Traffic Engineering Manual

Volume 3 – Additional Network Standards & Guidelines

Part 2.19

Accessibility (DDA) Guidelines for Road Infrastructure

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VICTORIA State Government | Department of Transport

Traffic Engineering Manual Volume 3

Additional Traffic Engineering Standards and Guidelines

Document purpose

This document is a Department of Transport (DoT) Additional Traffic Engineering Standards and Guidelines document.

The aim of this document is to provide practitioners guidance on a topic not covered (or not covered sufficiently) by other national or state standards and guidelines.

Practitioners are advised that guidance in this document be followed in order to achieve best practice outcomes.

Document hierarchy

This document has been published as a *Guideline* in DoT's document hierarchy. A *Guideline* contains relevant engineering knowledge which MUST be acknowledged and considered by a practitioner.

Where information contained in this guideline cannot be followed, the practitioner should seek technical advice from DoT and gain acceptance (where necessary) for a departure from the content in this guideline.

Document information and revision history

Further document information and revision history can be found at the end of this document.

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1 INTRODUCTION

1.1 Purpose of this guideline

The purpose of this Guideline is to assist practitioners involved in the detailed design and construction of road infrastructure related pedestrian facilities (not including public transport infrastructure related pedestrian facilities) in meeting their obligations under the Disability Discrimination Act 1992 (DDA). This Guideline provides information on applicable legislation, codes and standards and outlines the main design features to be addressed in providing accessible public pedestrian infrastructure.

This Guideline is to be read and used in conjunction with the AS 1428 suite of Australian Standards.

It should be noted that scope development and approval are an important pre-step before to the use of this document. Scope development and approval provides an opportunity to maximise the provision of accessible pedestrian infrastructure within a project. Such provision should consider the extent of works including the location and types of pedestrian crossings, the types of paths, path connections into the surrounding path network, future pedestrian demand volumes, function of the road, the speed environment, etc.

An example of such considerations in practice would be a project to construct a pedestrian bridge. Does the bridge need paths added to connect into the surrounding path network? Does the bridge need to be provided with a nearby pedestrian crossing? If so, where and what type of pedestrian crossing is going to be provided?

Further guidance relating to scope development and scope approvals can be found in DoT's Movement & Place Framework and DoT's Governance processes.

1.2 Accessible pedestrian facilities

For the purposes of this Guideline, the definition of **Accessible** is *having features to enable use by people with a disability (source: Australian Standards AS 1428.1 (2009))*.

The provision of accessible pedestrian facilities is vital for people with disabilities to gain access to public services, employment, education, community and social participation. Under the DDA, it is unlawful to discriminate against a person on the basis of their disability, including in the provision of employment, goods and services, access to premises, facilities and infrastructure. Road authorities are required to provide, 'as far as possible', safe, equitable and dignified access to all people, including those who have a disability.

It should be noted that whilst this document focuses on providing accessible (as defined above) road infrastructure related pedestrian facilities, more can be done to make these facilities more accessible in the general sense (easier to obtain or use). In road transport, this also relates to pedestrian level of service. Further guidance related to DoT's aspirational pedestrian levels of service can be found in DoT's Movement & Place Framework.

1.3 Types and incidence of disability

Approximately 20% of the population, or almost 4 million Australians, have been identified as having some form of disability (*source: Australian Bureau of Statistics*). In addition, the portion of the Australian population with a disability is increasing as our population ages.

Disability is an umbrella term covering impairments, activity limitations and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; and a participation restriction is a problem experienced by an individual in involvement in life situations. Disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which the person lives. A disability may be visible or hidden.

Disabilities can be caused by a genetic condition, illness or accident and can include:

- physical disabilities;
- sensory disabilities;
- psychosocial disabilities;

- acquired brain injuries;
- neurological impairments;
- ageing related disabilities;
- the presence in the body of disease-causing organisms; and
- any combination of these.

The most common types of disability are physical disabilities, followed by sensory and psychosocial disabilities. Physical disabilities generally relate to disorders of the musculoskeletal, circulatory, respiratory and nervous systems. Sensory disabilities involve impairments in hearing and vision. Psychosocial disabilities include disabilities that may arise from mental health or intellectual issues.

1.4 DoT's commitment to accessibility

DoT is committed to supporting its customers with disability in the Victorian community by ensuring our transport network and our services are accessible, inclusive and safe. DoT's *Accessibility Action Plan 2020 – 2023* guided the development of this technical document through Key Action 5.2.5: DoT will explore ways to progressively adopt universal design principles and take accessibility into account at inception stage for all new infrastructure projects.

2 DISABILITY ACTS, LEGISLATION, STANDARDS AND GUIDELINES

2.1 Disability Discrimination Act 1992 (DDA)

The Disability Discrimination Act 1992 (DDA) is the primary legislation in Australia addressing discrimination against people with disabilities. Enacted in 1992 by the Commonwealth Government, the DDA seeks to eliminate discrimination 'as far as possible' against people with a disability.

The DDA prohibits direct and indirect discrimination on the grounds of disability and makes it unlawful to discriminate in a wide range of areas including, but not limited to: access to employment, education, goods and services, premises and the provision of public transport. Specifically, for the public road and pedestrian infrastructure space, Section 23 of the DDA makes it unlawful to discriminate against people with disability, or their associates, in relation to access to, and use of, premises that the public is allowed to enter or use.

The DDA covers all aspects of premises and facilities, including pedestrian facilities. Thus, in order to meet the requirements of the DDA, pedestrian facilities are required to achieve safe, equitable and dignified access for all.

The definition of premises in the DDA extends to the whole of the built environment and includes:

- existing, new and proposed buildings;
- public transport systems (including public transport vehicles, buildings and associated infrastructure for use by the public as part of the public transport service); and
- external built elements of the landscape including car parking, pedestrian paths, recreational and sporting facilities, sports venues, public gardens and parks.

The DDA is not a prescriptive legislation in defining the minimum requirements for the built environment in achieving non-discriminatory access for people with disabilities, instead, this is guided by the various Legislation Standards and Australian Standards. The legal requirement to eliminate discrimination described within the DDA is enforced primarily through various complaint mechanisms, such as a complaint being made to the Australian Human Rights Commission (for example) by a person with a disability who believes they have been discriminated against on the basis of their disability.

There is under the DDA, the exemption to not provide accessibility to premises if this will cause major difficulties or excessive costs to a person or an organisation. This is considered 'unjustifiable hardship' and will be assessed on a case by case basis following a complaint being made. As each complaint is judged on its own merit, unjustifiable hardship in one situation may not be deemed unjustifiable hardship in another. Therefore, guidelines and advice provided can only suggest measures to reduce the chance of a complaint considered successful and unlawful discrimination has been ruled to have taken place.

2.2 Legislation standards

As noted above, the DDA is not prescriptive legislation, in that, whilst it makes disability discrimination unlawful, it does not prescribe how DDA compliance is achieved.

However, there is within the DDA the mechanism to develop Disability Standards to provide more detailed guidance on how non-discriminatory access for people with disabilities can be achieved. These standards are legally binding regulations set by the Attorney-General under the DDA.

The following Disability Standards have been prepared by the Commonwealth Attorney-General's Department under the Disability Discrimination Act:

- The *Disability (Access to Premises – Buildings) Standards*
- The *Disability Standards for Accessible Public Transport*
- The *Disability Standards for Education* (not relevant to road infrastructure)

The purpose of the *Disability (Access to Premises – Buildings) Standards* (also known as the 'Premises Standards') is to achieve equitable and dignified access to public buildings, and, to provide the construction industry with clarity as to the minimum accessibility requirements for building works to achieve non-discriminatory outcomes.

The purpose of the *Disability Standards for Accessible Public Transport* is to enable public transport operators and providers to remove discrimination 'as far as possible' from public transport by setting out the minimum accessibility requirements with respect to the design of public transport infrastructure, including public transport buildings, bus and tram stops, and, the pedestrian paths linking them.

