Fully framed glass panels

design elements

G1

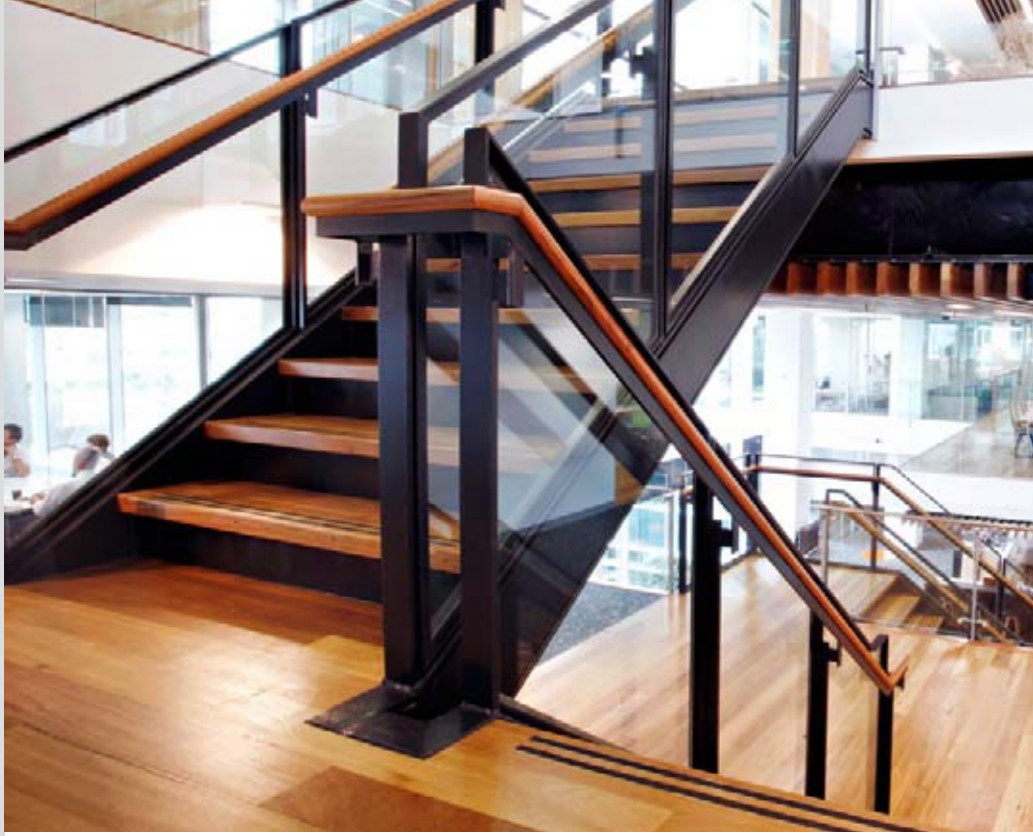
arden
ARCHITECTURAL STAIRCASES

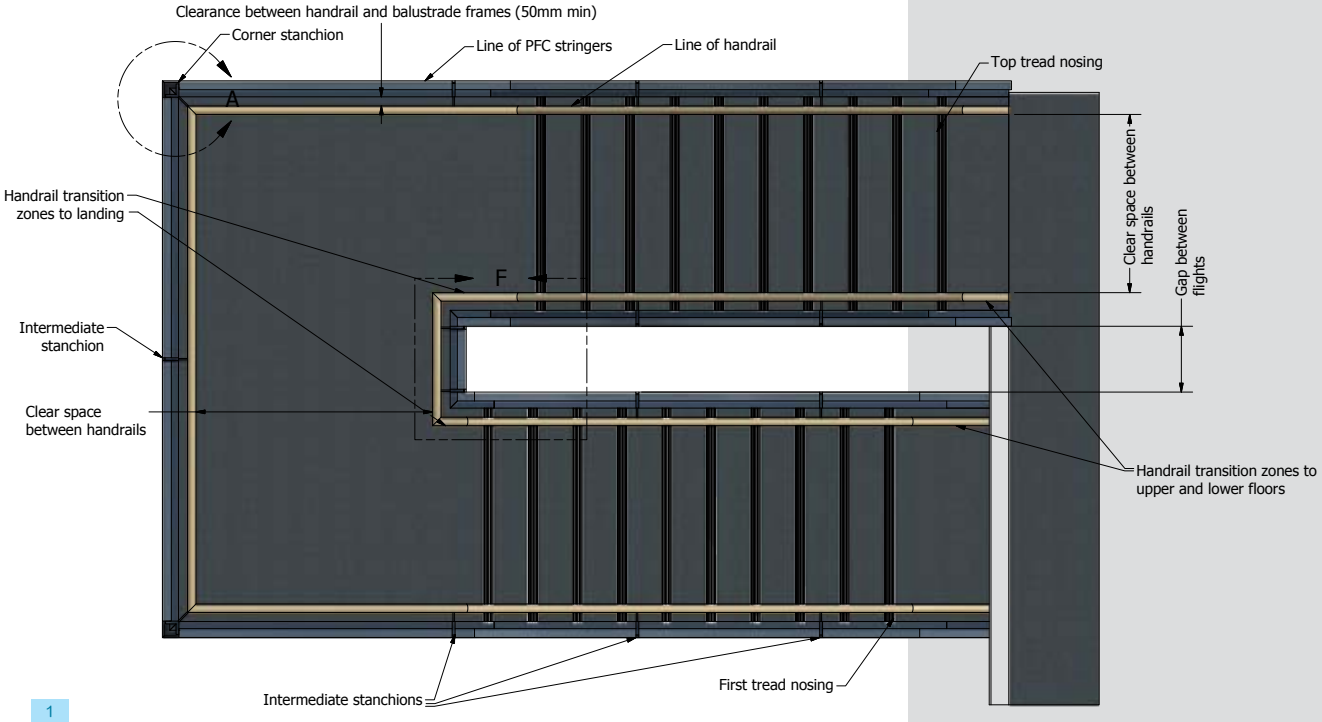
design

The G1 is a fully framed balustrade solution suiting a refined and deliberate architectural style. Rather than minimising the impact of the balustrade, as frameless systems do, the G1 emphasises and enhances the balustrade lines to generate its own design feature.

Characterised by flatness of profile and continuity of line, the panel frames define their own discrete collection of geometric shapes that relate logically to the lines of the staircase or void-edge. Point details are excluded in favour of vertical, horizontal, and raking lines. The linear perimeters of the panels are further defined by recessed stanchions in the vertical, and angle details are introduced at the interaction / transition points between raking and level sections. The final result is a balustrade solution that contributes to a polished and sophisticated architectural impression.

