



# The Ultimate Guide to Handrail & Balustrade Compliance

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# Contents

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Overview	03
A Summary of the Handrail Requirements under AS 1428	04
A Summary of the Handrail Requirements under AS 1657	05
A Summary of the Handrail Requirements under the Austroads Guide to Road Design Part 6A	6-7
A Summary of the Handrail Requirements under the NCC 2016 BCA Section D2.16	08
<b>DESIGN TIPS - Disability Ramps</b>	<b>09</b>
Handrail Terminations on Ramps under AS 1428	10
Top Mount Inline Handrails	11
Circulation Space for Wheelchair Turns - 30° to 90°	12
Location of Ramps to Prevent Protrusion of Handrails at Property Boundaries	13
Ramps that Return or Double-Back	14
Kerbrail Ramp Requirements under AS 1428	15
<b>DESIGN TIPS - Stairs</b>	<b>16</b>
Stairway Location and Handrail Extensions at Internal Corridors	17
Top and Wall Mounted Handrails Substrate Requirements on Stairs	18
Compliant Handrail Positioning on Intermediate Landings	19
<b>DESIGN TIPS - Other Scenerios</b>	<b>20</b>
Handrail Compliance in a Class 9B Building used as a Primary School	21
Handrail Requirements on Step-Type Ladders under AS 1657	22

## Handrail Design in Australia – Which standard do I use?

### BUILDINGS:

#### *Reference Documents*

The National Construction Code contains performance requirements for the construction of buildings. This code provides the minimum necessary requirements for safety, health, amenity and sustainability in the design and construction of new buildings and any new building work in existing buildings throughout Australia. The volumes that must be used for the design of building handrails are:

- Volume 1 – Building Code of Australia (BCA) – Covers Class 2 to 9 buildings which are commercial, industrial, and multi-residential buildings.
- Volume 2 – Building Code of Australia – Covers Class 1 and Class 10 buildings which are residential and non-habitable buildings.

These volumes cover:

The geometric requirements of handrails (For example, handrail height must be a minimum of 865mm, so that they are comfortable to use for most people and provide sufficient stability, support, and assistance). They also refer to two Australian Standards for the design loads that the handrails and its fixings must withstand:

- AS 1657 – This standard covers the design requirements of mezzanines, stairways, walkways, and service platforms to provide safe access to places generally used by operating, inspection, maintenance, and service personnel. This standard does not apply to areas that are accessible to the general public such as apartment balconies, rooftop gardens or similar or to situations where special provision is made in appropriate building or other regulations e.g. way of escape from fire.
- AS 1428 – This standard sets out the minimum design requirements for access and mobility on new building work to enable access for people with disabilities. It covers aspects of access to and within a building. It does not cover Class 1a or 1b buildings (private dwellings) and non-common areas in Class 2 buildings (e.g. block of units). However, it may be used as a legal reference.

### ROADS - WALKING & CYCLING PATHS

#### *Reference Documents*

The Austroad Guide to Road Design Part 6A is the reference document that must be used for designing handrails on pedestrian and cycling path projects to keep cyclists and pedestrians safe on a cycleway. It provides guidance on the geometric design of handrails on paths for safe and efficient walking and cycling within and outside the road corridor.

The design of paths may also be influenced by design considerations and requirements covered in other parts of the Guide to Road Design that need to be considered within roadsides. In particular, designers should also refer to:

- Guide to Road Design Part 6: Roadside Design, Safety and Barriers.
- Guide to Road Design Part 6B: Roadside Environment.

Please note that Guide to Traffic Management in relation to traffic management devices and requirements may also need to be considered as this may also influence the design.

# A Summary of the Handrail Requirements under AS 1428

The AS 1428 standard defines the minimum design requirements for mobility access on new building work to enable safe access for people with disabilities, with particular attention on:

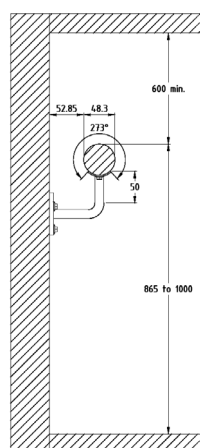
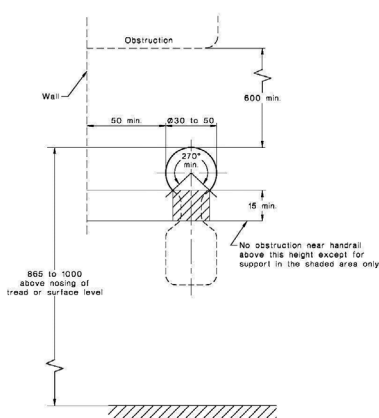
- Continuous accessible paths of travel and circulation spaces for people who use wheelchairs;
- Access and facilities for people with ambulatory disabilities;
- Access for people with sensory disabilities.

## When is a handrail required?

Handrail is required to both sides of a stair/ramp, with a minimum of 1000mm clearance between both handrails.

## What are the height regulations for a handrail?

- The top of the handrail must be not less than 865mm or greater than 1000mm from the nosing of a stair or the plane of the finished floor level on a ramp, walkway or landing.
- Handrail height shall be consistent throughout the ramp, stair and landing.
- The dimensions indicating the heights of handrails shall be taken vertically from the nosing of the tread to the top of the handrail.
- If a balustrade is required at a height greater than the handrail, both shall be provided.



## Further Design requirements:

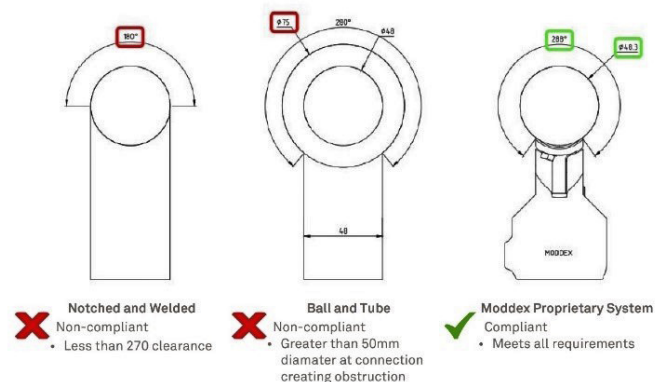
Under AS 1428.1-2009 Clause 12, handrails shall be designed to comply with the following:

- The cross-section of the handrail must be circular or elliptical, with a height & width of not less than 30mm or greater than 50mm for 270° around the uppermost surface. The horizontal axis on elliptical handrail must be the axis with the greater dimension.
- A clear space between a handrail & an adjacent wall or other obstruction must not be less than 50mm. A clear space of 600mm is also required above the top of the handrail.
- Handrails are to have no obstruction to the passage of a hand along the rail.

Please note that there are more requirements stated under Clause 12 and that the above list is only a small selection of them. For full AS 1428 requirements you can visit

<https://www.standards.org.au/>

The below comparison shows the requirements detailed in AS 1428.1-2009 Clause 12 and whether it's compliant:





# A Summary of the Handrail Requirements under AS 1657

## When is a handrail required?

Australian Standard AS 1657 states that handrailing is required on exposed sides of platforms, walkways and landings when the height exceeds 300mm.