The design and construction of much of the pedestrian infrastructure in the road environment that DoT is associated with (such as pedestrian footpaths, road crossings, overpasses, refuges, etc.) is outside the scope of the Disability Standards enacted under the DDA, in that the *Disability (Access to Premises – Buildings) Standards* covers the design and construction of buildings to which the public may enter (pedestrian facilities such as footpaths fall outside the definition of 'buildings') while the *Disability Standards for Accessible Public Transport* covers the design and operation of public transportation infrastructure.

Notwithstanding the above, elements of design and construction of facilities captured under these Disability Standards can be adopted to the design and construction of pedestrian infrastructure in the road environment that DoT is associated with.

2.3 Australian Standards

The technical requirements underpinning the *Disability (Access to Premises – Buildings) Standards* and the *Disability Standards for Accessible Public Transport* are covered in the *AS 1428 'Design for Access & Mobility'* suite of Australian Standards.

This suite of standards provides the technical detail required to achieve the level of access for a deemed-to-satisfy solution *(source: Australian Standards AS 1428.1 (2009))*.

The main Australian Standards from the AS 1428 suite applicable to public pedestrian facilities are:

- *AS 1428.1: Design for access and mobility – Part 1: General requirements for access – New building work;*
- *AS 1428.2: Design for access and mobility – Part 2: Enhanced and additional requirements – Buildings and facilities;* and
- *AS/NZS 1428.4.1: Design for access and mobility – Part 4.1: Means to assist the orientation of people with vision impairment.*

The primary focus of AS 1428.1 is considering the requirements of people who may have a mobility disability (e.g. a wheelchair user) or vision impairment. It is considered that by designing environments suitable for people using manual wheelchairs, the majority of people with a mobility disability will be accommodated.

Note:

In the absence of Disability Standards enacted under the DDA which specifically apply to pedestrian infrastructure in the road environment and in light of the AS 1428 suite of standards' focus on the design and construction of buildings, there may be cases where the best application of these standards to the design and construction of pedestrian infrastructure in the road environment is unclear.

2.4 DoT's Accessibility (DDA) Guidelines for Road Infrastructure (this guideline)

This Guideline outlines the relevant requirements of AS 1428 standards applicable to the design and construction of accessible pedestrian facilities in the road environment. It has been developed to provide practitioners with a centralised source of information to assist in achieving AS 1428 standards to the fullest extent within the road environment. This Guideline is to be read and used in conjunction with the Australian Standards AS 1428 suite of standards.

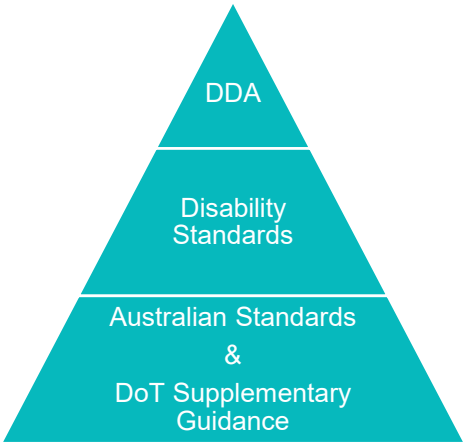


Figure 1: Hierarchy of Legislation and Standards

2.5 When standards cannot be met

Compliance with disability standards in the road environment can, at times, be challenging. Competing project demands, existing physical constraints and standards that don't always cater specifically for the road environment are just some of those challenges.

DoT must always endeavour to comply with the appropriate disability standards. Only in circumstances where it would be impossible or unjustifiably hard to comply, should DoT consider departing from the standards. In these circumstances, DoT should still comply with the standards to the fullest extent possible.

The Australian Human Rights Commission has issued a guideline under the DDA titled *Advisory Note on streetscape, public outdoor areas, fixtures, fittings and furniture* that is aimed at assisting with the understanding of compliance with disability standards in the road environment. It should be noted that this guideline does not have the force of law but may be a useful resource to assist in decision making.

humanrights.gov.au/sites/default/files/document/publication/2013_AdvisoryNoteStreetscape.pdf

When concerns exist that disability standards cannot be met, the engagement of a specialist DDA Auditor is considered good practice. A report produced from a DDA Auditor's work can be a good source for reasoning and decision making made through the course of a project.

Where a project or upgrade does not comply with AS 1428 or other applicable disability standards, the project or upgrade team should provide a report outlining the design elements that do not conform to the relevant disability standards. The report should analyse the non-compliances and any changes that would have to be made to ensure compliance with the disability standards (if possible). Where the design can be reasonably altered in such a way to ensure compliance, the change should be adopted.

Where the design remains non-compliant, the report should then indicate the reason that the Project / Region is unable to fully meet applicable disability standards.

The following are factors that may be considered in this regard:

- Technical impacts: exceptional operational, technical, topographical or geographical factors that affect the ability to comply.
- Constructability issues: substantial increase in time and/or cost in the construction of the project/upgrade.
- Financial impacts: substantial capital, operating or maintenance costs arising out of compliance and budgetary constraints.
- Community impacts: benefits/detriments of compliance for people with disabilities and for other persons and balancing these against the benefits/detriments of non-compliance.
- Road safety: negative impacts on road safety.
- Adjacent land use: adjacent land uses (hospitals, nursing homes, schools) that would make the area more likely to be used by people with universal accessibility requirements.

- Consultation: seeking views of external stakeholders (particularly disability groups).
- Good faith: efforts that have been made to comply with disability standards in good faith.
- Equivalent access: Alternative compliant routes which provide an equivalent standard of amenity, availability, comfort, convenience and safety.
- Any other benefits arising from non-compliance or problems that would arise from compliance.

The report should be completed in the planning and design phase of the project or upgrade, approved through the relevant governance process of the asset owner (likely to require a Technical Reference Panel (TRP) submission for DoT or MTIA projects) and continually reviewed throughout the Project's further development.

The report should be electronically filed in a manner that allows it to be easily accessed should a future need develop.

3 STANDARDS

3.1 Pedestrian paths

3.1.1 General requirements

To ensure equitable access for people with disabilities, pedestrian paths of travel are required to be unhindered, have sufficient unobstructed space (i.e. width and height clearance), as well as appropriate gradient and crossfall (or camber) to meet AS 1428.1. Paths of travel should also have a firm, stable and slip-resistant surface which is traversable by all people, including people who have a disability and may use a mobility aid (such as a walking frame, manual wheelchair or mobility scooter).

3.1.2 Widths

The following widths are required for generally straight sections of footpath to safely accommodate all pedestrians, including people who may be using wheelchairs, those with prams and people with an ambulant mobility using a mobility aid.

The absolute minimum footpath width to meet AS 1428.1 is 1000 mm, however this is not recommended.

The following footpath widths in accordance with AS 1428.2 are recommended:

- not less than 1200 mm to allow a single wheelchair user to traverse a path comfortably
- not less than 1500 mm to accommodate a wheelchair user and a pram to pass
- not less than 1800 mm to accommodate 2 wheelchair users to pass.