Many architects specify the G1 in order to create coherence with the surrounding architectural features, since windows and internal glass walls in most commercial fit-outs are generally framed. The G1 frame profile and materials may be specified to maximum coherence with the surrounding architectural components. The specification of the framing method and materials of the G2 may be modified to maximise similarity with nearby structures, so as to integrate the staircase or balustrade closely with the wider design.





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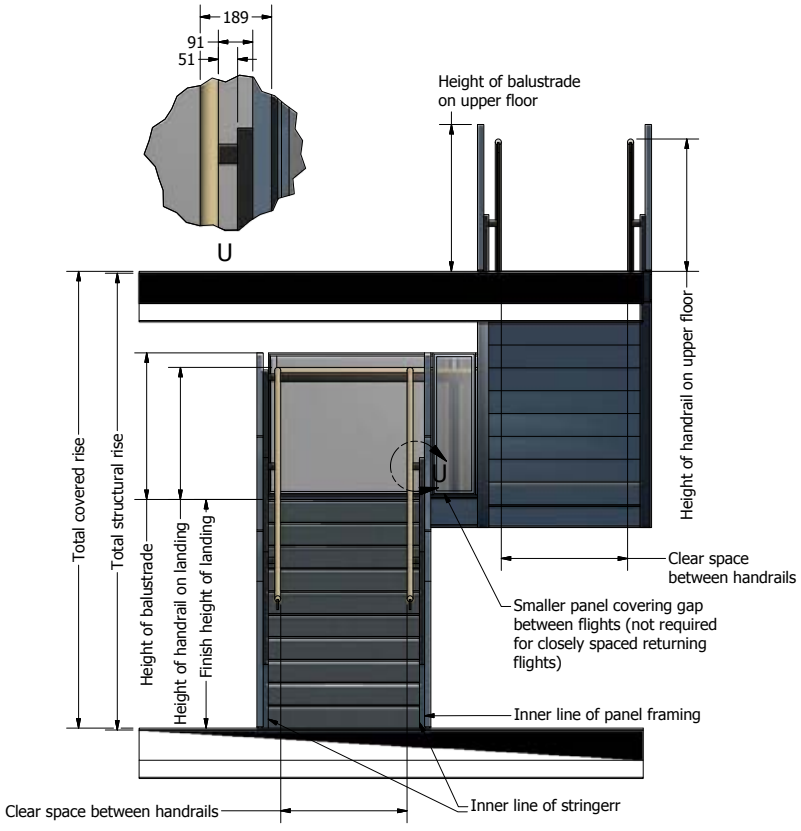

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Figure 1. Plan view of U-format staircase with fully framed panels. For successful fabrication and installation of fully framed glass panel balustrade, the design must be integrated carefully with the stringer design during the detailing phase. PFC stringers provide a convenient top surface upon which to mount balustrade panels.

Figure 2. Front elevation. Approximately 190mm must be allowed on either side of the traversable clear space between handrail to accommodate handrail, stanchions, balustrade framing and stringer.

