2 provided that the door incorporates one or more transoms. The transoms shall be fixed glazing bars, firmly attached to the door styles to locate and protect each face of the glass. Where only one transom is used it shall be located with its upper edge not less than 700 mm, and its bottom edge not more than 1000 mm, above the finished floor level abutting it. The transoms shall each have a face width of not less than 20 mm.

(c) *Unframed glass doors.* Glazing shall be toughened safety glass with a standard nominal thickness of not less than 10 mm.

(d) *Doors to showers and bath enclosures.* Glazing shall be in accordance with 308.

(e) *Wardrobe and closet doors.* Glazing shall be of Grade A or B safety glazing material in accordance with table 3.1. Where 4 mm vinyl backed safety mirror is used, the maximum area shall be 3.0 m².

(f) *Roller doors, tilting doors and sectional doors.* Glazing shall be Grade A or Grade B safety glazing material in accordance with table 3.1 or annealed glass in accordance with column 2 of table 3.2.

305 SIDE PANELS

305.1 General

305.1.1

A side panel is defined as a glazed panel having a vertical visible edge less than 300 mm from the nearest edge of the doorway opening, and within 30° of the plane of the closed door, except where defined by 305.1.3.

305.1.2

A panel that is adjacent to a door and either curved or at an angle greater than 30° to the plane of the closed door is not a side panel but may be classified by 306 or other clauses of this Part.

305.1.3

A glazed internal partition, consisting of more than one panel with unframed side edges, adjacent to a door shall not be regarded as a side panel and shall meet the requirements of table 3.4 except that the glass thickness shall not be less than 10 mm.

305.2 Framed side panels

305.2.1

All framed glazed side panels shall be of Grade A safety glazing material in accordance with table 3.1 except as provided by 305.2.2 and 305.2.3.

305.2.2
Annealed glass may be used in accordance with column 2 of table 3.2 in any one of the following cases:

(a) The clear width of the glass is no greater than 500 mm at any part;

(b) The lowest visible edge of the glass is 500 mm or more above the highest abutting finished floor level;

(c) The clear height of the glass panel is no greater than 1000 mm at any part;

(d) The side panel is provided with a crash rail or fixed glazing bar, firmly attached to the styles to locate and protect each face of the glass. It shall be located with its upper edge not less than 700 mm, and its bottom edge not more than 1000 mm, above the finished floor level abutting it. The crash rail or bar shall have a face width not less than 20 mm.

305.2.3
In non-residential buildings ordinary annealed glass in accordance with column 3 of table 3.2 may be used where:

(a) The clear width of the glass is greater than 2000 mm; and either

(b) The lowest part of the glass is 500 mm or more above the highest abutting finished floor level; or

(c) Annealed glass not less than 10 mm nominal thickness is used.

NOTE – If the clear width of the glass is greater than 2000 mm, it is considered that the glass panel is unlikely to be mistaken for an opening doorway.

305.3 Unframed and partly framed side panels

305.3.1
Unframed and partly framed side panels without exposed edges, with the exception of those defined in 305.1.3, shall be glazed with Grade A safety glazing material in accordance with the requirements of table 3.4.

305.3.2
Unframed side panels with exposed edges shall be glazed with toughened safety glass not less than 10 mm thickness.

306 GLAZED PANELS WHICH CAN BE MISTAKEN FOR AN UNIMPEDED PATH OF TRAVEL, AND NOT DEFINED AS DOORS OR SIDE PANELS

306.1
Any glazed panel shall be deemed capable of being mistaken for an open doorway or an unimpeded path of travel providing access to or egress from one part of a building to another, or between inside and outside, unless it complies with any one of the following cases:

(a) The clear width of glazing is less than or equal to 500 mm;

(b) The lowest visible edge of the glazing is 500 mm or more above the highest abutting finished floor level;

(c) The panel is marked by means of an opaque band or other decorative treatment to the requirements of 303.1;

(d) A crash rail or the like is provided in accordance with 305.2.2(d);

(e) There are permanent displays associated within glazed shop fronts.

If the glazing complies with either (a), (b), (d) or (e) above, annealed glass in accordance with column 3 of table 3.2 shall be used. If the glazing complies with (c), annealed glass in accordance with column 2 of table 3.2 shall be used.

306.2
Any glazed panel that is deemed capable of being mistaken for an open doorway or an unimpeded path of travel shall be glazed as follows:

(a) *For framed panels* – Grade A safety glazing material in accordance with table 3.1.

(b) *For unframed panels* – Grade A safety glazing material in accordance with the requirements of table 3.4.

307 LOW LEVEL AND WINDOW SEAT GLAZING

307.1
If the lowest part of the glazing is less than 500 mm above the finished floor level abutting it, or the window forms a backrest to a window seat or similar seating arrangement, annealed glass of not less than 5 mm thickness in accordance with column 2 of table 3.2 shall be used. Where the glazing material protects a difference in level below the window sill exceeding 1000 mm, the glazing shall meet the requirements of 310. A horizontal ledge wider than 100 mm shall be considered as a window seat.

308 SHOWER DOORS, SHOWER SCREENS AND BATH ENCLOSURES

308.1
Grade A safety glazing materials in accordance with table 3.1 shall be used in:

(a) Framed or unframed shower doors, shower screens and bath enclosures;

(b) Windows over or adjacent to baths and showers where the lowest edge of the glazing is less than 1500 mm above the level of the standing area of the bath or shower tray, or the nearest abutting finished floor, and the window is within a horizontal distance less than 500 mm of the standing area of the bath or shower.