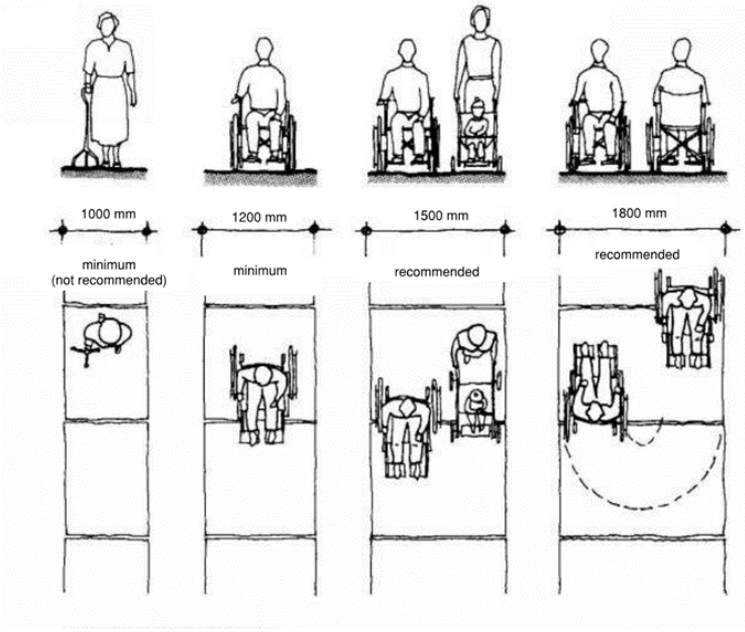


Figure 2: Footpath widths

Whilst appropriate footpath widths are subject to factors such as anticipated volume of pedestrian foot traffic and local land use (e.g. locations of hospitals, health centres, schools, shopping centres), it is desirable for minimum footpath widths of 1800 mm be provided along high-volume footpaths to allow two wheelchair users to pass. Guidance on pedestrian volumes can be found in *Austroads Guide to Road Design Part 6A*.

Where a width of 1800 mm is not practical for the entire path of travel, passing spaces not less than 2000 mm in length should be provided at intermediate locations (see Figure 3). The frequency of provision of passing spaces should be considered in the context of the location and purpose of the path.

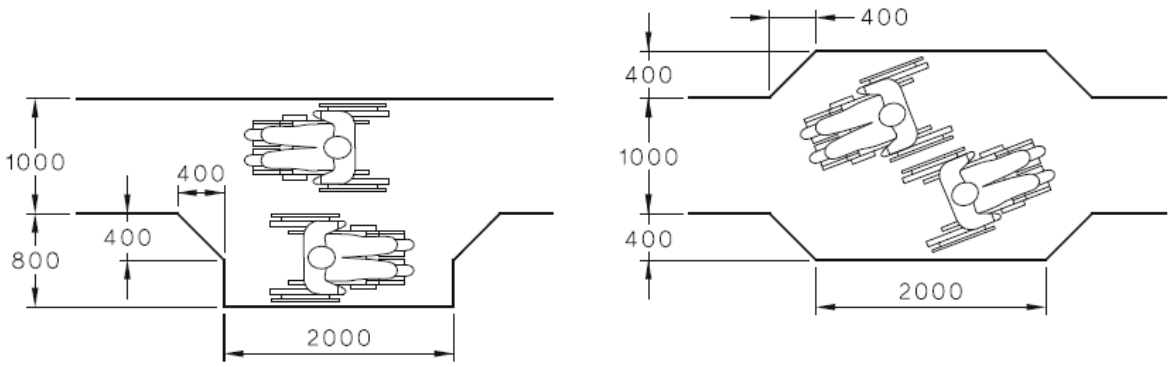


Figure 3: Examples of passing spaces for wheelchairs

The footpath widths are to be clear of all encroachments and obstructions such as light poles, traffic lights, street furniture, signage, vegetation and the like for a minimum height of 2m.

Figure 4: Example of a compliant pedestrian footpath

3.1.3 Turning / circulation spaces

The abovementioned footpath widths are designed to accommodate pedestrians travelling directly along the path of travel, that is, generally in a straight line. However, additional circulation and manoeuvring space is required for some pedestrians to undertake a turn along the path of travel (e.g. people using prams or mobility aids such as manual wheelchairs or electric scooters).

The following turning / circulation space requirements apply in accordance with AS 1428.1:

- For provisions for turns of 30° to <60° and the width of path is less than 1200 mm, a splay of at least 500 mm x 500 mm shall be made on the internal corner of the path (see Figure 5).
- For provisions for turns of 60° to 90°, a circulation space of not less than 1500 mm (width) and 1500 mm (length) shall be provided which may be splayed across the internal corner as shown in Figure 6, Figure 7 and Figure 8.
- For provisions for turns of >90° to 180°, a circulation space of not less than 1540 mm (width) and 2070 mm (length) shall be provided (see Figure 9).
- All turning spaces are required to be level (i.e. not steeper than 1:40 gradient and crossfall, or 1:33 for a bituminous surface) to allow wheelchair users to easily and safely manoeuvre.

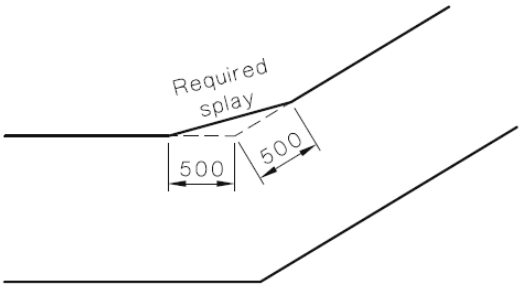


Figure 5: Splay for turns 30° to <60° in paths of travel less than 1200 mm wide

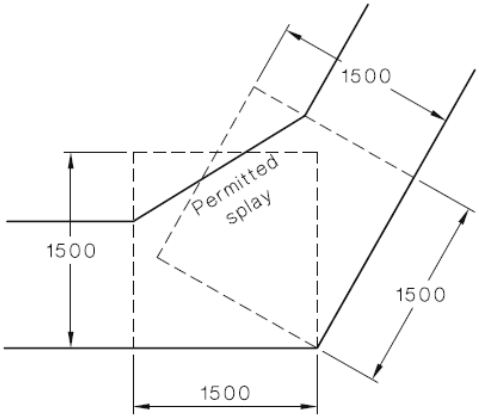


Figure 6: 60° turn in path of travel

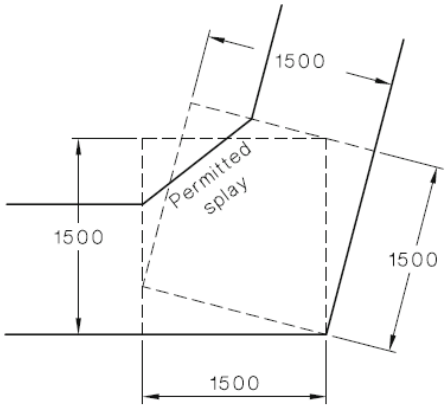


Figure 7: 75° turn in path of travel

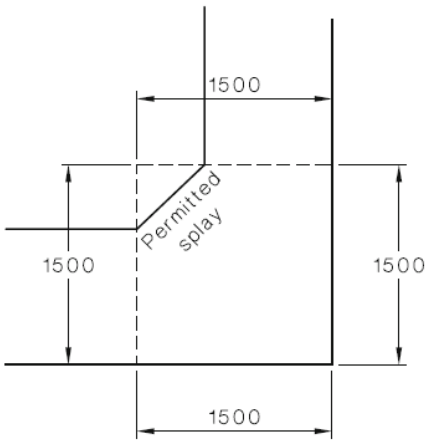


Figure 8: 90° turn in path of travel

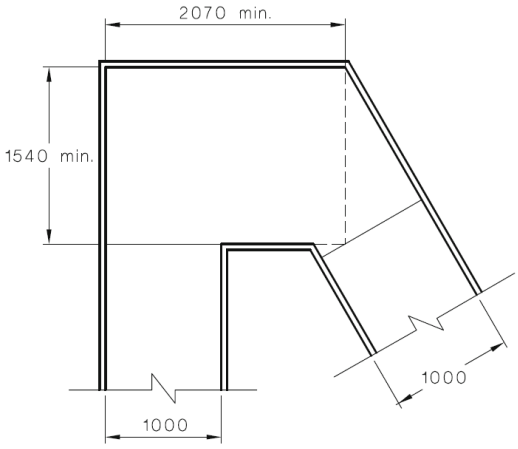


Figure 9: >90° turn in path of travel

Figure 10: Turning space around a bus shelter

Figure 11: Turning space at a pedestrian overpass

3.1.4 Gradients

Whilst the pedestrian path gradients that can be achieved may be limited by site topography, they should be as flat as possible for ease of use by people with a mobility disability. This requirement applies to footpaths, ramps, walkways, landings, turning spaces, public transport stops / waiting areas, and pedestrian roadway crossings.