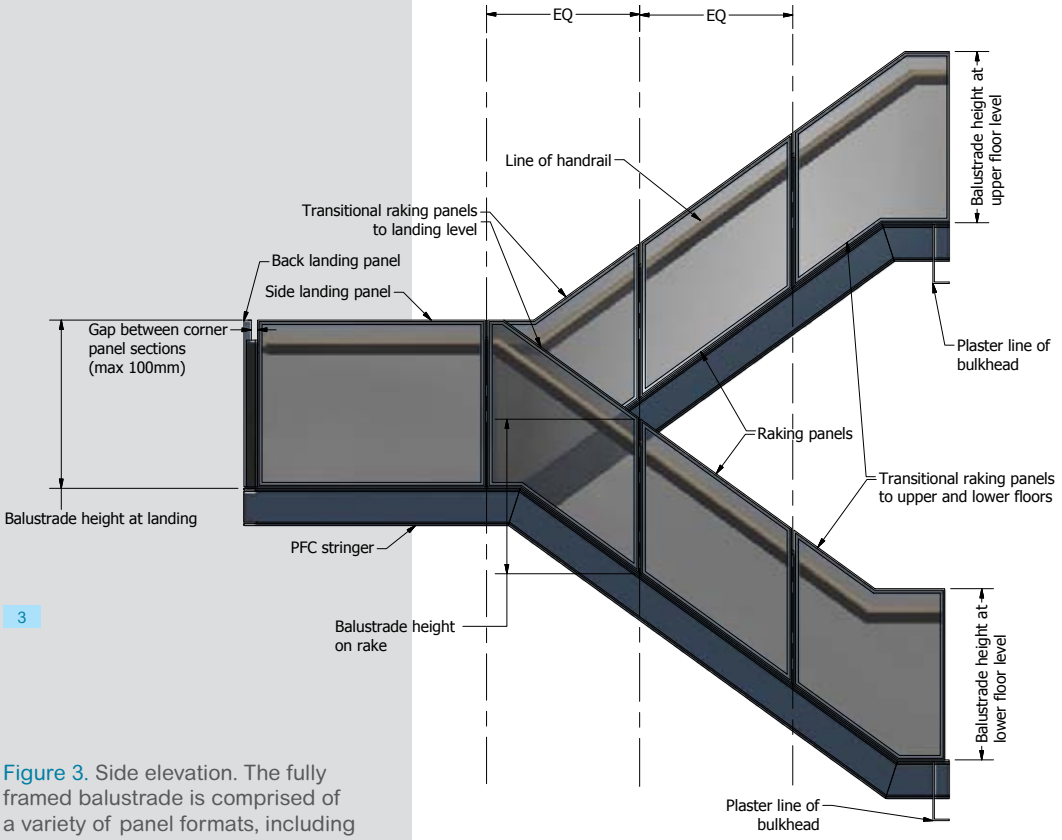

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Figure 3. Side elevation. The fully framed balustrade is comprised of a variety of panel formats, including level, raking, and transitional sections. Panels are supported on the bottom by a support plate fixed to the top face of the stringer and following the entire run of the staircase. Steel stanchions are located between panels, providing support for the framing and the handrail. As this elevation shows, care is taken to align, where possible, the stanchion locations on opposing flights. A priority is also to attempt to keep the relative dimensions of the variably shaped panels as close as possible, so that a natural balance of proportion is maintained.

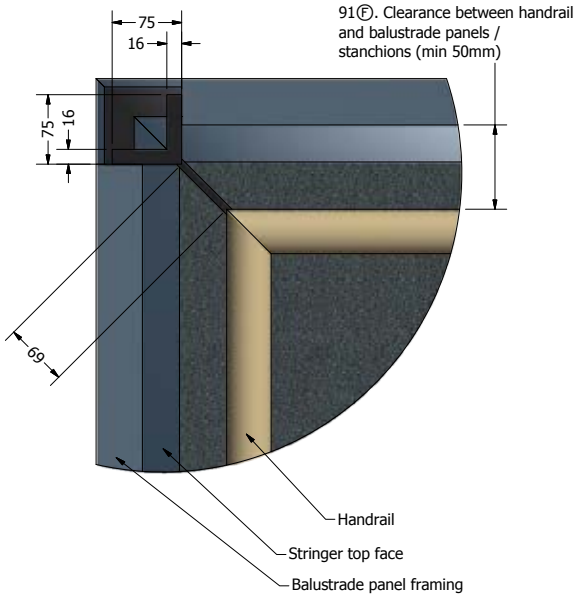

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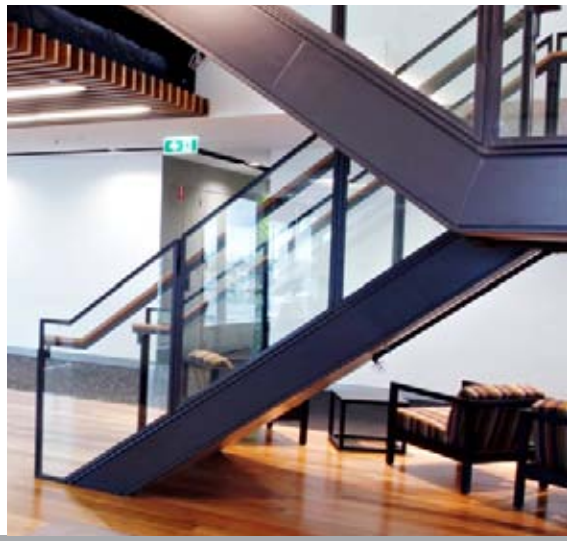
Figure 4. Plan view of landing corner detail. Corner stanchions usually provide the best method for connecting panels meeting at 90 degrees. To ensure compliance with Australian standards, minimum distances are maintained between stanchions / balustrade and the innermost point of the handrail.