308.2
In bathrooms glass panels or doors with one unframed or two opposite unframed edges shall be of toughened safety glass not less than 5 mm thickness.

308.3
In bathrooms glass panels or doors with two adjacent or three or more unframed edges shall be of toughened safety glass not less than 6 mm thickness.

308.4
Frameless glass shower doors using pivots or hinges shall be toughened safety glass of not less than 6 mm thickness.

309 SHOP FRONTS

309.1
The glazing of doors and side panels incorporated in shop fronts shall be in accordance with relevant clauses of this part (see 304 & 305).

309.2
All glazing in external or internal shop fronts that have a public walking surface located within 1000 mm horizontally of the vertical plane of the glazing, and cannot be mistaken for an

unimpeded path of travel (refer 306), shall be selected in accordance with column 3 of table 3.2 or with table 3.4.

309.3
All glazing in shop fronts other than that covered by 309.1 and 309.2 shall be selected in accordance with table 3.3 or 3.4.

310 GLAZING PROTECTING A DIFFERENCE IN LEVEL IN ANY BUILDING

310.1
Glazing used in any building in situations that require protection for the occupants from falling 1000 mm or more shall meet the requirements as set out in figure 3.1.

NOTE – Where the glazing material is to provide penetration resistance after breakage, for example in places of crowd assembly, careful consideration of the strength and breakage characteristics of the glazing material and framing system (refer 303.2) should be made (e.g. laminated glass should provide penetration resistance).

311 INTERNAL PARTITIONS

311.1 Framed internal partitions
Framed internal partitions other than those defined as doors or side panels (refer 305.1.3) may be glazed with annealed glass in accordance with table 3.3, except that where the lowest part of the glass is less than 500 mm above the highest abutting finished floor level, annealed glass of not less than 5 mm thickness may be used in accordance with the maximum areas specified in column 3 of table 3.2.

311.2 Unframed internal partitions

(a) *Top edge unframed*
Panels that are framed on three sides but not on the top edge shall be glazed with annealed glass in accordance with table 3.3 provided that the top edge is 1500 mm or greater above the highest abutting finished floor level, and the panel cannot be mistaken for a doorway or unimpeded path of travel. Alternatively, such panels may be considered as fully framed and shall be glazed with Grade A safety glazing material in accordance with table 3.1.

(b) *Side edges unframed*
Panels which have the top and bottom edges framed and have one or more side edges unframed but not exposed, shall be glazed in accordance with table 3.4.

(c) *Other unframed panels*
Unframed panels which are not covered by (a) or (b) shall be of safety glazing material in accordance with the manufacturer's recommendations.

312 BALUSTRADES AND FENCES

NOTE – Where the glazing material is to provide penetration resistance after breakage, for example in places of crowd assembly, careful consideration of the strength and breakage characteristics of the glazing material and framing system (refer 303.2) should be made (e.g. laminated glass should provide penetration resistance).

312.1 Fully framed balustrades and fences
For fully framed balustrades and fences, Grade A safety glazing of not less than 6 mm thickness in accordance with the maximum areas shown in table 3.1 shall be used, except that annealed glass not less than 4 mm thick may be used up to a maximum area of 0.3 m^2.

312.2 Unframed or partly framed balustrades and fences

For unframed or partly framed balustrades and fences, Grade A safety glazing of not less than 6 mm thickness shall be used in accordance with table 3.1 (i.e. they may be considered as fully framed).

312.3 Structural self supporting balustrades and fences

Where glass is used as a structural member to support handrail loads, Grade A safety glass shall be used. The thickness used shall be determined in accordance with the appropriate design load specified by NZS 4203 or other appropriate loadings standard, but in no case shall the thickness used be less than 10 mm.

313 STAIRWELLS

313.1

Glazing to stairwell landings that have a glass width greater than 500 mm shall be Grade A safety glazing in accordance with table 3.1. All other glazing in stairwells shall meet the requirements of figure 3.1 whether or not it protects a difference in level.

314 LEAD LIGHT GLAZING

314.1

For lead light glazing which is in a location subject to human impact, the individual glazing pieces within the lead light shall not exceed the maximum areas specified in column 1 of table 3.2 for the various thicknesses.

315 FIRE RATED GLAZING

315.1

All fire rated glazing shall conform to this Part, with the exception that Grade B safety glazing materials, such as wired glass, may be used in accordance with the maximum area specified in table 3.1 for Grade B.

Table 3.1 – Maximum areas of safety glazing material for fully framed glazing

Type of glazing	Standard nominal thickness mm	Maximum area m^2
Grade A safety glazing material*		
Toughened safety glass	3	1.0
	4	2.0
	5	3.0
	6	4.0
	8	6.0
	10	8.0
	12	10.0**
Laminated safety glass†	5	2.0
	6	3.0
	8	5.0
	10	7.0
	12	9.0**
Safety organic-coated glass and safety vinyl-backed mirror	Refer to detailed specifications of suppliers of organic plastics impact films. In the absence of specific design charts, refer to the above maximum areas of laminated safety glass.	
Safety plastics	Refer to detailed specifications of suppliers of safety plastics panel materials for thicknesses and corresponding maximum areas.	
Grade B safety glazing material*		
Safety wired glass	6	1.5
Safety organic-coated glass and safety vinyl-backed mirror	Refer to detailed specifications of suppliers of organic plastics impact films. In the absence of specific design charts, refer to the above maximum areas of laminated safety glass.	
Safety plastics	Refer to detailed specifications of suppliers of safety plastics panel materials for thicknesses and corresponding maximum areas.	