In order to meet AS 1428.1 the maximum gradient for accessible paths of travel is 1:14, however, it is recommended that gradients be not steeper than 1:20 wherever possible (note that paths with a gradient between 1:20 and 1:14 are considered 'ramps.' Refer Section 3.1.10 for additional accessibility requirements for ramps.)

3.1.5 Landings

Level landings are relatively flat areas along the path of travel where pedestrians, including those with disabilities, have an opportunity to stop and rest as well as undertake safe turning manoeuvres. Landings must be provided at all changes in direction as well as at the following maximum intervals:

- for gradients shallower than 1:33, no landings are required;
- for gradients of 1:33, at not greater than 25 m intervals;
- for gradients of 1:20, at not greater than 15 m intervals; and
- for gradients of 1:14, at not greater than 9 m intervals (gradients steeper than 1:20, but not steeper than 1:14 are considered ramps and have additional requirements, see Section 3.1.10).

Intervals for intermediate gradients are obtained by linear interpolation.

The intervals above may be increased by 30% if at least one side of the walkway is bounded by a raised kerb, a kerb rail and a handrail or a wall and a handrail, in accordance with AS 1428.1:

The following applies to landings in order to meet AS 1428.1:

- the gradient and crossfall of landings are required to be not steeper than 1:40 (or 1:33 for a bitumen or asphalt surface) to provide pedestrians an opportunity to rest on a flat surface;
- landings are to have a minimum length of 1200 mm if there is no change in direction;
- landings are to have a minimum length of 1500 mm where a change of direction of not greater than 90° is required;
- landings are to be provided at changes of direction along the path of travel (e.g. at a street corner); and
- where the footpath is steeper than 1:20, the path is considered a ramp and the gradient shall be constant throughout its length with a maximum tolerance of 3% (provided no section of the path is steeper than 1:14).

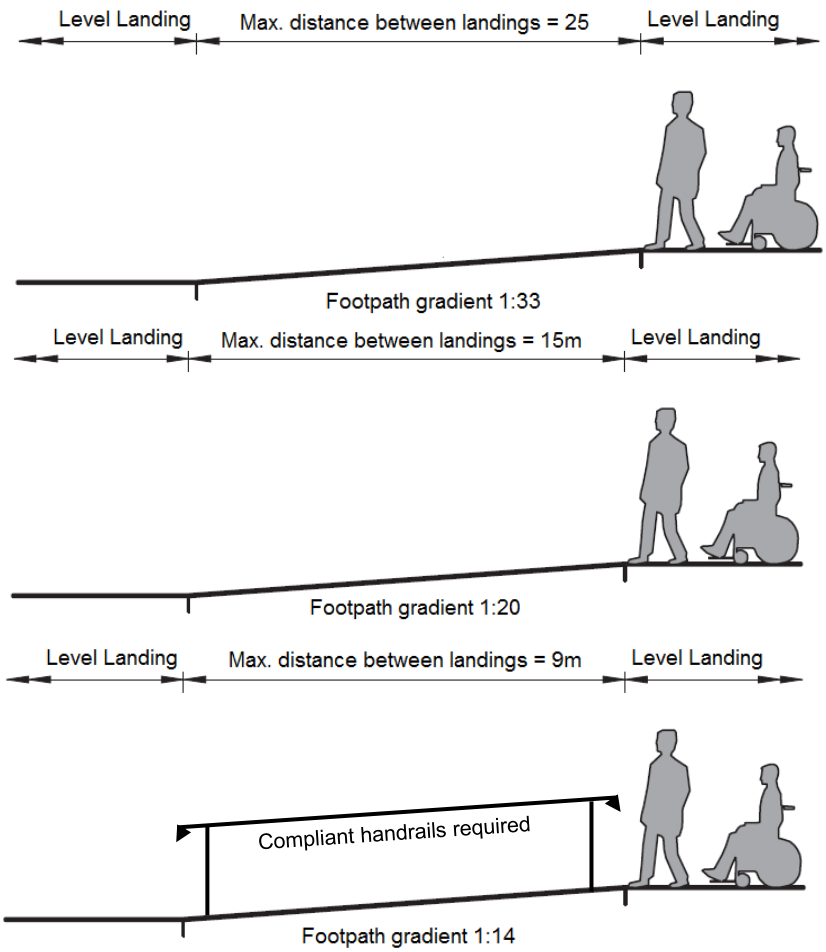


Figure 12: Distance between path landings

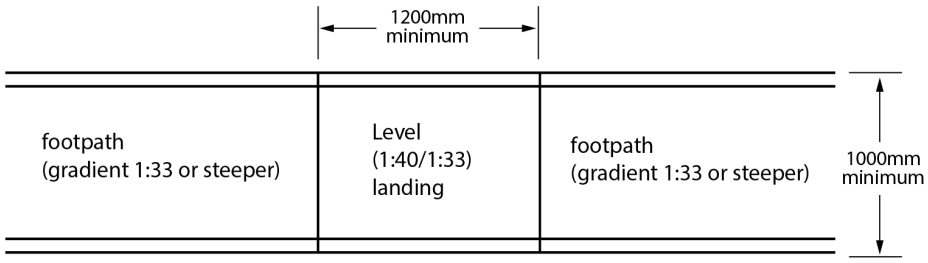


Figure 13: Minimum landing size along a straight path of travel

Notwithstanding the above, the Australian Human Rights Commission guideline that has been developed under the DDA titled *Advisory Note on streetscape, public outdoor areas, fixtures, fittings and furniture* acknowledges that topographical issues, historical practices and local conditions will affect the capacity for authorities to achieve this level of good practice in all circumstances. The guideline advises that while a footpath necessarily follows the natural topography of the area, in the best possible circumstances a continuous accessible path of travel along a footpath should comply with gradient, crossfall, kerb ramp, TGSI, width, envelope and surface requirements. Practitioners should make their own decisions on the inclusion of footpath landings based on the needs of local communities and local conditions. Refer to Section 2.5 for further information.

3.1.6 Crossfall

The crossfall (or camber) of a pedestrian path is required to be not steeper than 1:40 (or 1:33 for a bitumen or asphalt surface). This requirement applies to footpaths, ramps and walkways, landings, turning spaces, public transport stops / waiting areas, and pedestrian roadway crossings.

It is important that suitable cross-falls are achieved to pedestrian paths of travel as paths of travel with steeper cross-falls are extremely difficult and tiring for many people with a mobility disability to traverse and contribute to trips and falls.

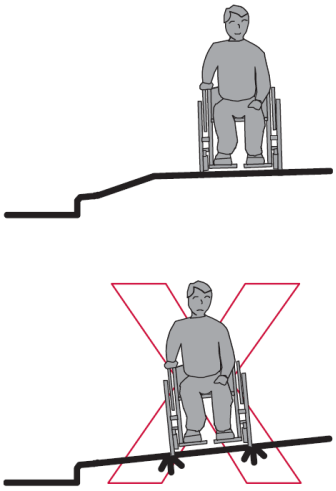


Figure 14: Correct and incorrect footpath crossfall

Figure 15: Footpath with crossfall exceeding 1:40 / 1:33

3.1.7 Ground Surfaces

Accessible pedestrian paths of travel are required to have a slip-resistant surface, with surface texture that is traversable by people using a wheelchair.

Satisfactory materials generally include:

- concrete with abrasive or textured finish;
- asphalt;
- natural stone with a rough finish; and
- paving bricks with a special abrasive finish.

Pedestrian accessways are required to be designed so that water does not accumulate on the surface.

Abutting pedestrian surfaces should be level with a smooth transition. This applies to transitions / changes in surface materials, where new and existing paths abut, service pit lids, at the base of ramps and the like.