Ⓕ indicated on dimensions denotes a nominal dimension that typically varies according to specific application, engineering requirements or client preferences.

technical

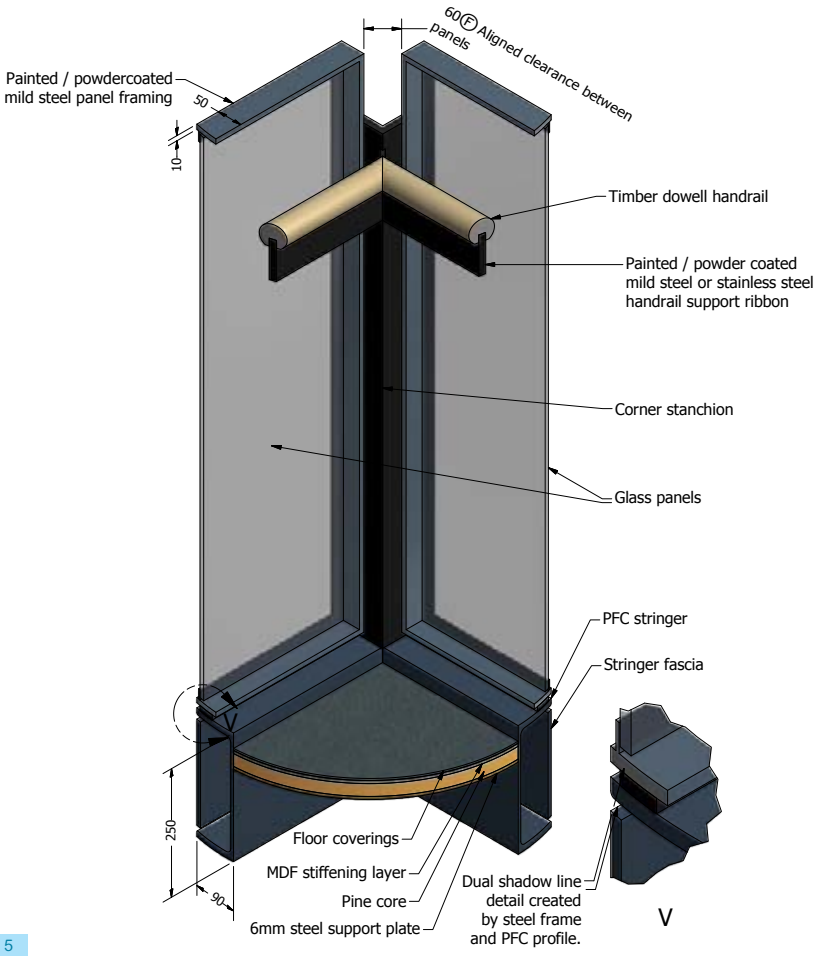
Because glass panels are fully framed, glass specifications can be reduced to as low as 6-8mm laminated safety glass, resulting is less expenditure on the glass component.

The G1 is defined by a fabricated frame around the full perimeter of each balustrade panel. Panels are typically glass, but other applicable glazing mediums can be used, including polycarbonate -based glazing plastics, Perspex, steel mesh or sheet metal. These frames are then fixed to stanchions positioned between panels, and to a recessed mounting strip that is itself fixed to the stringer or structural floor surface.

Handrails may be mounted from stanchions (which maintains compliance with 1428 disability code), or the framing at the top edge of each panel may be modified to create an effective timber or steel handrail.

Figure 5. Landing corner section isometric view providing an overview of the balustrade interaction with handrail and the supporting stringer design. A typical installation of the G1 on a PFC stringer and composite tread staircase is illustrated. Shadow line details often well- suit a G1 installation, but may be avoided if required.

Figure 6. Plan view of upper and lower flight return section detail. The transitional zone where balustrade, handrail and stringer lines change direction in a relatively constrained space. The integrated 3D modelling design approach favoured by Arden ensures that all design issues can be addressed before fabrication commences.



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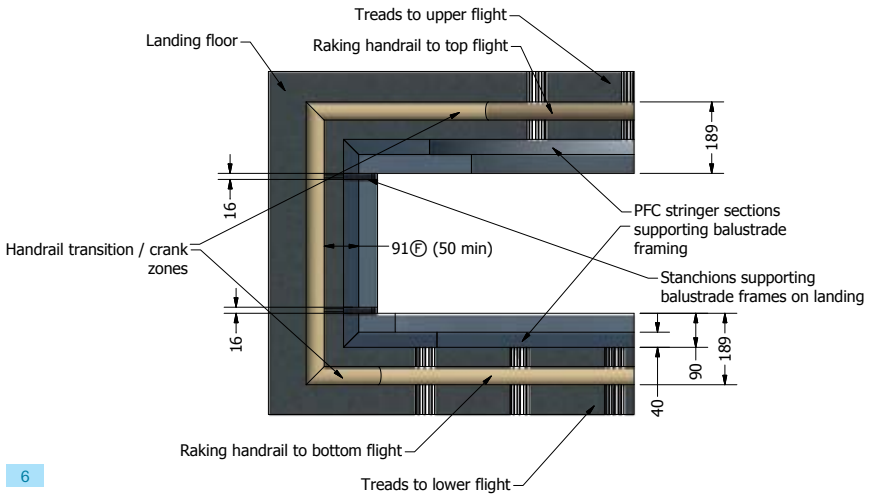