* Grade A and Grade B safety glazing material as defined in AS 2208 (Refer Appendix 3.B).

** This area may not be readily available.

† Based on total glass thickness only (Interlayer thickness not included).

Table 3.2 – Maximum areas of annealed glass for fully framed glazing (m^2)

Standard nominal thickness, mm	Column 1 High risk	Column 2 Med.risk	Column 3 Low risk
3	0.05	0.1	0.3
4	0.2	0.3	1.1
5	0.5	1.2	2.2
6	0.9	2.1	3.3
8	1.8	3.2	4.5
10	2.7	4.4	6.0
12	4.5	6.3	8.0
15	6.3	8.2	10.0
19	8.5	10.3	12.0
25	12.0	13.5	15.0
Glazing locations	Hinged, revolving and bi-fold doors Unframed glazed panels Top edge unframed Partitions Lead lights	Sliding doors with transoms Roller, tilting and sectional doors Framed side panels Low level and window seat	Internal partitions Side panels (non-residential) Shop fronts

Table 3.3 – Maximum areas of annealed glass for shop fronts, internal partitions, and other glazed panels (m^2)

Standard nominal thickness mm	Fully framed Maximum area	Top edge unframed Maximum area
4	2.2	0.3
5	3.4	0.5
6	4.7	0.9
8	7.3	1.8
10	9.5	2.7
12	12.0	4.5
15	16.0	6.3
19	16.0	8.5
25	16.0	12.0

NOTE – Maximum areas based on a design face load of 1.0 kPa.

Table 3.4 – Shop fronts, internal partitions and other glazed panels with unframed side edges

Height of Glass (Span) m	Type of glass	Minimum standard nominal thickness, mm	Maximum number of vertical butt joints per opening	Maximum number of individual glass panels per opening	Maximum individual panel width, mm
≤2.0	Annealed	6	1	2	800
	Heat strengthened	6	1	2	1000
	*Toughened	6	2	3	1200
	*Toughened	8	No limit	No limit	No limit
	*Laminated†	6	2	3	1200
	*Laminated†	8	No limit	No limit	No limit
>2.0≤2.6	Annealed	8	1	2	800
	Annealed	10	2	3	1000
	Annealed	12	3	4	1000
	Heat strengthened	10	2	3	1200
	*Toughened	8	2	3	1200
	*Toughened	10	No limit	No limit	No limit
	*Laminated†	8	1	2	1000
	*Laminated†	10	No limit	No limit	No limit
>2.6≤3.0	Annealed	10	1	2	1000
	Annealed	12	2	3	1000
	Heat strengthened	10	2	3	1200
	*Toughened	10	No limit	No limit	No limit
	*Toughened	12	No limit	No limit	No limit
	*Laminated†	10	2	3	1000
	*Laminated†	12	No limit	No limit	No limit

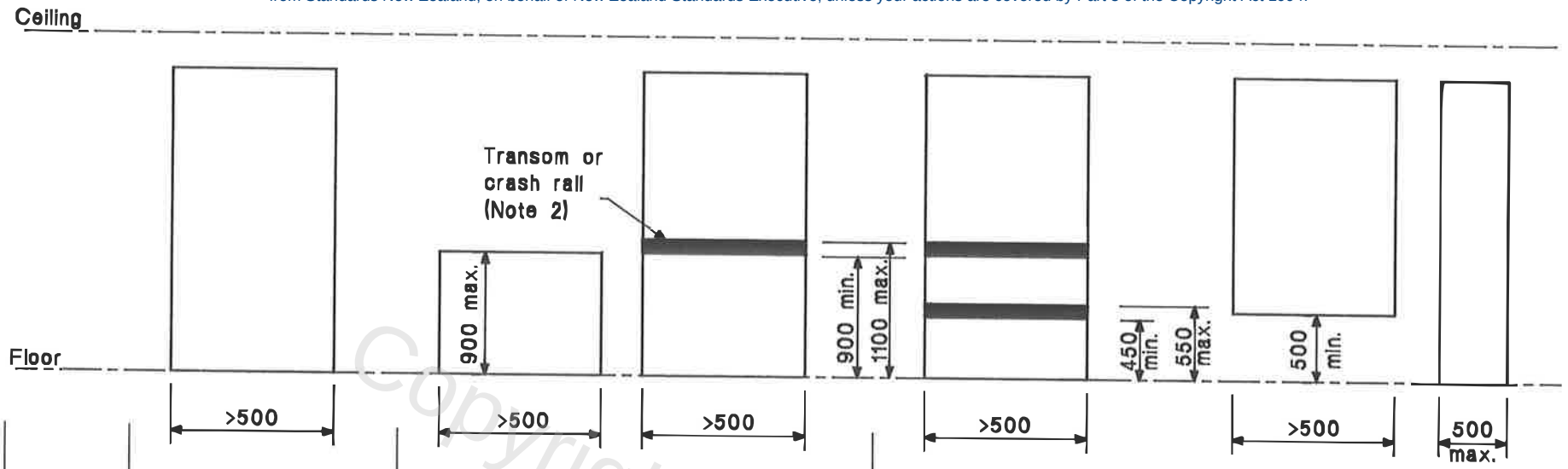
*Safety glazing material Grade A to AS 2208 (Refer Appendix 3.B).