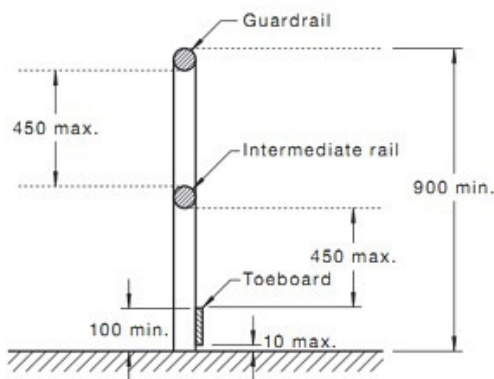
When it comes to constructing handrail, there are a surprising number of regulations that apply.

Some of the most vital regulations concern how high the handrail should be designed, the height of the platform or base the handrail is being installed on, and whether a handrail or barrier is required. These requirements have been developed specifically to prevent height-related injuries, especially for platforms or mezzanines located high above ground where a fall could cause serious injury or death.

## What are the height regulations for a handrail?

The height of a handrail, measured vertically above the floor, walkway surface or the nosing of a stair tread, shall not be less than 900mm or greater than 1100mm, as shown in figure 6.1.

The height of the top of the handrail shall be consistent through the ramp (or stairs) and any landings.



DIMENSIONS IN MILLIMETRES

FIGURE 6.1 TYPICAL GUARDRAILING—KEY DIMENSIONS

## When is a toeboard or kickplate required?

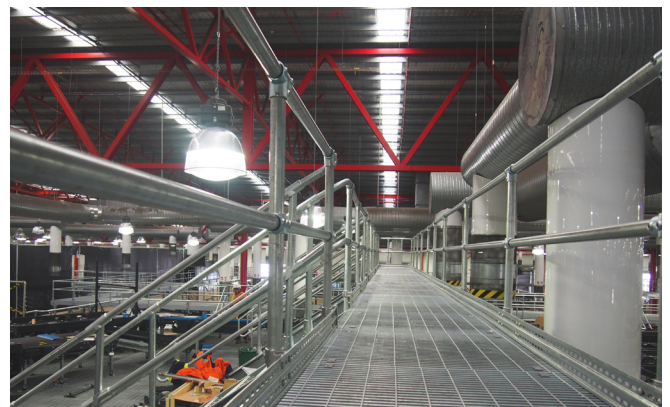
Where an object could fall from a platform or landing onto an area where persons have access to the area below and to the side of the walkway, a toeboard needs to be installed.

A toeboard shall be installed on the edge of a walkway where there is no permanent structure within 10 mm of the edge. Any gap between the underside of the toeboard and the walkway surface shall not exceed 10 mm. The top of the toeboard shall be not less than 100 mm above the floor.

## Design Requirements:

Where guardrailing/handrailing is of post and rail construction, the following requirements apply:

- They shall consist of a top rail— supported by posts at intervals as necessary to meet the specified imposed actions; parallel to the floor or, where used on a sloping walkway, parallel to the slope of the walkway.
- One or more intermediate rails shall be provided parallel with the top rail and spaced such that the maximum clear space between the rails or between the lowest rail and toeboard, where fitted, shall not exceed 450 mm.
- Where no toeboard is installed, the clear space between the lowest rail and the floor shall not exceed 560 mm.





## A Summary of the Handrail Requirements under the Austroads Guide to Road Design Part 6A.

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Below is an extract from the Austroads Guide to Road Design so you can see at a glance what is required to keep cyclists and pedestrians safer on a cycleway.

The installation of a barrier at the side of a path used by cyclists is desirable where:

- There is a steep batter or large vertical drop located in close proximity to the path.
- The path is adjacent to an arterial road and it is necessary to restrict cyclist access to the road.
- A bridge or culvert exists on a path.
- A hazard exists adjacent to a particular bicycle facility.
- Cyclists are likely to be 'blazing a separate trail' at an intersection between paths or around a path terminal.

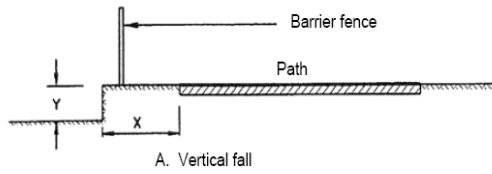
Moddex barrier system used for shared pathways, complying with the recommendations in the Austroads Guide to Road Design.

Fences may also be required where a sharp turn or curve in a pathway occurs after a downhill grade, to prevent cyclists from potentially misjudging the speed required to take the turn or curve which could lead to them coming off the pathway. Treatments in these situations should be guided by a risk assessment of the area to best reduce any potential risks.

Figure 5.10 below provides a specific recommendation for the provision of a fence on a path in close proximity to a steep batter or vertical drop. This also details the circumstances in which either a partial barrier fence (Figure 5.11 - Page 7) or full barrier fence (Figure 5.12 - Page 7) or equivalent form of protection should be used.

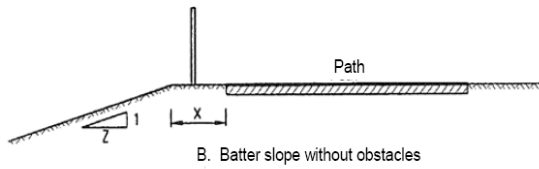


**Figure 5.10: Requirement for fence barriers at batters and vertical drops**

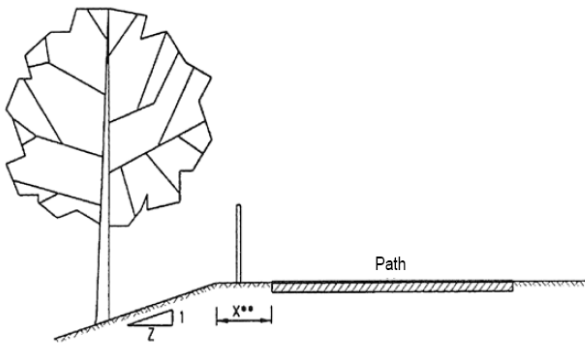


	X (m)	Y (m)
Fence not required*	<2	<0.25
Partial barrier fence required	<5	0.25 to 2
Full barrier fence required	<5	>2

\* Batter off the surface where fall is within 1 m of path.



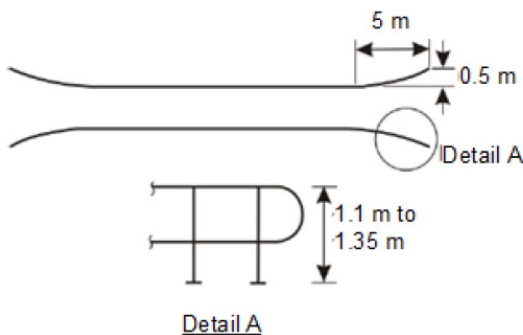
	X (m)	Z (m)
Fence not required	<1 1 to 5	>8 >3
Partial barrier fence required	<5	1 to 3
Full barrier fence required	<5	<1



	X (m)	Z (m)
Fence not required	<1 1 to 5	>8 >4
Partial barrier fence required	<5	3 to 4
Full barrier fence required	<5	<3

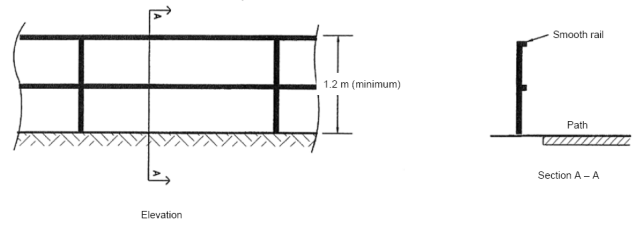
\*\* Barrier fence required if obstacle within 1 m of path.