Treads to upper flight
Landing floor
Raking handrail to top flight
189
16
PFC stringer sections supporting balustrade framing
Handrail transition / crank zones
91Ⓕ (50 min)
Stanchions supporting balustrade frames on landing
16
90
189
40
Raking handrail to bottom flight
Treads to lower flight

6

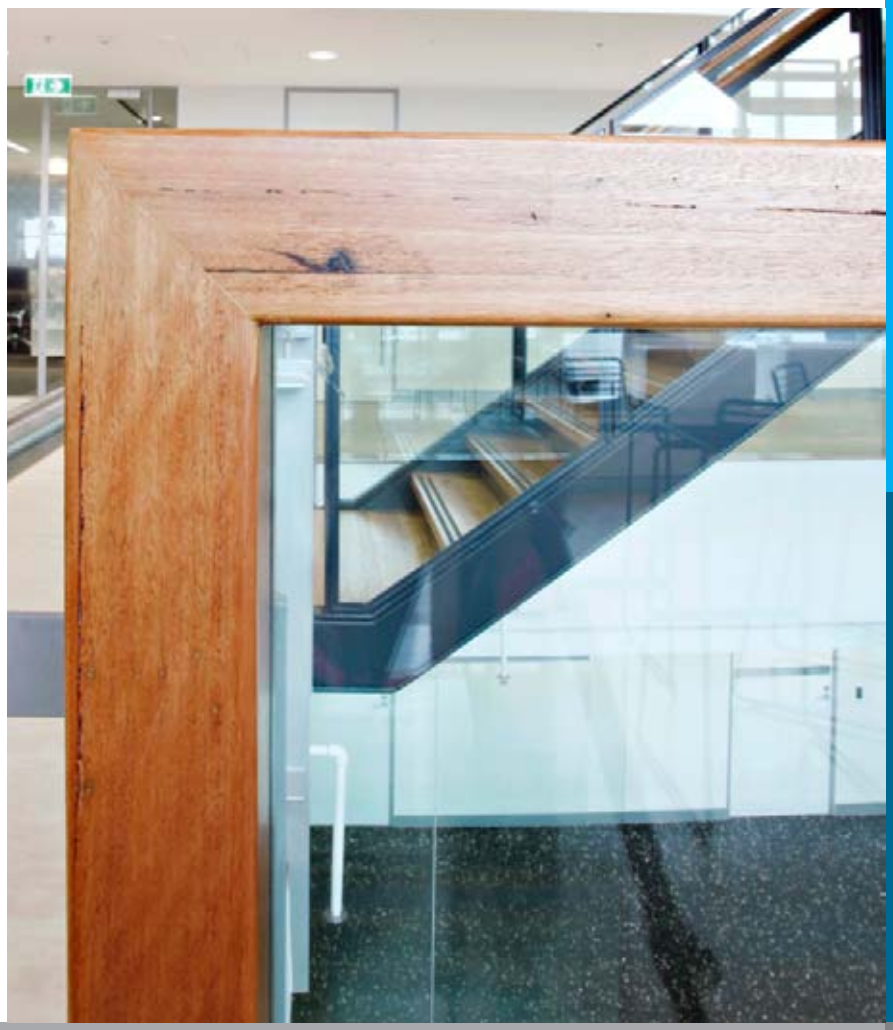
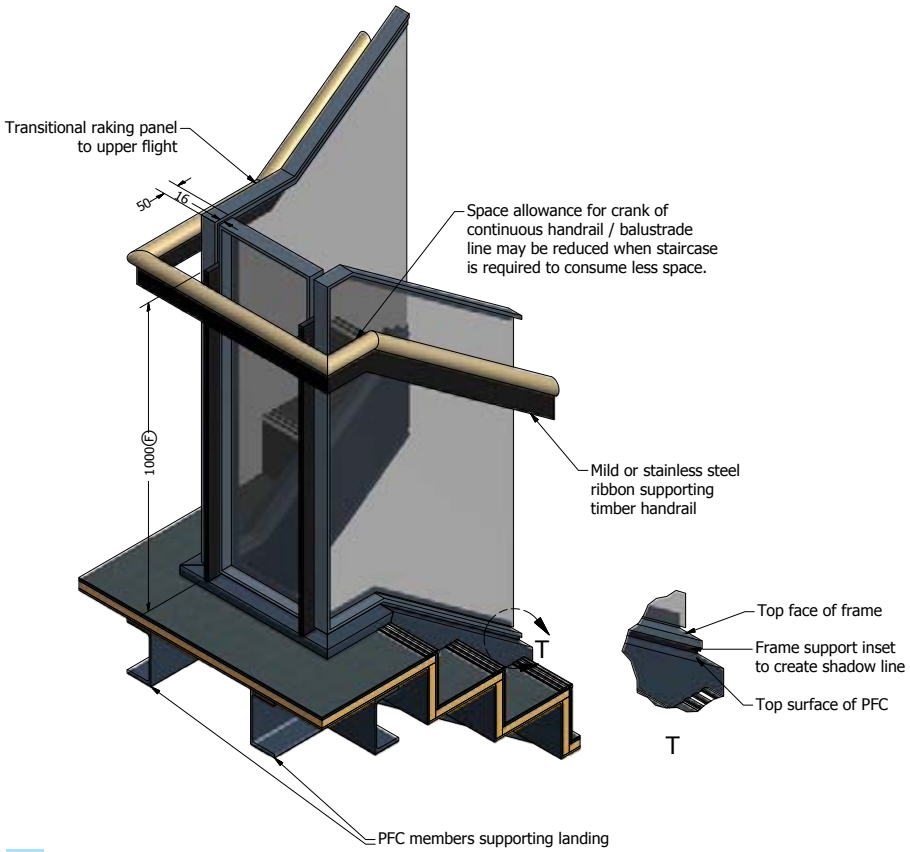