†Based on total glass thickness only (Interlayer thickness not included and should be added).

NOTE –

(1) Heights above 3.0 m require engineering design.

(2) Adequate edgecover is required to retain the glass under load (refer 303.2, and tables 25 & 27 of NZS 4223:Part 1.



Household units	Safety glazing material to table 3.1 or annealed glass to column 1 of table 3.2	Safety glazing material to table 3.1 or annealed glass to column 2 of table 3.2 with 5 mm minimum thickness	Select glass thickness by reference to wind design charts in Part 1 NOTE – Refer also to section 307
All other buildings (Note 1)	Safety glazing material to table 3.1 or annealed glass to column 2 of table 3.2	Safety glazing material to table 3.1 or annealed glass to column 3 of table 3.2 with 5 mm minimum thickness	Select glass thickness by reference to wind design charts in Part 1 NOTE – Refer to section 307

NOTE –

(1) For Special Activity Buildings, refer to 303.9. For stairwells refer to section 313.

(2) Crash rails should be designed to discourage people from sitting on them.

(3) Thickness of glazing materials shall also be checked for wind loading.

(4) Glazing materials shall be contained in accordance with 303.2.

Figure 3.1 – Glazing protecting a difference in level in any building

APPENDIX 3.A
SCHEDULE OF SAFETY GLAZING MATERIALS

3.A1 General
Safety glazing materials are those materials so constructed, treated or combined with other materials as to reduce the likelihood of cutting and piercing injuries resulting from human impact with them. They shall have been tested to and comply with the relevant requirements of AS 2208, BS 6206 or ANSI Z97.1. Such materials include but are not limited to those set out in 3.A2 to 3.A11 following.

3.A2 Heat strengthened laminated safety glass
Laminated safety glass utilising two panels of heat strengthened glass permanently bonded together by one or more sheets of plastic interlayer or by liquid chemicals that cure to form a plastic type interlayer.

3.A3 Laminated safety glass
A glass consisting of two or more sheets of glass permanently bonded together by one or more sheets of plastic interlayer.

3.A4 Liquid laminated safety glass
A glass consisting of two or more sheets of glass permanently bonded together by liquid chemicals that cure to form a plastic type interlayer.

3.A5 Safety double (or multiple) insulating glass units
Double (or multiple) glass units in which all panels are safety glass and separated by airspaces.

3.A6 Safety organic-coated glass
A glazing material consisting of a piece of glass coated and permanently bonded on one or both sides with a continuous polymeric coating, sheet or film.

3.A7 Safety plastics glazing material
A glazing material which contains as an essential ingredient, an organic substance of large molecular mass, is solid in its finished state, and at some stage in its manufacture or in its processing into finished articles can be shaped by flow. Plastics may consist of a single sheet of synthetic plastics material, a combination of two or more such sheets laminated together, or a combination of plastics material and reinforcement material in the form of fibres or flakes.

3.A8 Safety vinyl backed mirror
A glazing material consisting of a piece of mirror with a vinyl sheet permanently bonded to one side.

3.A9 Safety wired glass
A single sheet of glass with wire completely embedded in the glass.

3.A10 Toughened laminated safety glass
Laminated safety glass utilising two panels of toughened glass permanently bonded together by one or more sheets of plastic interlayer or by liquid chemicals that cure to form a plastic type interlayer.

3.A11 Toughened safety glass
A glass which has been converted to a safety glass by subjection to a process of pre-stressing (by heat or chemical treatment) so that, if fractured, the entire piece disintegrates into small, relatively harmless particles. Also known as "tempered safety glass".

APPENDIX 3.B
CLASSIFICATION OF SAFETY GLAZING MATERIALS ACCORDING TO BEHAVIOUR ON IMPACT

STANDARD	GRADE	BEHAVIOUR ON IMPACT			
		Drop heights (Energy levels)			
		200 mm (90J)	300 mm (135J)	450 mm (203J)	1200 (541J)
BS 6206	A	N/A	No breakage or breaks safely	No breakage or breaks safely	No breakage or breaks safely
	B	N/A	No breakage or breaks safely	No breakage or breaks safely	No requirement
	C	N/A	No breakage or breaks safely	No requirement	No requirement
AS 2208* (Note 2)	A	N/A	No breakage or breaks safely	No breakage or breaks safely	No breakage or breaks safely
	B	Breaks safely	N/A	N/A	N/A
ANSI Z97.1	(Note 3)	N/A	No breakage or breaks safely	No breakage or breaks safely	No breakage or breaks safely

* Grade A and Grade B safety glazing material as defined in AS 2208.

NOTE –

(1) Definitions

No breakage – The glazing material remains undamaged. Therefore, the next drop height must be used to break the panel.

Breaks safely – Breakage occurs, but numerous cracks and fissures are allowable provided that no shear or opening results through which a 75 mm diameter sphere may be freely passed after all loosely hanging pieces are removed.

(2) Where breakage occurs this is considered to be the impact drop height for calculation of energy at break.

Grade B applies only to a safe break at 200 mm. If no break occurs at 200 mm, refer to Grade A, 300 mm. Any safe break at 300 mm or above is Grade A.

(3) Classification is based on the size of the glass panel and not behaviour.

L = Limited – this applies to panels up to and including test specimen of 34" x 76" (864 mm x 1930 mm)

U = Unlimited – this applies to panels 34" x 76" (864 mm x 1930 mm) or larger.