The design transition for abutting surfaces shall be 0 mm. Construction tolerances per AS 1428.1 are as follows:

- 0 ± 3 mm where vertical edges are provided
- 0 ± 5 mm where rounded or bevelled edges are provided to reduce risk of tripping

Figure 16: Concrete path with textured finish

Figure 17: Abutting surfaces not level

3.1.8 Edge Protection

Where the edges of a pedestrian path do not abut a property boundary or kerb, the edge of the path shall have some form of edge protection to ensure people do not trip on the edge and wheelchair users do not fall off the edge of the path.

Acceptable forms of edge protection are any one of the following:

- grass areas, garden beds and the like abutting the sides of the walkway to provide a firm and level surface of a different material to that of the footpath (the surface must also be at the same level and follow the footpath grade and extend horizontally for a minimum of 600 mm);
- a 150 mm high kerb rail;
- a compliant kerb rail and handrail; or
- a wall of not less than 450 mm in height.

3.1.9 Grates and Pits

Wherever possible, grates and pits should be located outside of pedestrian paths of travel. This applies especially to the face and landings of kerb ramps and where tactile ground surface indicators (TGSIs) are provided.

If grates and pits are required to be located within pedestrian paths of travel, the size of openings shall not exceed those outlined in AS 1428.1 and AS 1428.2.

That is:

- circular openings not greater than 13 mm in diameter; and
- slotted openings not greater than 13 mm wide and 150 mm long and orientated so that the longer dimension is transverse to the predominant pedestrian path of travel (where openings are less than 8 mm, this is not required).

Figure 18: Service grate with size of openings greater than 13 mm

Figure 19: Grate with suitably sized openings

3.1.10 Ramps

Walkways with a gradient steeper than 1:20, but not steeper than 1:14 are considered 'ramps'. In addition to meeting the general requirements outlined so far for pedestrian paths, ramps fully meeting AS 1428.1 shall be provided with the following:

- a maximum gradient of 1:14;
- level landings (maximum 1:40 / 1:33 gradient and crossfall) at the top and base of the ramp and at a maximum interval of 9m;
- sharp transitions (in gradient) between abutting planes of ramps and landings;
- a constant gradient throughout the length of the ramp (with a maximum allowance tolerance of 3% providing no section of the ramp exceeds a gradient of 1:14);
- the provision of handrails to both sides which meet AS 1428.1, extend at least 300 mm horizontally past the top and base of the ramp and do not impede minimum path width requirements;
- the provision of side protection in the form of either kerb / kerb rail with a height between 65 mm -75 mm or at least 150 mm (i.e. the top of the kerb / kerb rail shall not be between 75 mm - 150 mm) or a side wall (minimum 450 mm high); and
- the provision of warning TGSIs in accordance with AS/NZS 1428.4.1 to the top and base of ramp.

In some locations, there will be a need to provide ramp(s) fully meeting AS 1428.1 in order to achieve additional pedestrian amenity and / or safety, such as at pedestrian overpasses, tram or bus stops.

Figure 20: Ramp with compliant handrails

3.2 Kerb ramps

Kerb ramps are provided to achieve access through kerbs from footpaths to roadways. Good, accessible design and construction of kerb ramps is crucial in achieving accessible pedestrian facilities and infrastructure. If accessible and safe kerb ramps are not provided, a continuous accessible path of travel along the pedestrian network will not be achieved.

Poorly designed and constructed kerb ramps create barriers and safety issues for people with mobility and sensory disabilities. Well designed and constructed kerb ramps will assist people with disabilities in safely negotiating and navigating the built environment.

Practitioners should consider the possibility of implementing cut through medians / pedestrian refuges, raised pedestrian crossings etc. to avoid the use of kerb ramps where possible. These treatments eliminate the potential barriers and safety issues associated with poorly designed kerb ramps.

In accordance with AS 1428.1 and AS 1428.2, kerb ramps shall meet the following:

- have a slip-resistant surface;
- be aligned in the direction of travel;
- a maximum rise of 190 mm and maximum length of 1520 mm;
- a gradient not steeper than 1:8;
- be provided with level landings (minimum gradient and crossfall of 1:40 / 1:33 for asphalt surface) not less than a length of 1200 mm (or 1500 mm if a change of direction is required);
- 45° angled sides which are tapered or splayed and have a tooled joint between the ramp and side wings;
- the centre line of kerb ramps aligned across the roadway;
- the top and bottom of the kerb ramps aligned 90° to the pedestrian path of travel to provide appropriate and accurate environmental cues to people with a visual impairment in negotiating the roadway;
- the top and bottom of kerb ramps have a sharp gradient transition so that kerb ramps and landings do not merge into one (clearly defined kerb ramps and landings are important features for a wheelchair user to be able to pause, rest and prepare prior to negotiating a kerb ramp at a roadway, or a person with low vision in detecting the sloping surface);
- the angle between the kerb ramp surface and the lower surface (i.e. the roadway) is a minimum of 166° degrees (i.e. it is required to be within the range of 166° and 180°); and
- the surface shall be free of thresholds or lips that will obstruct the travel of people using wheelchairs.

Note:
Due to the competing requirements of road and pedestrian traffic design (e.g. site topography, road geometry, drainage, etc.) there are circumstances where achieving fully compliant kerb ramp design can pose further issues / challenges.

See Figure 24 for example. Care needs to be taken to ensure the highest level of compliance possible with AS 1428.1 is achieved whilst maintaining safe and uncompromised operation of the facility. In this situation, consideration (at the design stage) could have been given to an alternative footpath alignment, kerb ramp layout, gradient / crossfall etc. to mitigate the need for such a design.

Where fully compliant kerb ramps cannot be provided, alternatives may be considered such as cut through medians / pedestrian refuges, raised pedestrian crossings etc.

Management of drainage surface flows, generally by appropriate provision of drainage pits upstream of kerb crossing points, is required regardless of whether kerb ramp or cut through treatments are being considered.