Figure 7. Isometric view of upper and lower flight returns section. If handled correctly, zones of transition and interaction can comprise the most attractive parts of a staircase design. The illustrative example shown provides a relatively generous allowance for handrail and balustrade to transition to differing level and raking heights. Via flexible model optimisation, Arden can determine the minimum required space to achieve continuous lines.



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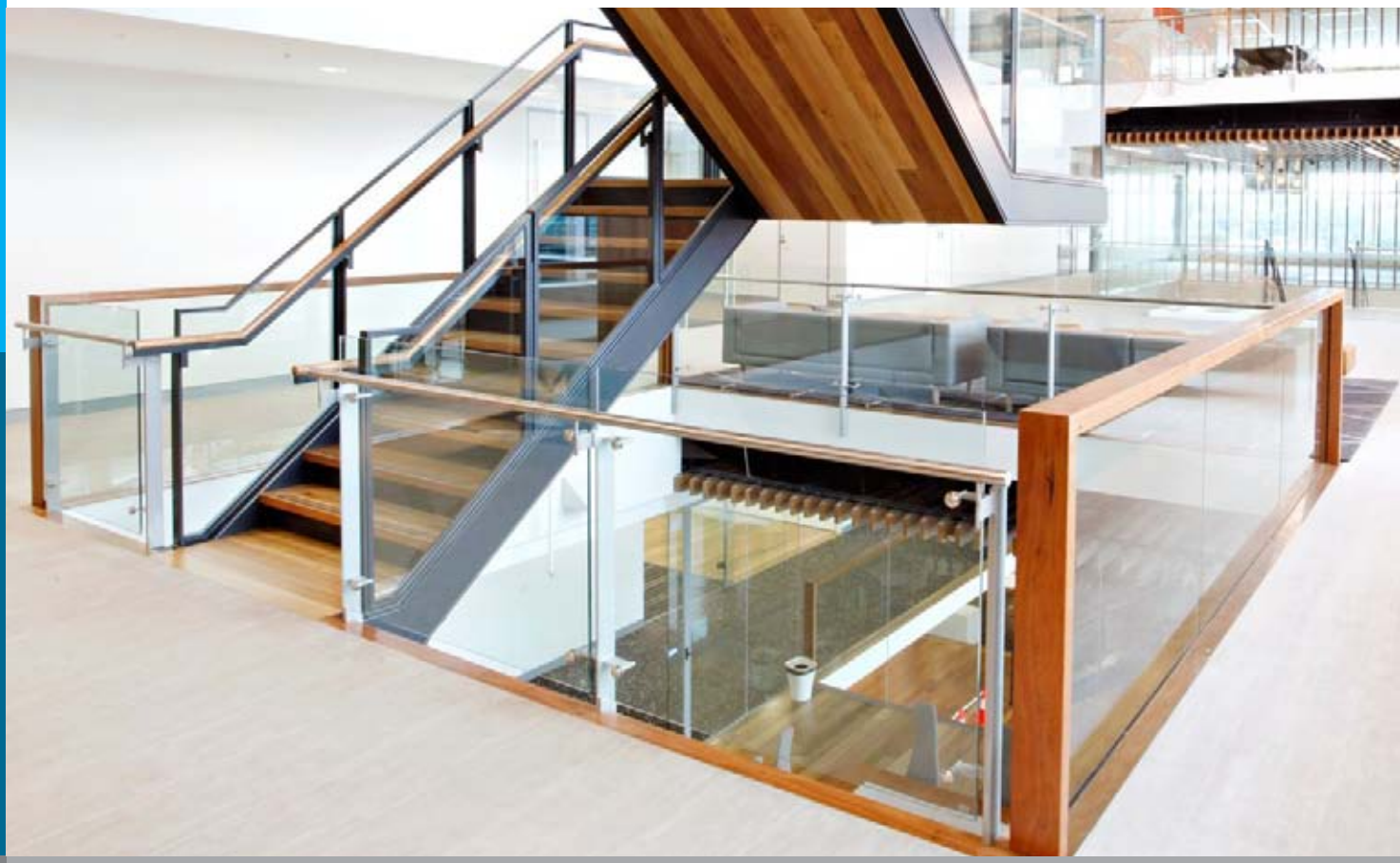