APPENDIX 3.C
RIGIDITY OF FRAMING ELEMENTS

For the purposes of 303.3, to ensure that a framing element is sufficiently robust to support glazing which may be subjected to impact loads, the rigidity of the framing element shall be such that:

$EI_{frame} > 3\ d^4$ (refer to table below)

where

E = Modulus of elasticity of the frame (GPa)

I = Second moment of area of the frame (mm^4)

d = Glass thickness (mm)

Glass thickness (mm)	Required frame rigidity EI (Nmm^2)
3	243
4	768
5	1875
6	3888
8	12288
10	30000
12	62208

APPENDIX 3.D
INTERPRETATION OF COMMON HUMAN IMPACT SAFETY REQUIREMENTS

3.D1 General
This Appendix provides assistance in the interpretation of common human impact safety requirements of this Part of NZS 4223. It is not intended to cover all situations.

3.D2 Examples of the use of glazing in compliance with the human impact safety requirements.
Figures 3.D1 to 3.D4 give examples of glazing in common situations and the glazing requirements are set out in the corresponding tables 3.D1 to 3.D4.

Table 3.D1 – Human impact safety requirements for typical examples of fully framed glazed doors and side panels shown in figure 3.D1

Panel designation	Panel details	Human impact safety requirements
D1, D3	Hinged door with panels of area > 0.5 m^2	Grade A safety glazing material in accordance with table 3.1 (see 304.1)
D2	Hinged door with panels of area ≤ 0.5 m^2	Annealed glass in accordance with column 1 of table 3.2 (see 304.1(a))
D4	Sliding door with transom	Annealed glass 5 mm minimum thickness in accordance with column 2 of table 3.2 (see 304.1(b))
S1	Side panel of width > 500 mm and lower edge < 500 above highest abutting floor level	Grade A safety glazing material in accordance with table 3.1 (see 305.2.1 and 305.2.2)
S2	Side panel of width ≤ 500 mm	Annealed glass in accordance with column 2 of table 3.2 (see 305.2.2(a))
S3	Side panel with lower edge ≥ 500 mm above highest abutting floor level	Annealed glass in accordance with column 2 of table 3.2 (see 305.2.2(b))
S4	Side panel of clear height ≤ 1000 mm	Annealed glass in accordance with column 2 of table 3.2 (see 305.2.2(c))
S5	Side panel with transom or crash rail	Annealed glass in accordance with column 2 of table 3.2 (see 305.2.2(d))
S6	Side panel of width > 2000 mm and lower edge < 500 mm above highest abutting floor level, in non-residential buildings only	Annealed glass in accordance with column 3 of table 3.2 but ≥ 10 mm thick (see 305.2.3(a) & (c))
S7	Side panel of width > 2000 mm and lower edge ≥ 500 mm above highest abutting floor level, in non-residential buildings only	Annealed glass in accordance with column 3 of table 3.2 (see 305.2.3(a) & (b))