**Figure 5.13: Example of flared bicycle rail terminal**

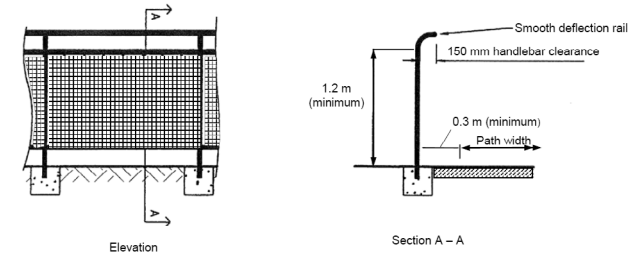


Source: Queensland Department of Transport and Main Roads (2015a).

**Figure 5.11: Example of a partial barrier fence**



**Figure 5.12: Example of a full barrier fence**



The minimum height of a fence should be 1.2m and should only be used where the severity of the hazard is considered to be low. A higher fence (→ 1.4m) should be considered where the fence is protecting path users from a very severe hazard (high falls, water hazards etc.) or at a location where there is a risk of the cyclist being vaulted off their bicycle if they collide with the fence, like the sharp turn after a downhill fall mentioned above.

Where barrier fencing with vertical components or balusters is provided directly adjacent to a path, consideration should be given to including a cyclist deflection rail (Figure 5.12). Cyclist deflection rails are designed to enable a cyclist to deflect off the smooth horizontal rail, striking the rail between the cyclists shoulder and elbow (between 1.2m and 1.4m from path surface) so that their handlebars (typically 1.0m from surface level) do not get caught in the vertical components of the fence.

The termination of the fence also needs to be considered to avoid it being a hazard to cyclists. An example of a termination which has been flared away from the line of the rail to reduce the likelihood of a cyclist colliding into the end of the rail is shown in Figure 5.13.

# A Summary of the Handrail Requirements under NCC 2016 BCA Section D2.16.

Under the NCC 2016 BCA Section D2.16, a continuous barrier must be provided along the side of:

- A roof in which general access is provided; and
- A stairway, ramp, floor, corridor, hallway, balcony, deck, verandah, mezzanine, access bridge or similar; and
- Any delineated path of access to a building

If the trafficable surface is 1 m or more above the surface beneath, in the areas listed above.

A barrier required under the above must be constructed in accordance with the table below.

Please note, the heights are measured vertically from the surface beneath, except for stairways where the height must be measured vertically from the nosing line of the stair. A transition zone can also be incorporated where the barrier changes height from 865 mm on a stair flight or ramp to 1 m at a landing or floor.<sup>2</sup> The maximum 125 mm barrier opening for a stairway is measured above the nosing line of the stair treads.

Please note that the list to the left & table below is only a small snippet of the compliances detailed under NCC 2016 BCA Section D2.16 for barriers. The standard must be read in full to understand all of the compliances required to create a compliant barrier system.

1. Barrier Heights <sup>1</sup>	
<i>Location</i>	<i>Minimum Height</i>
<ul style="list-style-type: none"> <li>• Stairways or ramps with a gradient of 1:20 or steeper</li> <li>• A landing to a stair or ramp where the barrier is provided along the inside edge of the landing and does not exceed 500 mm in length</li> </ul>	865 mm
<ul style="list-style-type: none"> <li>• In other locations</li> </ul>	1 m
2. Barrier Openings <sup>2</sup>	
<i>Location</i>	<i>Maximum Opening</i>
<ul style="list-style-type: none"> <li>• Fire-isolated stairways, fire-isolated ramps and other areas used primarily for emergency purposes, excluding – external stairways; and               <ul style="list-style-type: none"> <li>• external ramps</li> </ul> </li> <li>• Class 7 (other than carparks) and Class 8 buildings</li> </ul>	A 300 mm sphere must not be able to pass through any opening; or  where rails are used - <ul style="list-style-type: none"> <li>• A 150 mm sphere must not be able to pass through the opening between the nosing line of the stair treads and the rail or between the rail and the floor of the landing, balcony or similar; and</li> <li>• The opening between rails must not be more than 460 mm</li> </ul>
<ul style="list-style-type: none"> <li>• In all other locations</li> </ul>	A 125 mm sphere must not be able to pass through any opening
3. Barrier Climability	
<i>Location</i>	<i>Requirement</i>
<ul style="list-style-type: none"> <li>• Fire-isolated stairways, fire-isolated ramps and other areas used primarily for emergency purposes, excluding –               <ul style="list-style-type: none"> <li>• external stairways; and</li> <li>• external ramps</li> </ul> </li> <li>• Class 7 (other than carparks) and Class 8 buildings</li> </ul>	No requirement
<ul style="list-style-type: none"> <li>• For floors more than 4 m above the surface beneath, in all other locations</li> </ul>	Any horizontal or near horizontal elements between 150 mm and 760 mm above the floor must not facilitate climbing





**Design Tips:  
Disability  
Ramps**





## Handrail Terminations on Ramps under AS1428

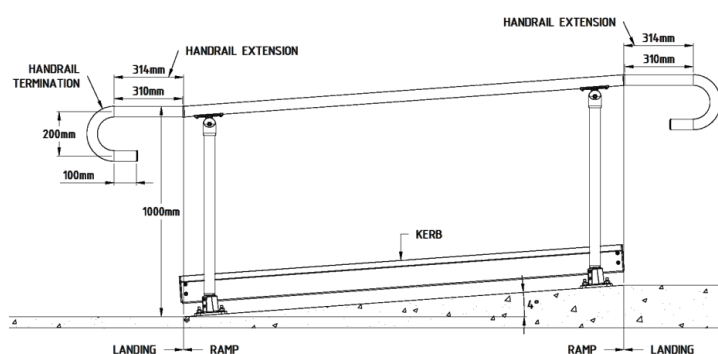
Under AS 1428.1-2009 Clause 10.3, ramps shall have a handrail complying with Clause 12 installed on each side of the ramp, as shown in Figure 14.

At the terminations of the handrail, the handrail must extend a minimum of 300 mm horizontally past the transition point at the top and bottom of the ramp except where the inner handrail is continuous at an intermediate landing.