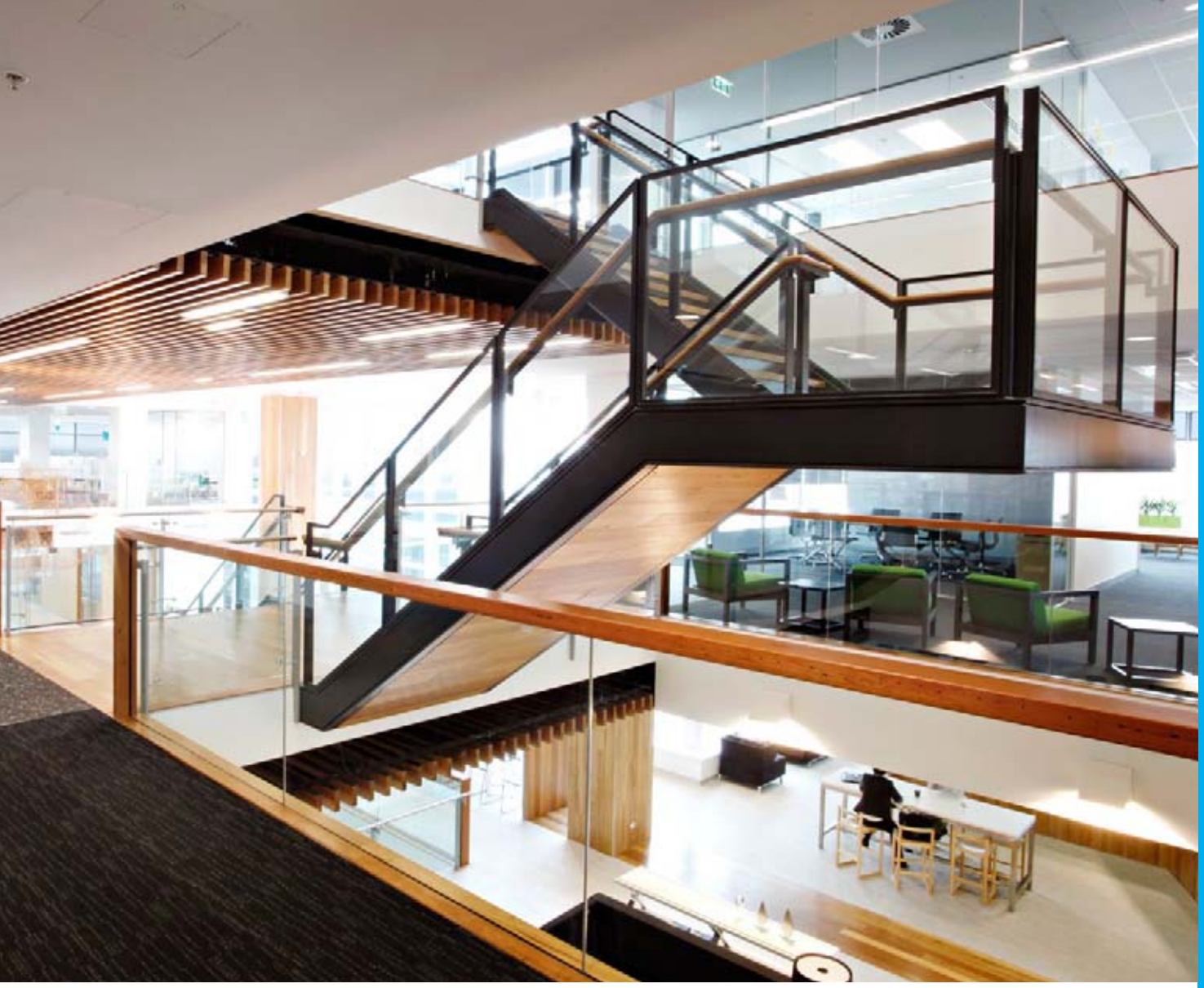

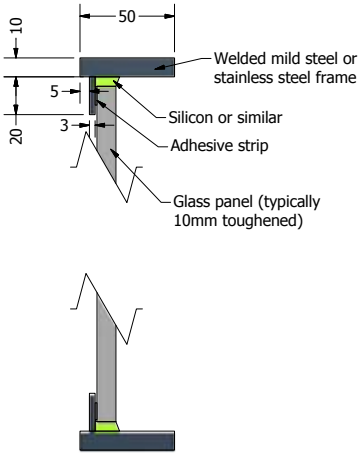

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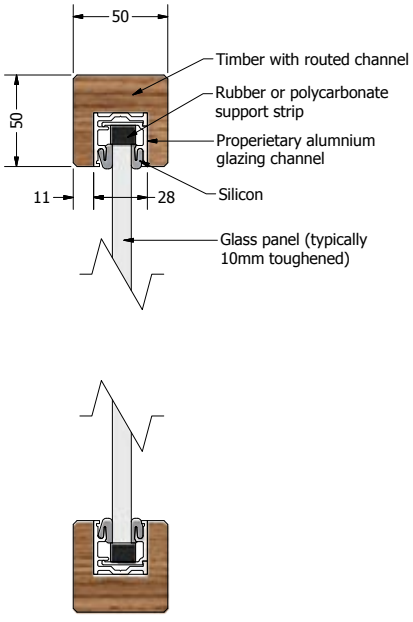

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Figure 8. Balustrade panel profile section of fabricated steel panels. This is proven successful design that may be adopted by designers and architects. However, given that minimum structural requirements are met, a variety of profile designs can be applied.