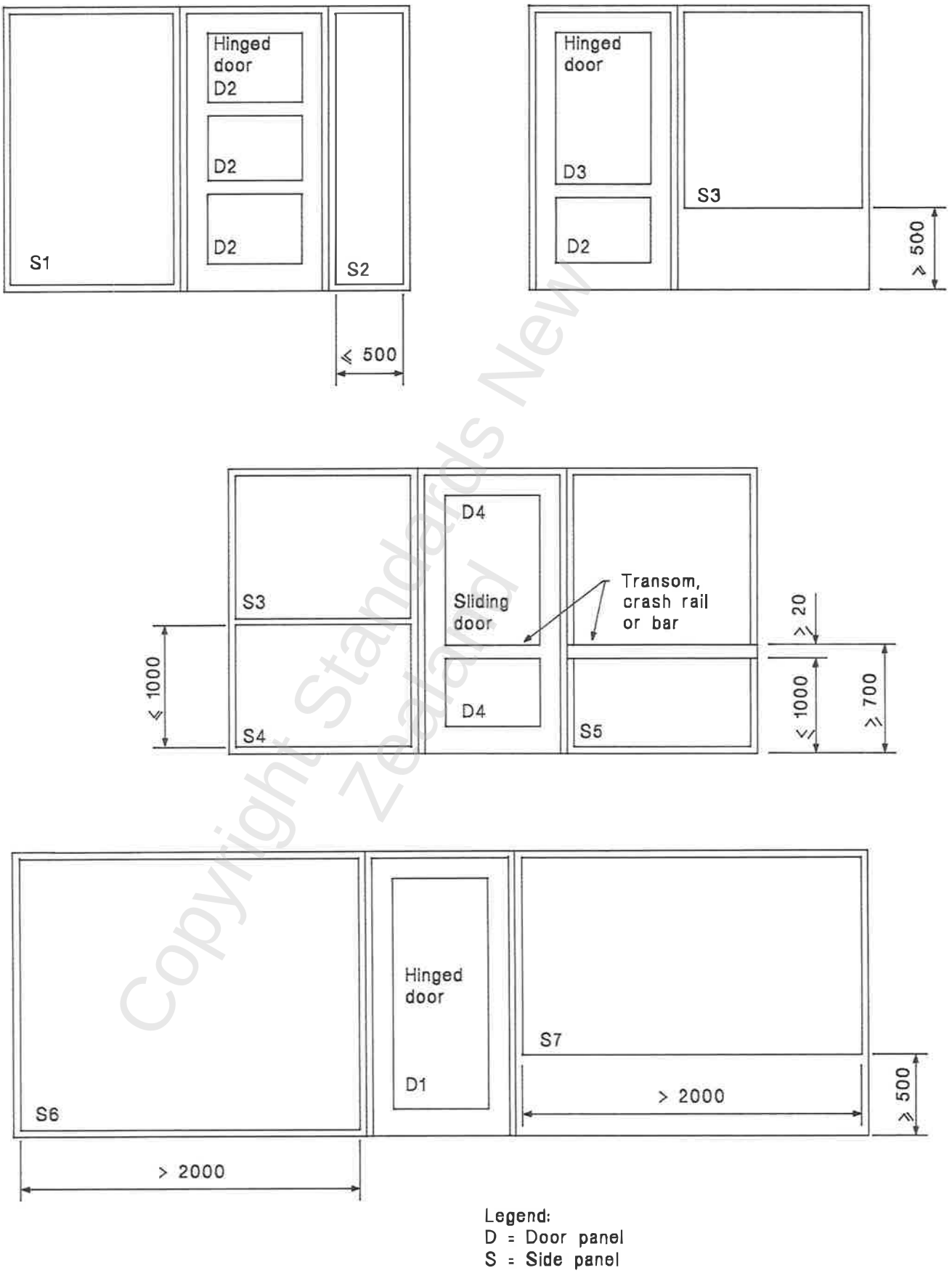


Figure 3.D1 – Typical examples of fully framed glazed doors and side panels

Table 3.D2 – Human impact safety requirements for typical examples of glazed internal partitions shown in figure 3.D2

Panel designation	Panel details	Human impact safety requirements
D1	Hinged framed door with panels of area > 0.5 m^2	Grade A safety glazing material in accordance with table 3.1 (see 304.1)
D5	Unframed door of any area	Toughened safety glass of nominal thickness ≥ 10 mm (see 304.1(c))
S8	Unframed side panel without exposed edges	Glazing material in accordance with table 3.4, but thickness ≥ 10 mm (see 305.1.3). Refer Note 2 below
S9	Unframed side panel with exposed edges	Toughened safety glass of nominal thickness ≥ 10 mm (see 305.3.2)
P1	Unframed panel	Safety glazing material in accordance with table 3.4 (see 311.2 (b))
P2	Framed panels	Annealed glass in accordance with column 3 of table 3.2, but ≥ 5 mm thick (see 311.1)
P3	Framed panel with lower edge ≥ 500 mm above highest abutting floor level	Annealed glass in accordance with table 3.3 (see 311.1)
P4	Panels framed on 3 sides, but not on top edge. Top edge ≥ 1500 mm above highest abutting floor level	Annealed glass in accordance with table 3.3 Grade A safety glazing material in accordance with table 3.1 (see 311.2(a))
P5	Panels framed on top and bottom edges and one or more sides unframed	Glazed in accordance with table 3.4 (see 311.2(b))

NOTE –

(1) Where panels may be mistaken for an unimpeded path of travel, refer to table 3.D3.

(2) Single pane partitions are to be considered as side panels, refer 305.3.1.