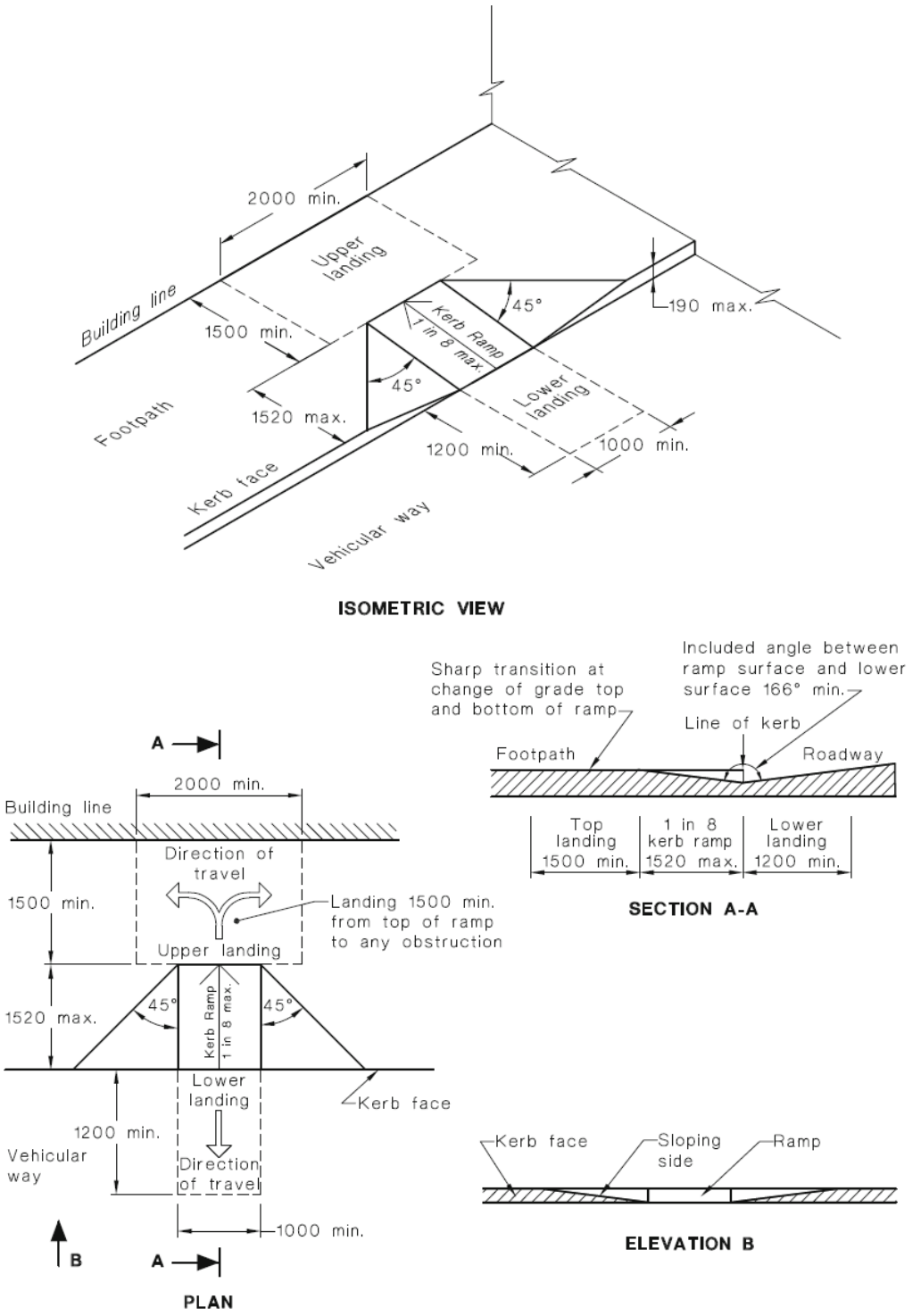


Figure 21: Kerb ramp specifications

Note: the 1500 mm dimension at the upper landing is to permit a 90° turn either left or right when reaching the top of the ramp, if there is no turn involved, the length of the top landing may be reduced to 1200 mm

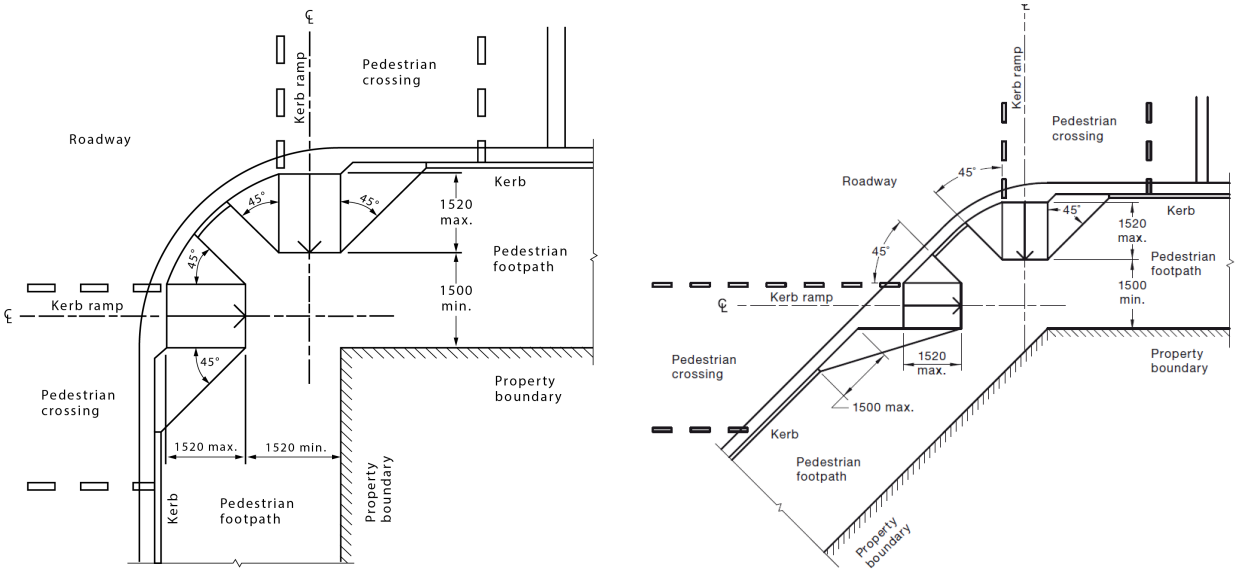


Figure 22: Alignment of kerb ramps

Figure 23: Example of a compliant kerb ramp at intersection (note: defined landing, 45° angled sides, sharp gradient transition, top and bottom of ramp perpendicular to direction of travel)

Figure 24: Compliant kerb ramp causing drainage issues

3.3 Pedestrian refuges

3.3.1 Median with kerb ramps

Like kerb ramps, the design of accessible pedestrian refuges is essential to link footpaths and ensure continuous accessible pedestrian paths of travel are maintained throughout the pedestrian environment.

The features required to achieve accessible footpath design covered in this Guideline are applicable to the design and construction of accessible pedestrian refuge areas.

The main considerations applicable to pedestrian refuges are:

- the refuge is to have a crossfall not steeper than 1:40 (or 1:33 for an asphalt surface);
- the refuge is to have a gradient not steeper than 1:40 (or 1:33 for an asphalt surface);
- where kerb ramps are provided, they are required to be provided at both sides and sufficient circulation space shall be provided to accommodate the sloping surface of the kerb ramp and landings;
- where turning spaces are required within the refuge / median, these shall have a landing (level surface with no stepper than 1:40 / 1:33) and sufficient dimensions to meet AS 1428.1 (clear of all encroachments such as pedestrian fencing, safety barriers, push button assemblies etc.); and
- where turning spaces are not required within the refuge / median, the landing shall be minimum 1200 mm in length to meet AS 1428.1.

Poorly designed and constructed kerb ramps create barriers and safety issues for people with mobility and sensory disabilities. Well designed and constructed kerb ramps will assist people with disabilities in safely negotiating and navigating the built environment.

Practitioners should consider the possibility of implementing cut through medians / pedestrian refuges, raised pedestrian crossings etc. to avoid the use of kerb ramps where possible. These treatments eliminate the potential barriers and safety issues associated with poorly designed kerb ramps.

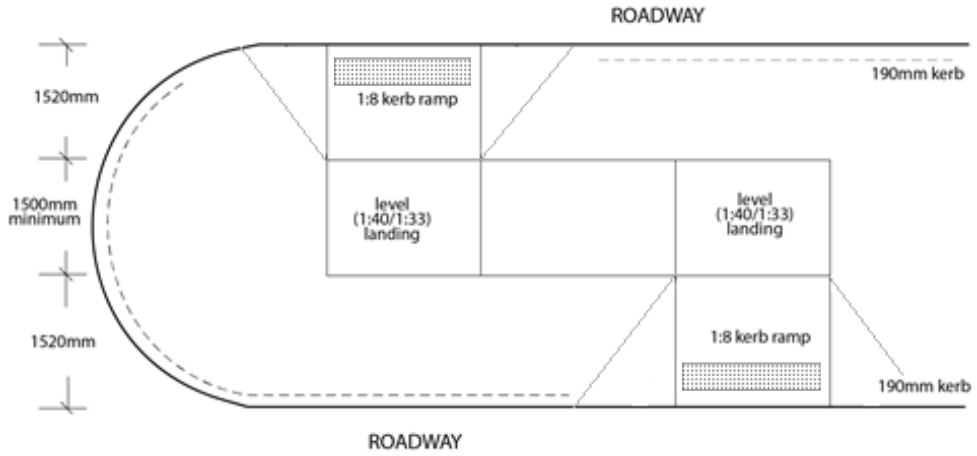


Figure 25: Minimum circulation space requirements at kerb ramps with 90° turn at landing

3.3.2 Median with cut through

Practitioners should consider the possibility of implementing cut through medians to avoid the use of kerb ramps where possible. Median with cut through treatments eliminate the potential barriers and safety issues associated with poorly designed kerb ramps.