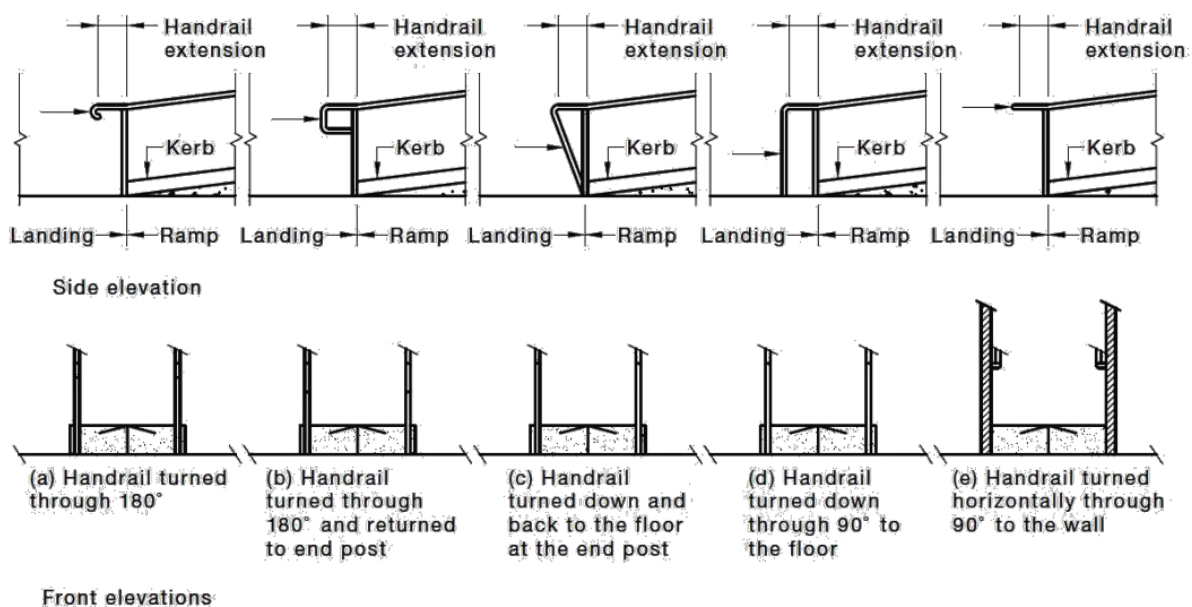
There are six examples of how the handrail should terminate at the top or bottom of a ramp, according to the Australian Standards. These are shown in Figure 15(A) below.

Figure 24 below shows our Assistrail AR20 with Flexalyte on a 4° ramp, with the handrail turned through 180° closure bend at the top & bottom of the ramp.

**FIGURE 24**



**FIGURE 15 (A)**

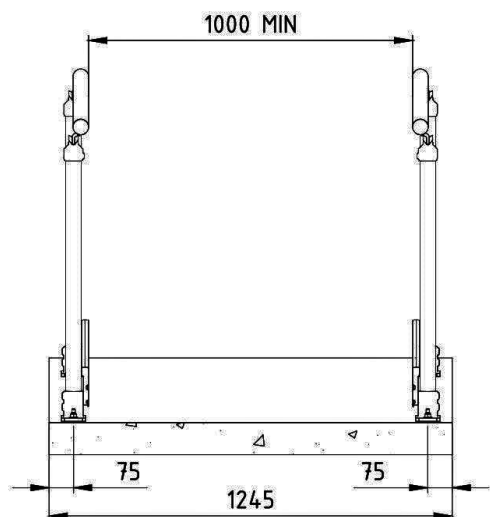






## Top Mount Inline Handrails

Top mounted inline Handrails such as the Moddex AR20 and AR40 used on disability ramps, require a substrate width of 1195+mm to meet the minimum 1000mm clear between requirements of AS 1428. Space permitting, a substrate design width of 1245mm+ to achieve compliance & allow for stanchions to be placed 75mm in from edge of concrete is ideal.

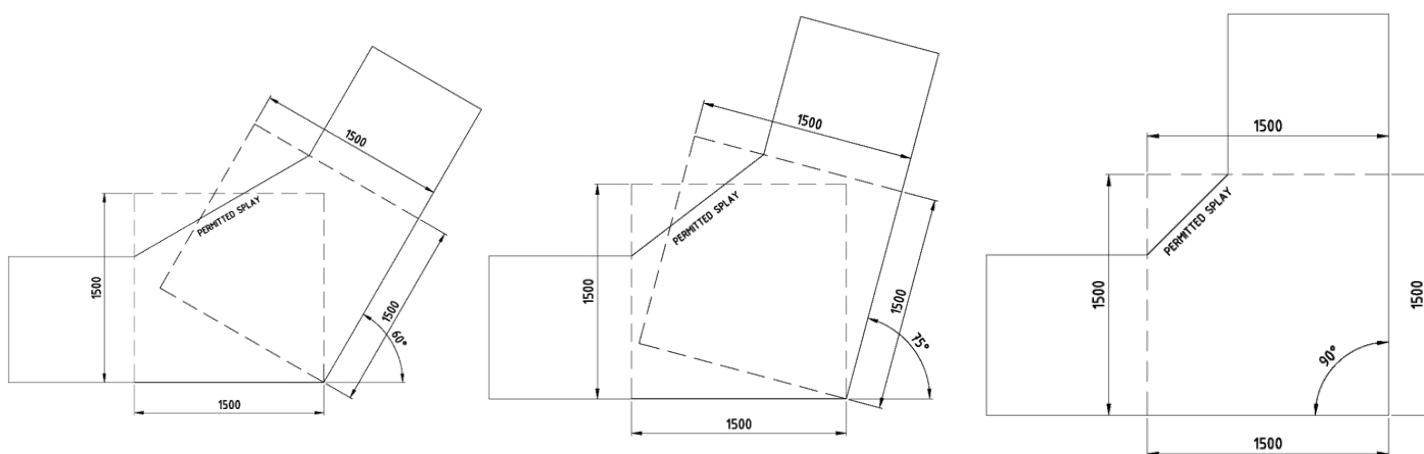


# Circulation Space for Wheelchair Turns – 30° to 90°

Under the Australian Standards of AS 1428.1-2009, wheelchairs require a minimum circulation space whenever attempting a 30° to 90° turn.

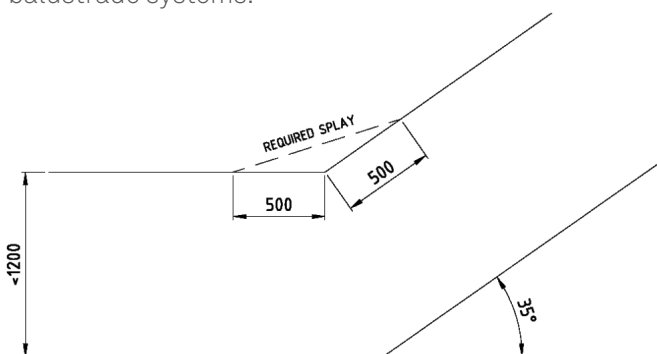
These degrees of turn are split into two parts within the standards: 60° to 90° & 30° to <60°.

Under Clause 6.5.1, the circulation space required for a wheelchair to make a 60° to 90° turn shall not be less than 1500mm wide and 1500mm long in the direction of travel. A space splayed across the internal corner can be allowed for. The following images below show different angles of change in direction, ranging from 60° to 90°.



Under Clause 6.5.2, where the angle of turn is 30° but less than 60° and the width of the path of travel is less than 1200mm, a splay of 500mm x 500mm is required on the internal corner of the pathway. The image below shows a path less than 1200mm wide with a change of direction of 35°.

These circulation spaces must allow for any items that may protrude into the pathways, including handrail & balustrade systems.