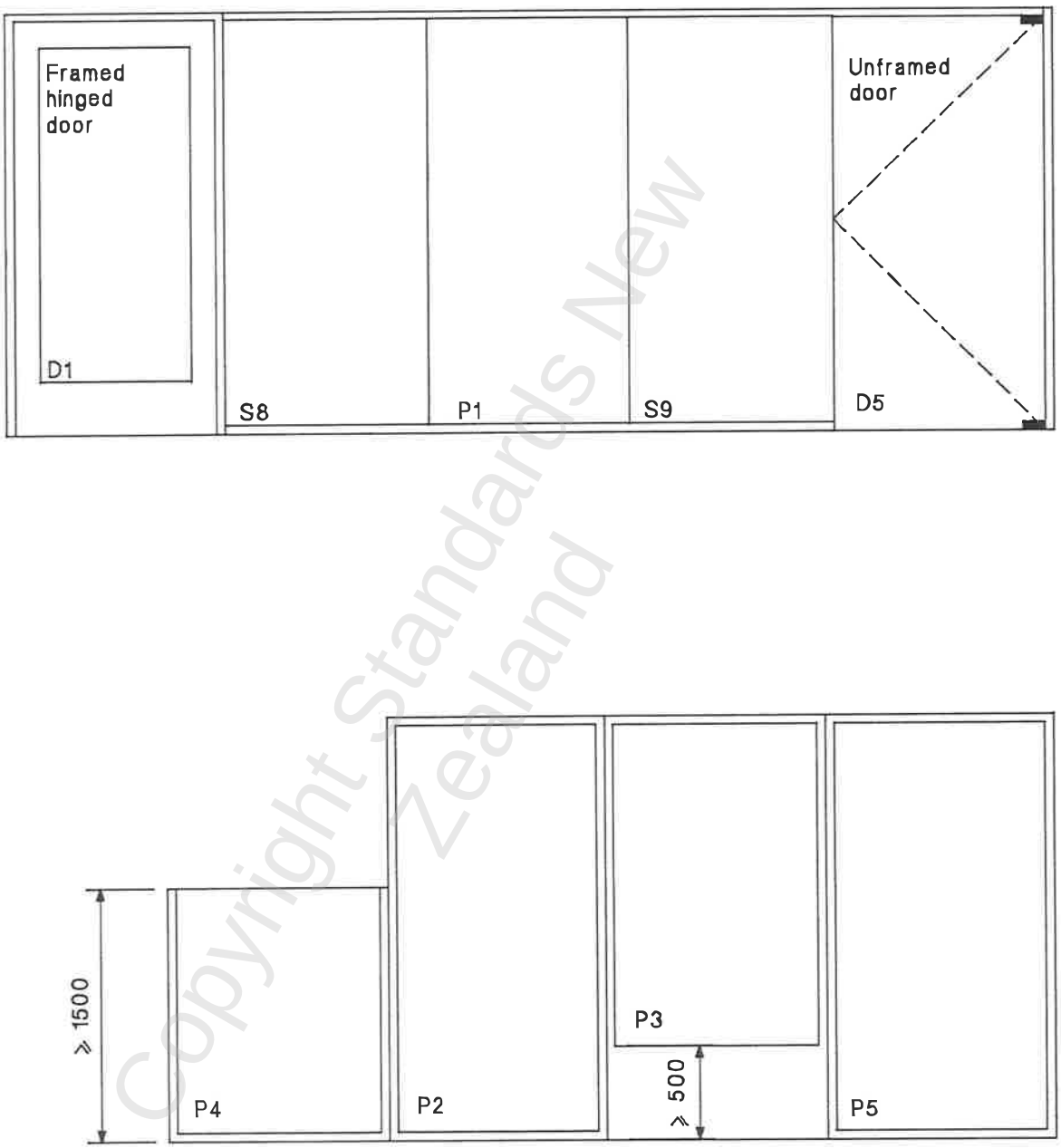
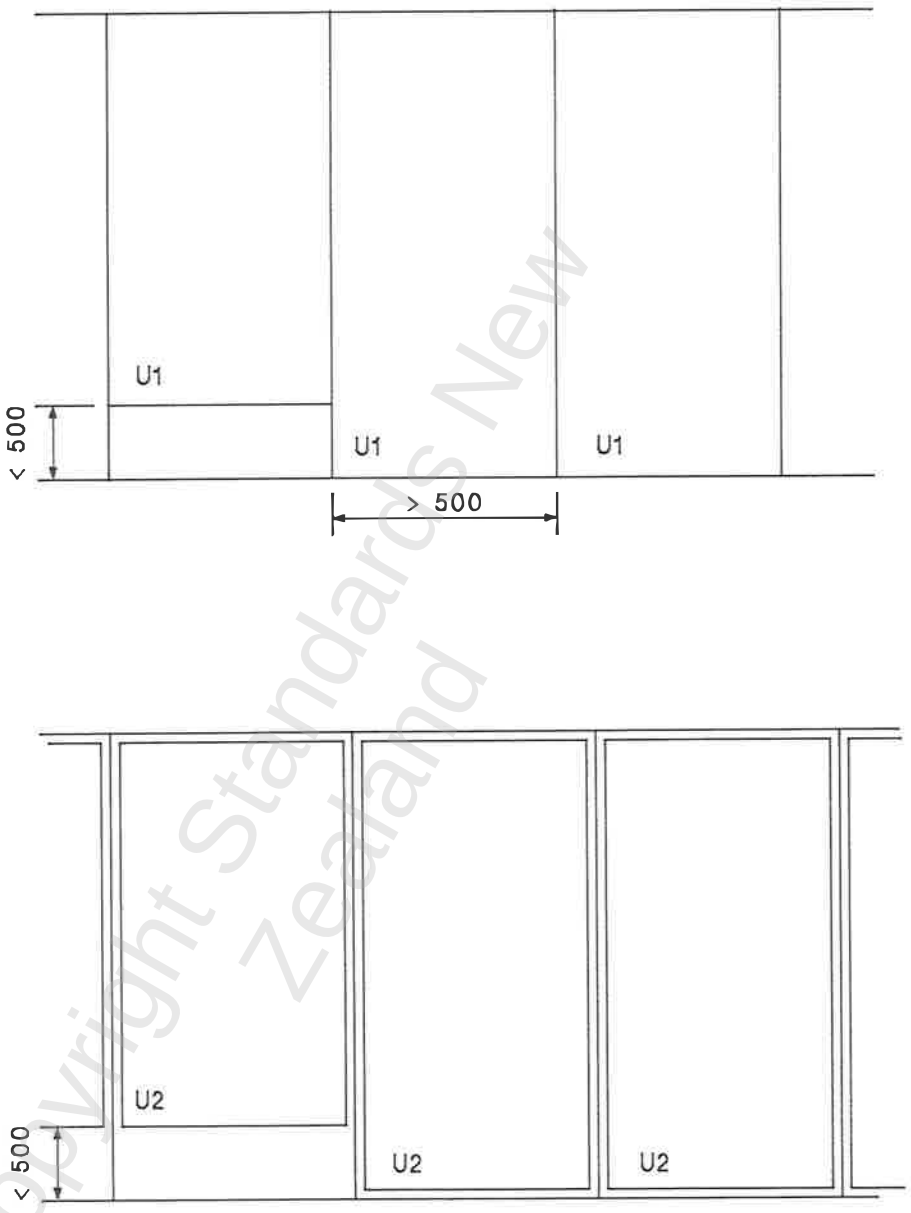


Figure 3.D2 – Typical examples of glazed internal partitions

Table 3.D3 – Human impact safety requirements for glazed panels capable of being mistaken for an unimpeded path of travel (refer figure 3.D3)