Raised crossing islands should be cut through level with the roadway on both sides of the island. Median cut throughs also allow for easy access for users of wheelchairs or mobility aids such as a walking frame.

To indicate and warn of the edge of the roadway, warning TGSIs shall be placed on either side of the median for the full width of the cut.

The median should be a minimum width of 2.5 m which will allow two sets of warning TGSIs to be installed adjacent and set back 300 mm from the line of kerb.

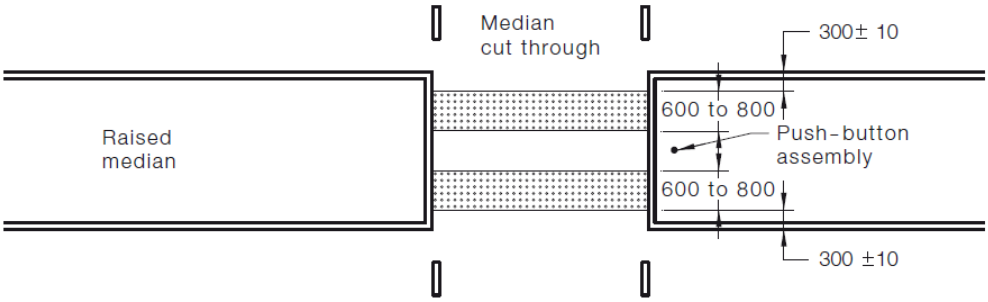


Figure 26: Median cut through

Figure 27: Median with cut through (in lieu of kerb ramps)

3.4 Tactile ground surface indicators (TGSIs)

3.4.1 General Requirements

Tactile ground surface indicators (TGSIs) assist people who are blind or have low vision in identifying hazards and wayfinding in the built environment.

TGSIs take the form of raised dots or bars which, through their textural and luminance contrast, can be identified by a person who is blind or has low vision and provide important information regarding features in the environment.

TGSIs should only ever be installed where required. The use of TGSIs in addition/surplus to what is required is not considered to be beneficial.

It is important that TGSIs are UV resistant and designed, constructed and maintained to ensure their installation continuously meets AS/NZS 1428.4.1 throughout the lifetime of installation.

3.4.2 Types of TGSIs

TGSIs may be in the form of raised dots or bars. The raised dots are known as warning tactile ground surface indicators (warning TGSIs) and the raised bars are known as directional tactile ground surface indicators (directional TGSIs).

Both warning and directional TGSIs are available in either integrated or discrete forms. Integrated TGSIs are in the form of a tactile tile, while discrete TGSIs are in the form of individual or discrete studs which may be either a single colour or two tone (two tone studs are also known as composite TGSIs).

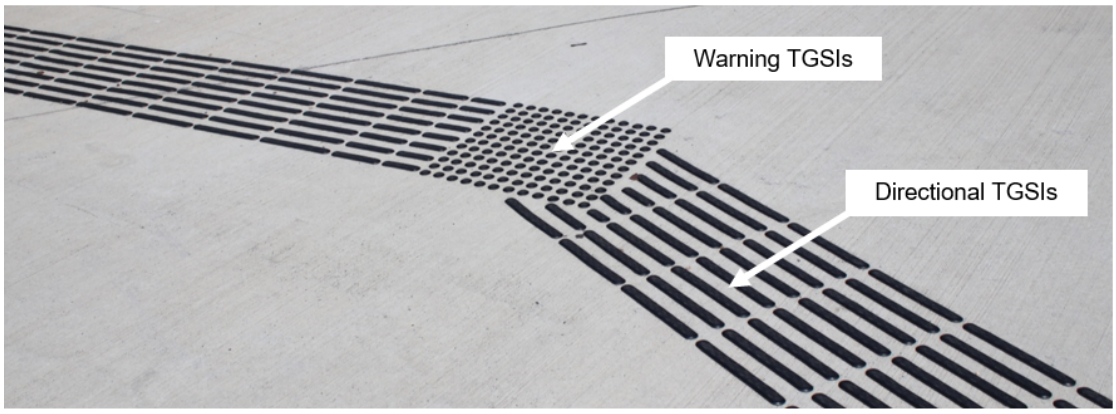


Figure 28: Warning and directional tactile ground surface indicators

Figure 29: Integrated TGSIs (tiles)

Figure 30: Discrete TGSIs (individual studs)

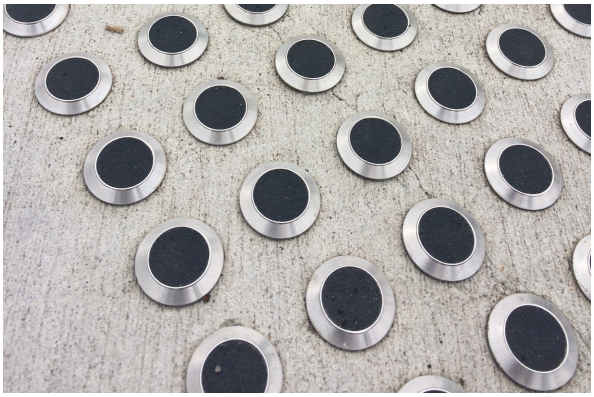


Figure 31: Discrete TGSIs (individual studs - composite / two tone)

3.4.3 Warning TGSIs

The main function of warning TGSIs is to warn people of a hazard ahead (that cannot be detected by other means) such as at a vehicular roadway, bicycle or shared use path, stairway, ramp, etc. When used as a square block in conjunction with directional TGSIs, warning TGSIs also assist in wayfinding by indicating a change in direction to the path of travel or the location of a bus or tram stop.

Warning TGSIs in the pedestrian environment are to be installed in accordance with AS/NZS 1428.4.1 in the following locations;

- at hazardous crossing points;
- at kerb ramps (if required - see Note below);
- at the top and base of a stairway (comprising two or more risers); and
- at the top and base of a ramp (e.g. at a pedestrian bridge or overpass).

Note:

Warning TGSIs are not required to be installed (and should not be installed) on a kerb ramp if ALL of the following conditions are met (AS/NZS 1428.4.1:2009 Appendix C):

- the distance between the building line / boundary and the top of the kerb ramp is less than 3 m;
- the gradient of the kerb ramp is between 1:8 and 1:8:5; and
- the kerb ramp is aligned with the building line and in the direction of travel across the roadway.

Warning TGSIs are to be installed in accordance with AS/NZS 1428.4.1 as follows:

- setback 300 mm (± 10 mm) from the edge of the hazard (such as the roadway edge, stair nosing or commencement of the ramp);
- at a depth of 600 mm to 800 mm; and
- located perpendicular to the direction of travel and for the full width of the path of travel.

Where warning TGSIs need to be detected by a person approaching at an angle to the continuous accessible path of travel, the TGSIs shall be arranged as below and shown in Figure 32:

- over a minimum depth of 600 mm to 800 mm from the direction of approach for integrated warning TGSIs; and
- with a minimum of 12 discrete studs in the direction of travel for discrete warning TGSIs.