The multiple handrail & balustrade systems that Moddex supply do have varying protrusion lengths between each system, which can affect how wide a pathway needs to be constructed to.



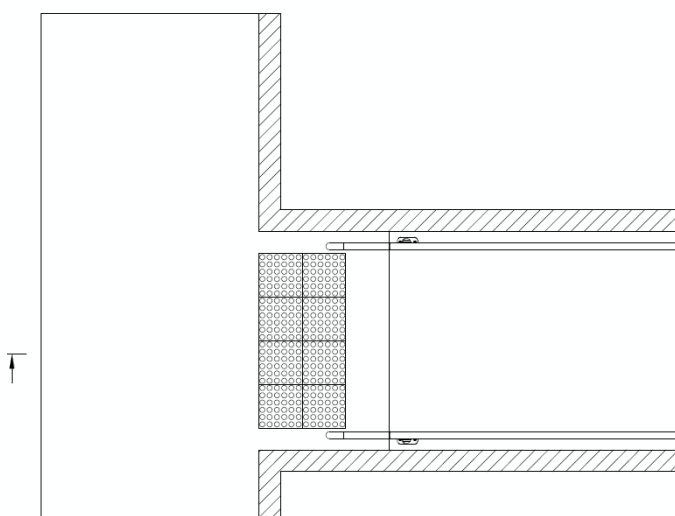




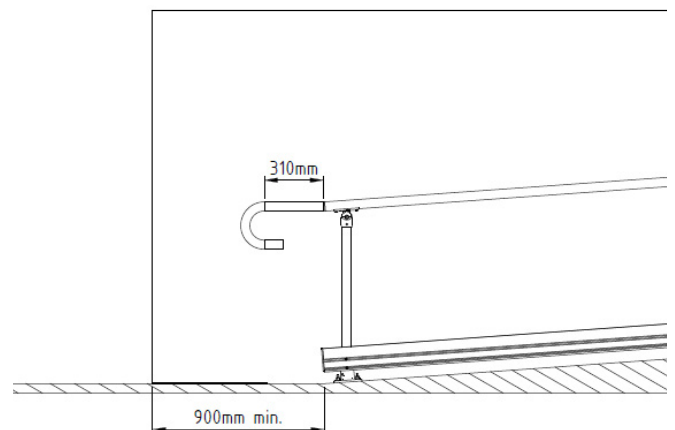
## Location of Ramps to Prevent Protrusion of Handrails at Property Boundaries

In accordance with AS1428.1-2009 Clause 10.3 (f), ramps that intersect at a property boundary need to be set back by a minimum of 900mm so that the handrail (compliant to Clause 12) and TGSIs do not protrude into the transverse path of travel.

As shown in the plan & section view below, the Moddex Assistrail AR20 has been designed in to show that it fits within the 900mm minimum



SECTION A-A





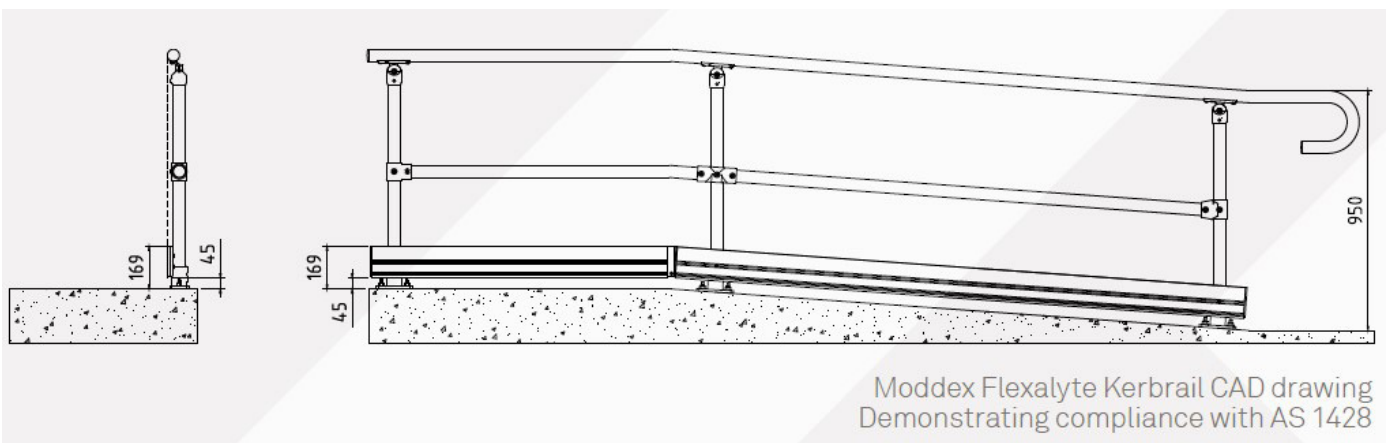
A kerbrail system is required on ramps and their intermediate landings;

- Whenever the ramp is deemed public access
- or otherwise required.

## Kerbrail Ramp Requirements under AS 1428

There are many guidelines that need to be followed for a compliant kerbrail system. The most important guidelines for compliant kerbrails in AS 1428 applications are listed below;

- Kerbrails are required on both sides of a ramp, however if one side or both are solid walls, then no kerbrail is required on these walls.
- The height of the top of the kerbrail shall not be within the range of 75mm to 150mm above the finished floor.
- The maximum gap allowed between the very bottom of the kerbrail and the finished floor is 75mm.
- The ramp-side face of the kerbrail is to be flush with the ramp-side face of the handrail OR no greater than 100mm behind the ramp-side face of the handrail. A kerbrail that protrudes past the ramp-side face of the handrail is deemed non-compliant to AS 1428.

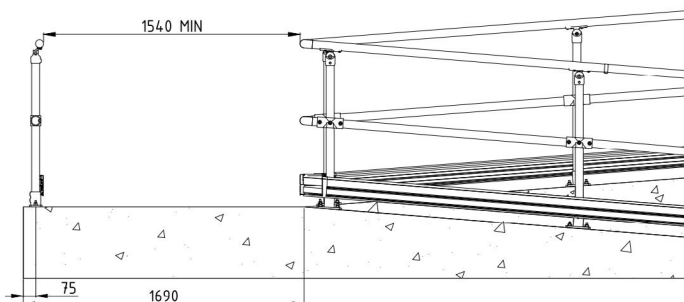




# Ramps that Return or Double-Back

For ramps that return or double-back, the handrails on the landings require a minimum 1540mm clear between them. Top mounted Inline Handrails such as the Moddex AR20 and AR40 used in this application will require a substrate width of 1665+mm to achieve the minimum 1540mm clear between, a requirement of AS 1428.

Space permitting, a landing substrate design width of 1690mm+ to achieve compliance & allow for stanchions to be placed 75mm in from edge of concrete is ideal.







# Design Tips: Stairs



# Stairway Location and Handrail Extensions at an Internal Corridor

In accordance with AS 1428.1-2009 Clause 11.1 (b), stairs that intersect at an internal corridor shall be set back in accordance with Figure 26(B), as shown below.

As shown in the plan & section view below, Moddex recommends the minimum set back must allow for at least one tread length + 435 mm for our standard 180° closure bend.