Figure 9. Balustrade panel profile section of mitred timber panels. Since the panels are supported by stanchions, the G1 balustrade style may incorporate mitred timber framing, and still conform to relatively high design loads.

Ⓕ indicated on dimensions denotes a nominal dimension that typically varies according to specific application, engineering requirements or client preferences.

infill glass panels

This table shows the recommended maximum glass span (mm) depending on design load.

	Annealed laminated safety glass (mm)				Toughened monolithic safety glass (mm)			Toughened laminated safety glass (mm)		
Design load	6	8	10	12	8	10	12	10	12	16
Domestic/Residential	910	1210	1490	1770	1640	2000	2300	1980	2290	2830
Offices/Commercial stairs	640	850	1050	1250	1070	1650	1930	1630	1920	2380
Retail/Restaurant	520	690	860	1020	1140	1430	1730	1420	1720	2150
C5 high loads	Special glass engineering: designed as required									

Notes

1. These tables are to be used as a general design guide only.
2. Individual project requirements will dictate final glass specification and thickness.
3. All spans nominated are indicative of normal internal conditions. In some exposed situations, wind loads may exceed design load and thicker glass or smaller spans may be required.

design standards for glass panels

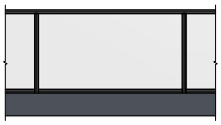
Glass balustrade panels must satisfy engineering requirements as specified in AS1288, and the Arden balustrade styles shown here are defined and specified with regard to the relevant design standards.

Of particular importance in the initial design stage, it is critical to maintain an awareness of the designation of glass panels as structural or infill, and the classification of handrail as load-supporting, non-load-supporting, or interlinking. Combined with other considerations (e.g. whether or not mechanical point-fixings are specified, span is cantilevered or supported on both sides), this determines the grade of glass (e.g. laminated annealed, toughened safety, laminated toughened) and type of handrail that satisfies the code.

As in other aspects of stair and balustrade design, Arden will advise with respect to the practicability of preliminary designs with respect to Australian standards.

glass balustrade styles

Cantilevered structural. Glass panels supporting an interlinking handrail cantilever from an appropriate floor fixing.



Fully framed. Glass panels are provided with four-edge support and are therefore rated as infill only.

Two-edge clasp. Glass panels are supported on two opposite edges by clasp-style mechanical fixings. The bearing of point loads influence the required grade of glass.

Semi-framed vertical channel. Glass panels are fixed via proprietary or custom channel system on each side.

Two-side patch-fitting. Glass panels are supported on two opposite sides by through-glass mechanical fixings. The bearing of point loads influence the required grade of glass. Stanchions may be located between, or at intermediate locations within, each panel span.

Semi-framed lateral channel. Glass panels are fixed via proprietary or custom channel system on the bottom rail and underside of handrail.

Hybrid. Glass panels are provided with a combination of the above methods so as to comply with safety requirements.

compliance

Arden is a BSA licensed contractor for carpentry, joinery, glass, glazing and aluminium as well as structural metal fabrication and erection. Arden supplies a Form 16 (Licensed Contractor) on all projects. In design and construct contracts, a Form 15 (Design Engineer) certification is supplied upon request. For products and services incorporating the G1 system, this table shows compliance with relevant codes and standards.

Key

- ● full compliance with the code
- ○ not applicable to this element

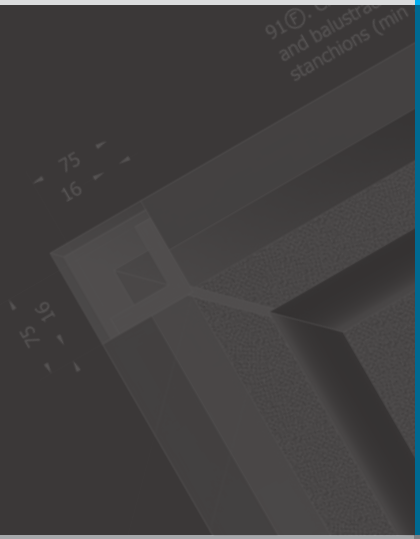
Code	Title	Applicability
BCA	The Building Code of Australia	●
AS NZS 1170.1-2002	Structural Design Actions – Permanent, imposed and other actions	●
AS 1288-2006	Glass in Buildings. Selection and installation.	●
AS NZS 1554.1-2004	Structural steel welding - Welding of steel structures	●
AS 1554.6-1994	Welding stainless steels for structural purposes	●
AS NZS 4586-2004	Slip resistance classification of new pedestrian surface materials	○
AS 1428.1-2009	Design for access and mobility	●
AS 1657-1992	Fixed platforms, walkways, stairways & ladders. Design, construction and installation	●

design note

For all commercial applications, it is important that sufficient space for the stairwell cavity be allowed to satisfy Australian Standards and BCA requirements.

The footprint is primarily driven by the floor to floor rise, as well as the staircase configuration chosen. However, stringer and balustrade style design may increase the amount of space required. Allowing too small a cavity can restrict the design options of the staircase. Also, points at where the staircase interacts with other structures are best addressed early in the design cycle.

Consultation with Arden early on will help ensure that these design issues can be addressed in a cost-effective manner.



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