Panel designation	Panel details	Human impact safety requirements
U1	Unframed panels of width > 500 mm, or lower edge < 500 mm above the highest abutting floor level, or not marked to indicate presence of glazing and with no rail, or shop front display	Grade A safety glazing material in accordance with the requirements of table 3.4 (see 306.1 & 306.2)
U2	As U1 but framed	Grade A safety glazing material in accordance with table 3.1 (see 306.1 & 306.2)

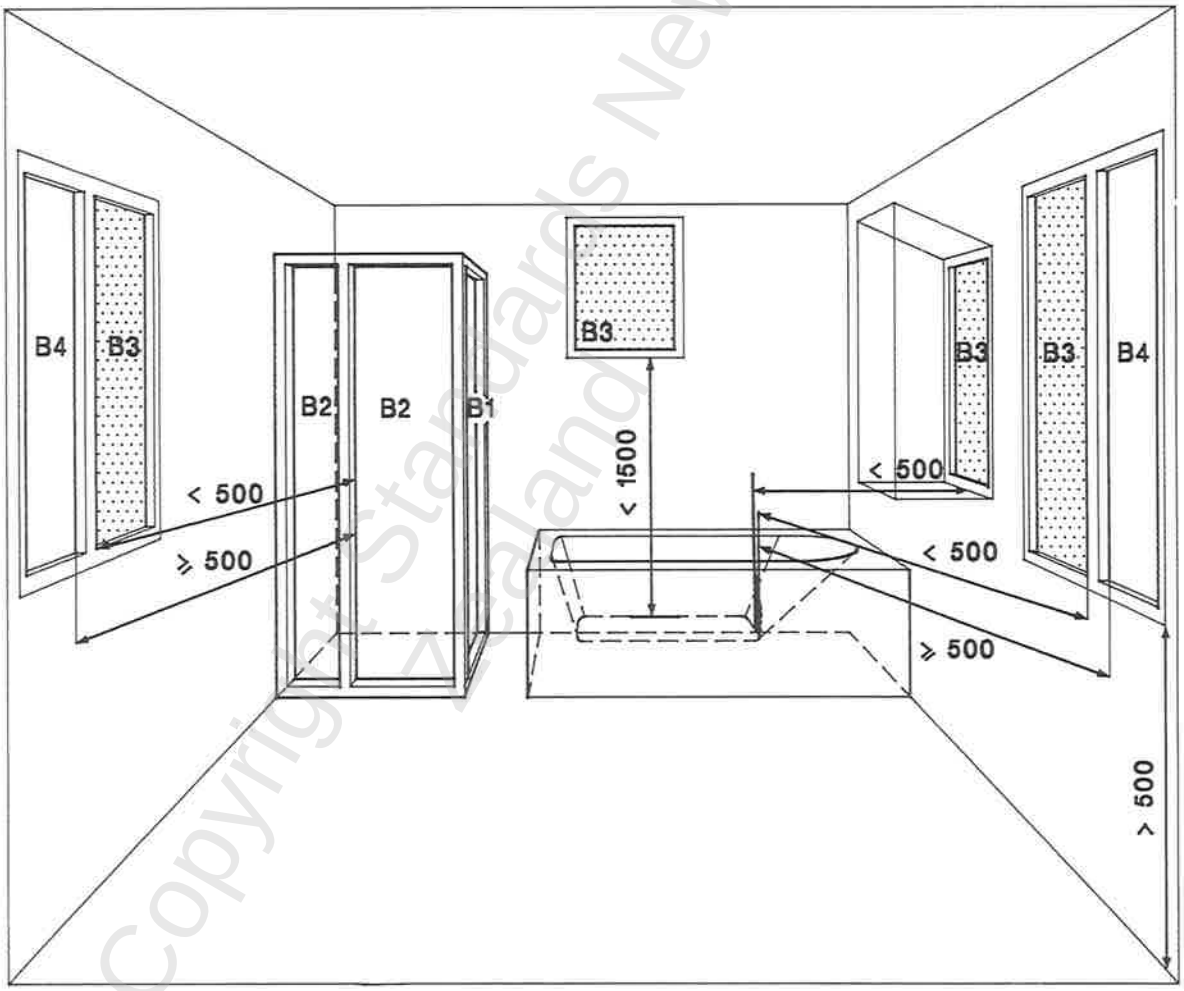


Legend:
U = Panel capable of being mistaken for an unimpeded path of travel

Figure 3.D3 – Typical examples of glazed panels capable of being mistaken for an unimpeded path of travel

Table 3.D4 – Human impact safety requirements for glazed panels and windows in bathrooms (refer figure 3.D4)

Panel designation	Panel details	Human impact safety requirements
B1	Panels and doors of any size within 1500 mm of the highest abutting floor level, shower or bath base	Grade A safety glazing material in accordance with table 3.1(a) (see 308.1)
B2	Panels and doors with one unframed edges	Toughened safety glass ≥ 5 mm thick unframed or two opposite (see 308.2)
B3	Panels or windows of any size within a horizontal distance of 500 mm of the standing area of bath or shower and within 1500 mm above the nearest abutting floor level or standing area of bath or shower	Grade A safety glazing material in accordance with table 3.1(a) (see 308.1 & 308.4)
B4	Windows of any size at a horizontal distance not less than 500 mm of the standing area of bath or shower	Select glass by reference to wind design charts in Part 1



Legend:
B = Shower doors, shower enclosures, bath enclosures and adjacent windows

Figure 3.D4 – Typical examples of glazed panels and windows in bathrooms

NOTES

THE NEW ZEALAND STANDARD CERTIFICATION MARK SCHEME

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