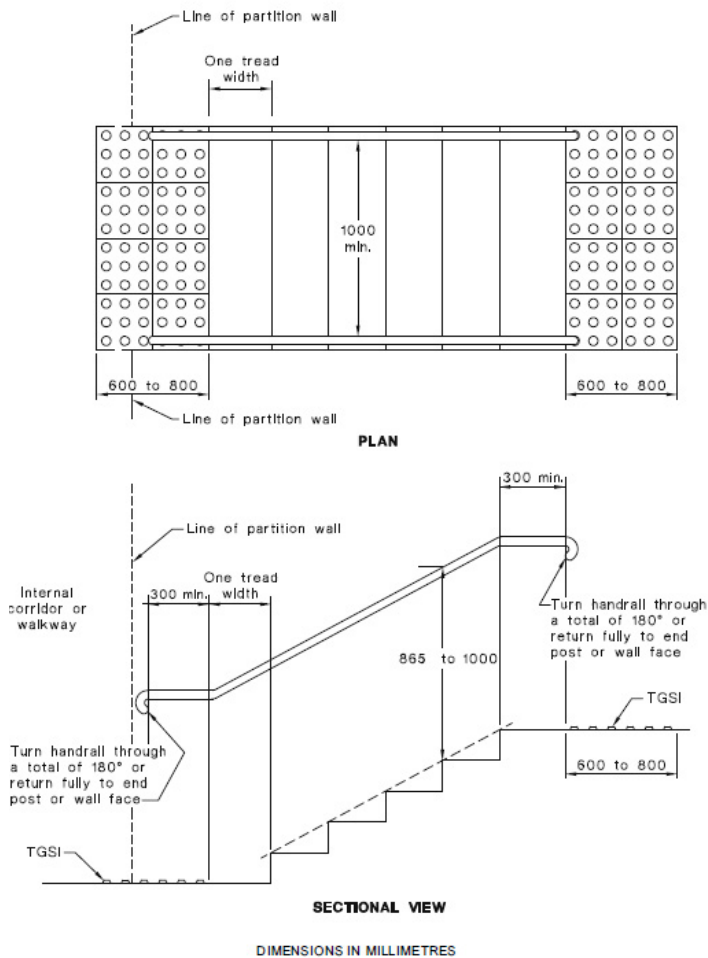
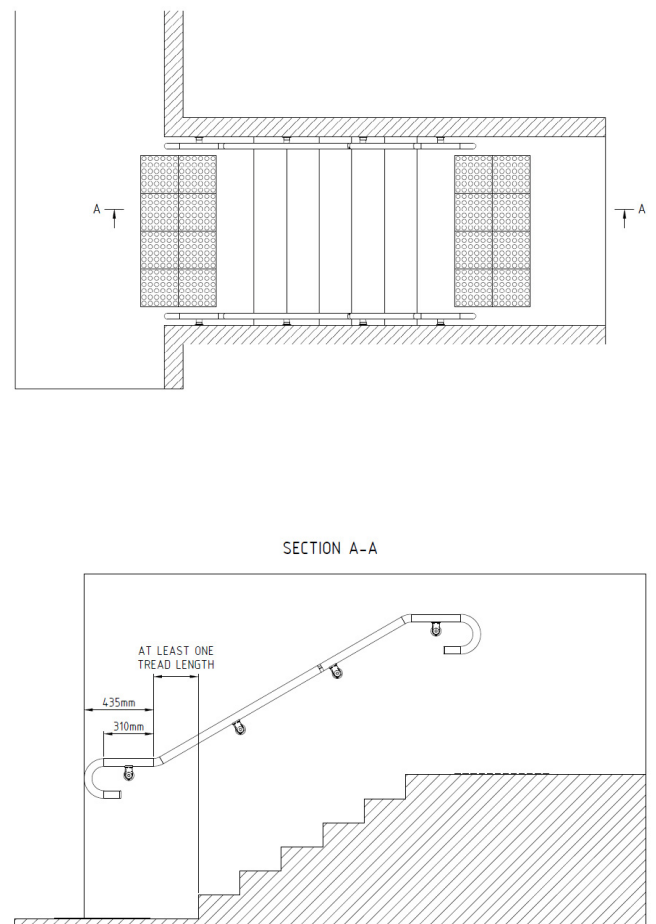


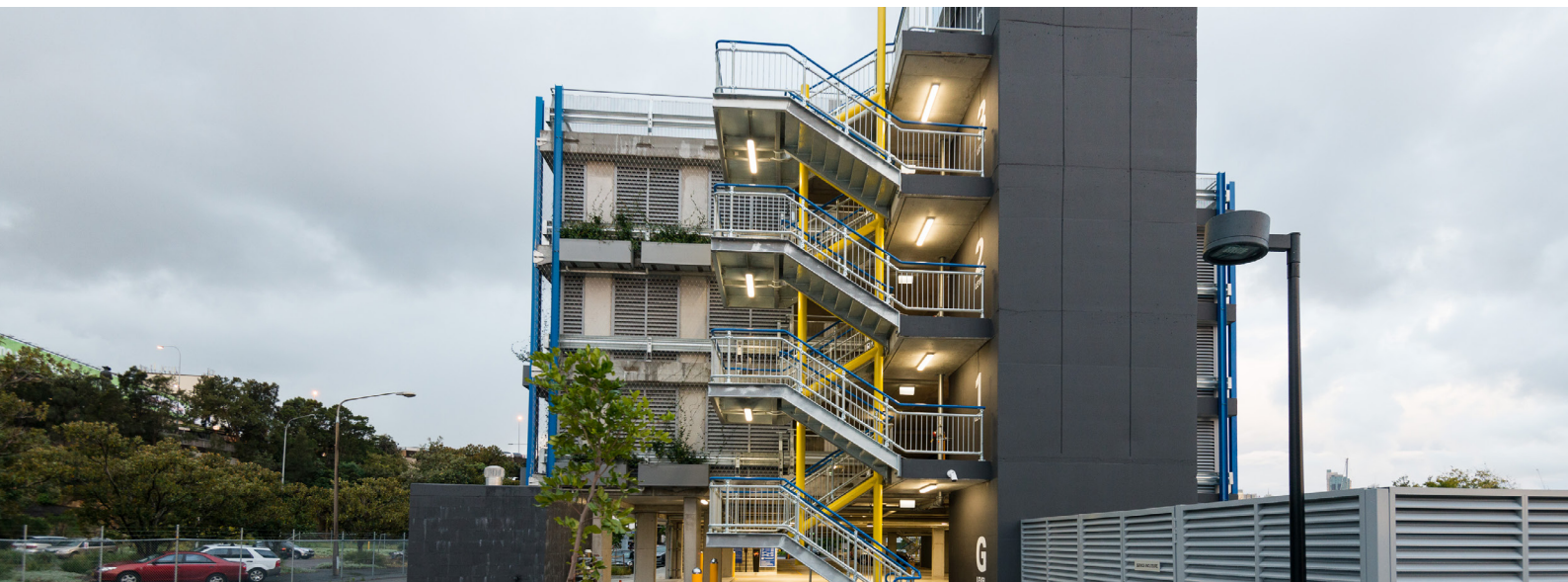
FIGURE 26(B) STAIRWAY LOCATION AND HANDRAIL EXTENSIONS AT END OF STAIRWAY OTHER THAN AT LINE OF BOUNDARY



From what is shown in Figure 26(B), it is interpreted that the partition wall must allow for a compliant handrail extension at the bottom of a stair, without the handrail protruding past the wall.



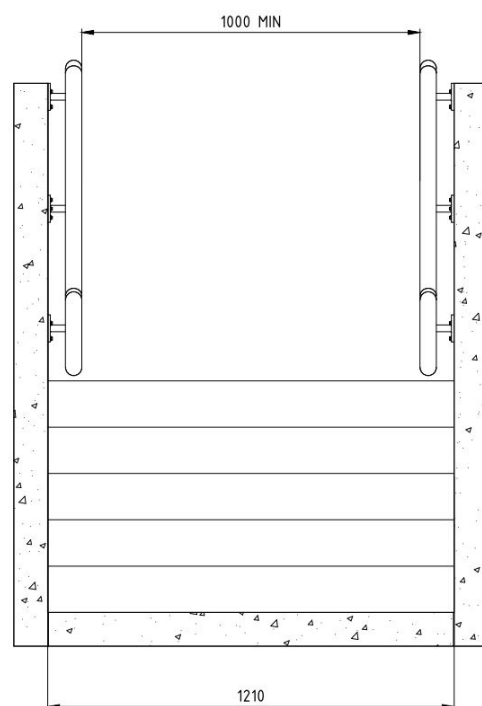
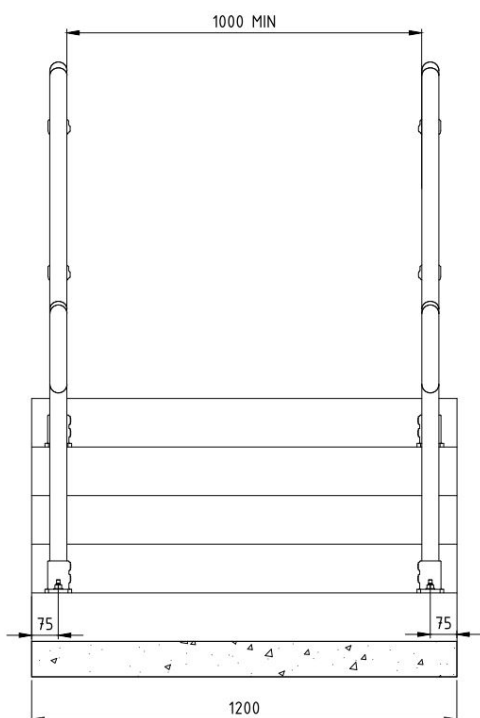




## Top and Wall Mounted Handrails Substrate Requirements on Stairs

Top mounted Handrails such as AR10, AR45 or CB30 used on stairs, require a substrate width of 1150+mm to meet the minimum 1000mm clear between rails requirement of AS 1428 & NCC/BCA. Space permitting, a substrate design width of 1200mm+ to achieve compliance & allow for stanchions to be placed 75mm in from edge of concrete is ideal

Wall mounted Handrails such as AR150, used on stairs, require a substrate width of 1210+mm to meet the minimum 1000mm clear between rails requirement of AS 1428 & NCC/BCA.



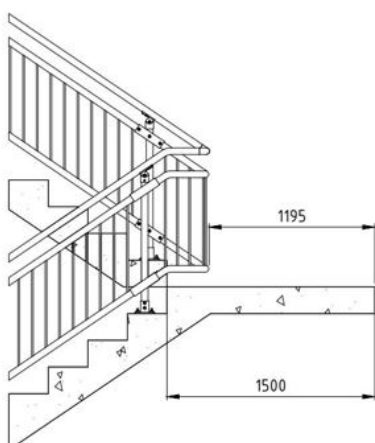
# Compliant Handrail Positioning on Intermediate Landings

In accordance with AS 1428.1 12 (a), handrails and balustrades shall not encroach into required circulation spaces i.e. a clear, unobstructed area, enabling persons using mobility aids to manoeuvre.

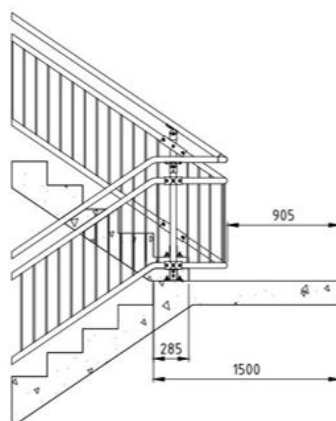
This point can be adversely affected by the location of the start position of the second flight which also determines the positioning of the handrail or balustrade.

Australian Standard AS 1428.1 requires a minimum clearance of 1000mm on a landing 'circulation space' whether it be between the handrail and the opposite wall or hand rail to hand rail.

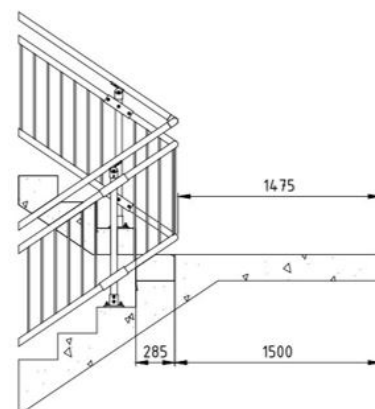
The start position of the second flight will affect this distance with configurations such as Moddex type AR45, CB30 and CB50. Below are the 3 different scenarios using type CB30 balustrade that will affect the distance between the handrail and the wall. As angle and landing lengths can change, the scenario that will achieve the most width is example C.



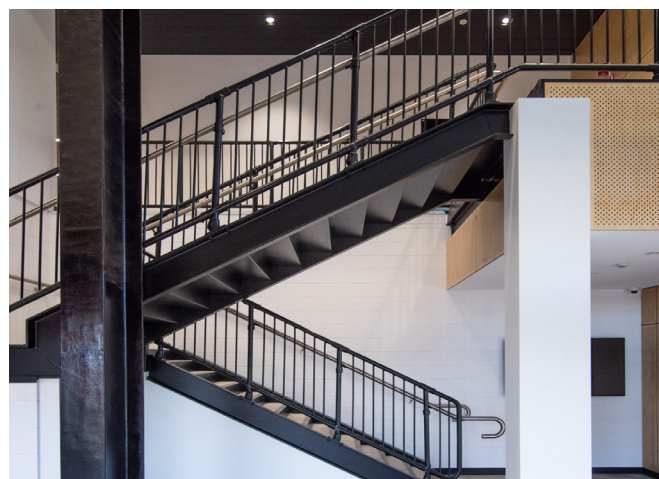
(A) - STAIRS INLINE



(B) - TOP STAIR BEHIND  
BOTTOM STAIR



(C) - TOP STAIR IN FRONT  
OF BOTTOM STAIR





**Design Tips:  
Other  
Scenarios**

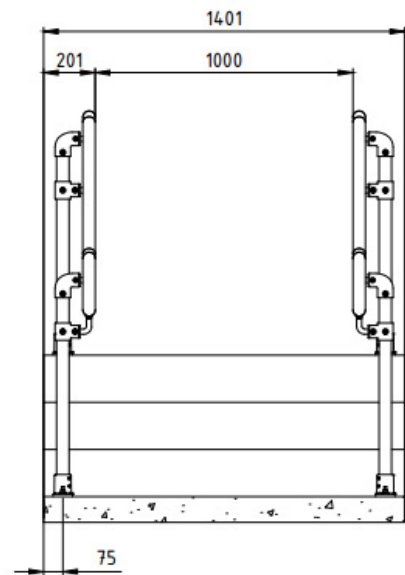
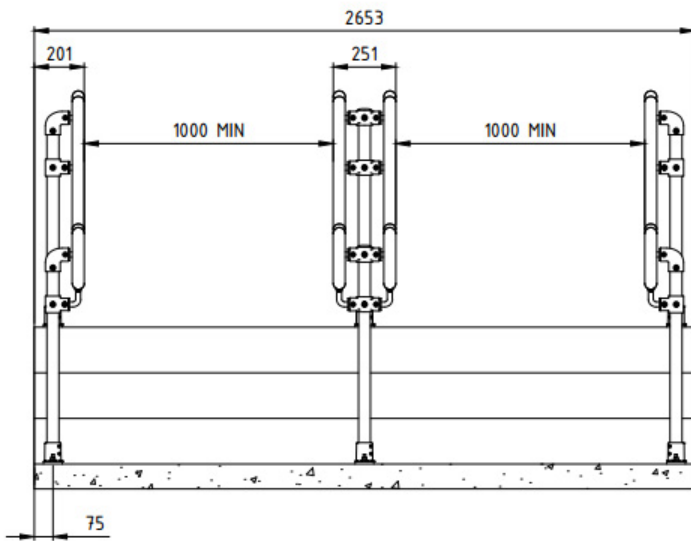
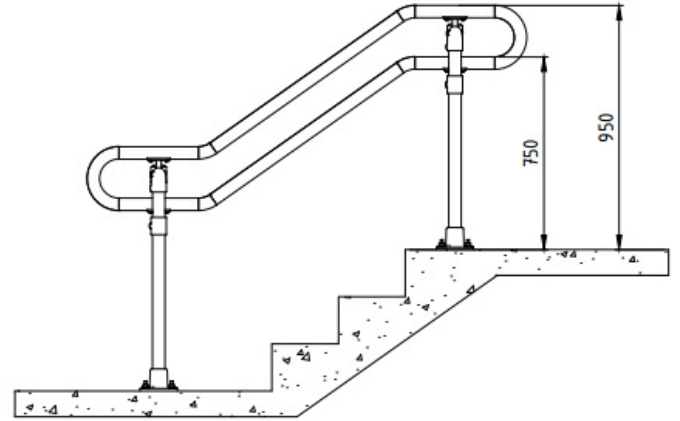


# Handrail Compliance in a Class 9B Building used as a Primary School

As per figure 1 handrails complying to BCA clause D2.17, a, iii, like our AR110 and AR140 configurations, must be installed on a substrate that allows a minimum 1000mm between handrails as stated in AS1428.1-2009 clause 6.3 and BCA clause D1.6, B, i.

As per figure 2 the minimum substrate width to achieve 1000mm between handrails using our AR110 configuration must be no less than 1401mm.

As per figure 3 the minimum substrate width to achieve 1000mm between handrails using our AR110 and AR140 configurations must be no less than 2653mm.



# Handrail Requirements on Step-Type Ladders under AS 1657

Under AS 1657:2018 Clause 7.3.4, a step-type ladder must have handrails complying with AS 1657:2018 Clause 5.6 provided on both sides of the ladder and must also comply with the following requirements.

- The clearspace between the handrails must not be less than 550 mm or greater than 750 mm.
- The clear distance between the handrail & the plane of the nosing of the treads, which is measured perpendicular to the slope of the step-type ladder, must not be less than 150 mm or greater than 200 mm.
- The bottom of the handrails shall commence at a point not more than 900 mm above the landing.

Where the handrails of a step-type ladder join into handrails on a walkway or platform above, there are additional requirements that must be met:

- The section view below shows a custom height Assistrail AR10 system mounted onto a 65° ladder joining into Tuffrail TR25 on a platform above. The handrails of the step-type ladder & platform/walkway should be blended to form a smooth transition to allow continuous contact with the handrail while moving from the ladder to the platform/walkway and vice versa.
- Alternatively, handrails should be located to –
  - Permit an uninterrupted hand passage along the handrail surface until the user has reached the walkway or platform.
  - Ensure a clearance of not less than 50 mm between the handrail surface & any adjacent structure that could make contact with the user's hand.
  - Ensure that any gap measured between the ends or components of the handrails does not exceed 100 mm measured horizontally.
  - Follow the slope of the ladder; and
  - Avoid the need for direction changes that might

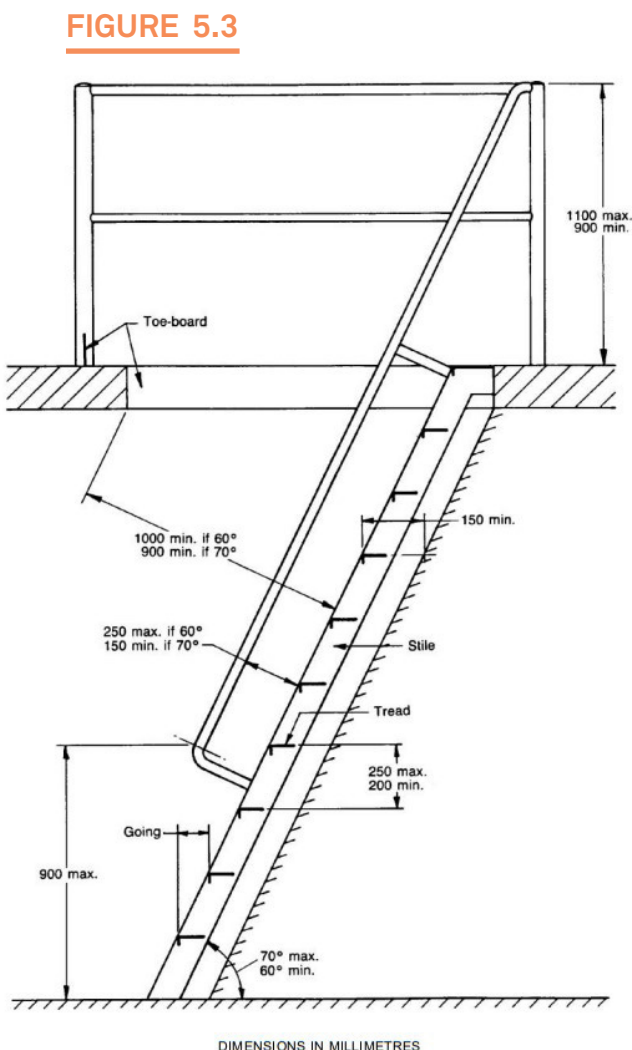


FIGURE 5.3 CLEARANCES FOR STEP LADDERS

The section view to the left shows a custom height Assistrail AR10 system mounted onto a 65° ladder joining into Tuffrail TR25 on a platform above.



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