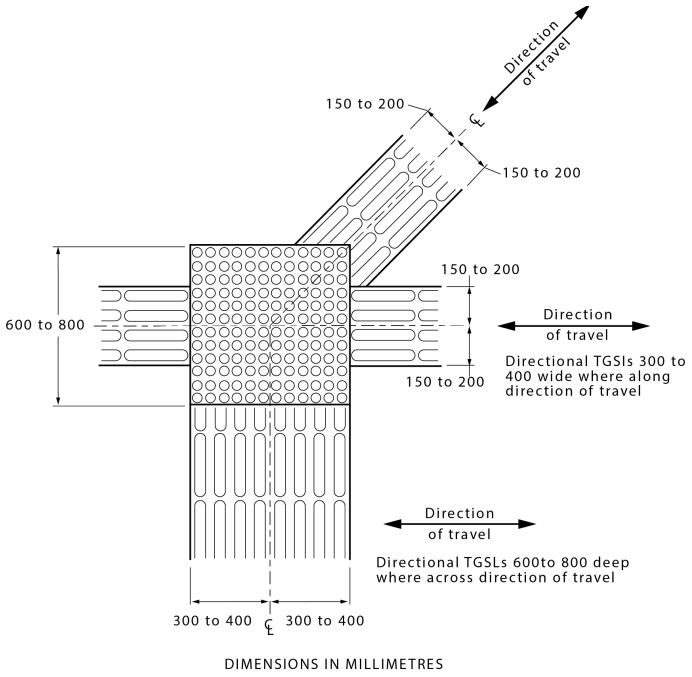


Figure 32: Installation of TGSIs denoting a change in direction

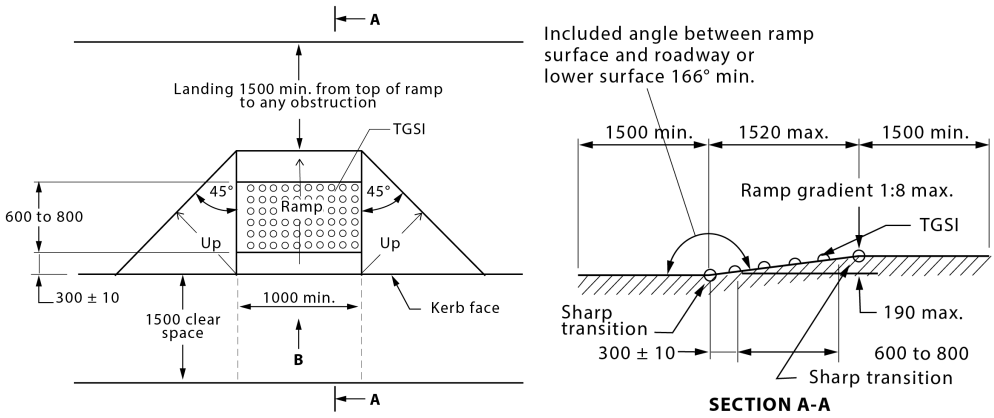


Figure 33: Installation of warning TGSIs at a kerb ramp (if required)

3.4.4 Directional TGSIs

Directional TGSIs are used to assist people with a visual impairment in wayfinding and indicates the direction of travel where there are insufficient environmental cues. The use of directional TGSIs with warning TGSIs will not correct bad design and therefore should only be used where alternative environmental cues cannot be provided to assist with wayfinding.

People who are blind or have vision impairments often navigate environments using a technique known as ‘shore lining’ where they follow a wall, kerb or the edge of contrasting surfaces to maintain their orientation along a path until they reach a decision-making point. Therefore, directional TGSIs may be considered in wide, open footpaths where people with vision impairments may require guidance, for example, to a bus stop or signalised crossing point.

Directional TGSIs in the pedestrian environment may be required in accordance with AS/NZS 1428.4.1 for the following:

- to give directional orientation where a person must deviate from the regular accessible pedestrian path of travel to have access to –
    - a mid-block kerb ramp or street crossing;
    - public transport access point (e.g. bus or tram stop);
    - a point of entry to a significant public facility (e.g. railway station, public hospital, sports or entertainment centre);
- where a kerb ramp is not in the direct continuous accessible path of travel and environmental cues to lead pedestrians to the crossing point is insufficient;
- to designate the route to be taken in order to avoid a hazard where there are insufficient existing tactile cues;
- at intersections where the point of entry to the road is more than 3 m from the property line;
- at intersections that incorporate slip lane crossings to indicate the position of the crossing and the direction of travel across the island where the path of travel has not been cut through the island;
- across large open spaces, where there are no other tactile cues (e.g. a train station concourse); and
- at bus and tram stops in accordance with the *Disability Standards for Accessible Public Transport*.

Directional TGSIs are to be installed in accordance with AS/NZS 1428.4.1 as follows:

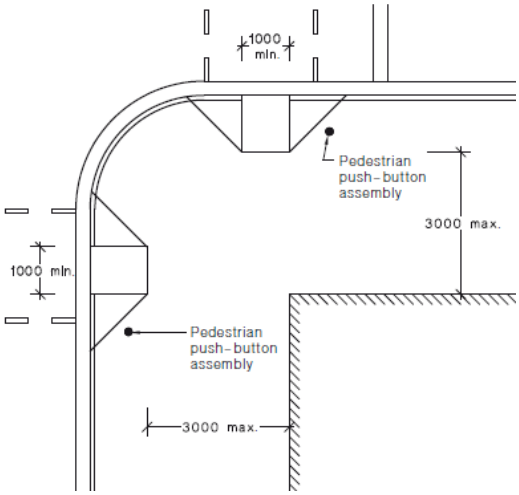
- parallel with and along the centre line of the required direction of travel;
- where the directional TGSIs are parallel to the predominant pedestrian path of travel, they should be installed at a depth of 300 mm to 400 mm;
- where the directional TGSIs are perpendicular to the predominant pedestrian path of travel, they should be installed at a depth of 600 mm to 800 mm;
- clear of any obstructions or encroachments within 600 mm of either side of the line of tactile; and
- where there is a change in direction denoted by directional TGSIs, warning TGSIs should be installed.

The arrangement of directional and warning tactile ground indicators at pedestrian intersections and crossings is described in Appendix C of AS/NZS 1428.4.1. Figure 34 shows the arrangement of warning and directional TGSIs at a right-angle intersection with dual entry pedestrian crossing points.

≤ 3000 mm from property boundary to top of ramp

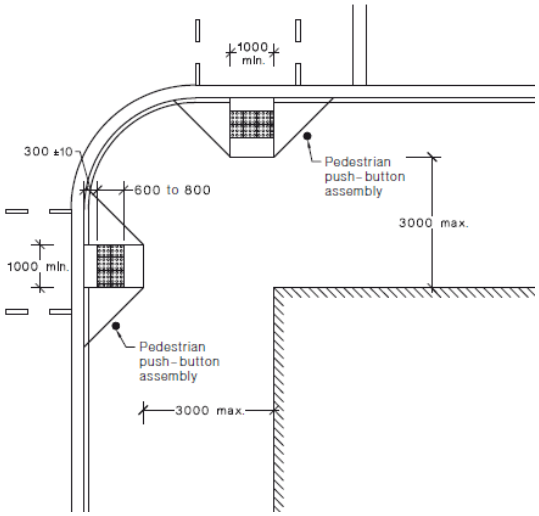
Kerb ramp is aligned with the building line and in the direction of travel across the carriageway

For kerb ramp gradients between 1:8 and 1:8.5



≤ 3000 mm from property boundary to top of ramp

For kerb ramp gradients flatter than 1:8.5



≥ 3000 mm pathway or the ramp is not aligned with the building line

1:8 kerb ramp gradient

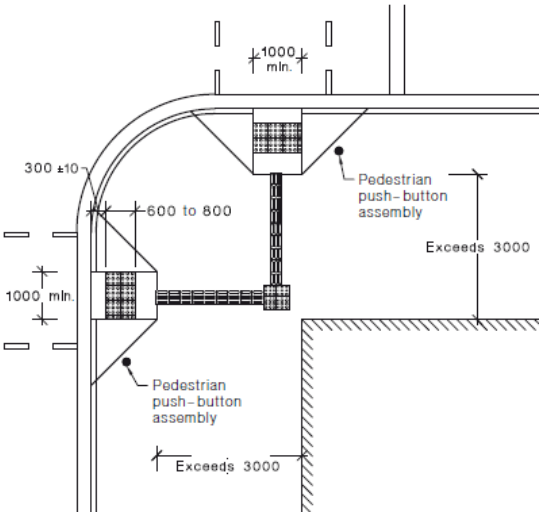


Figure 34: General arrangement of warning and directional TGSIs at intersections

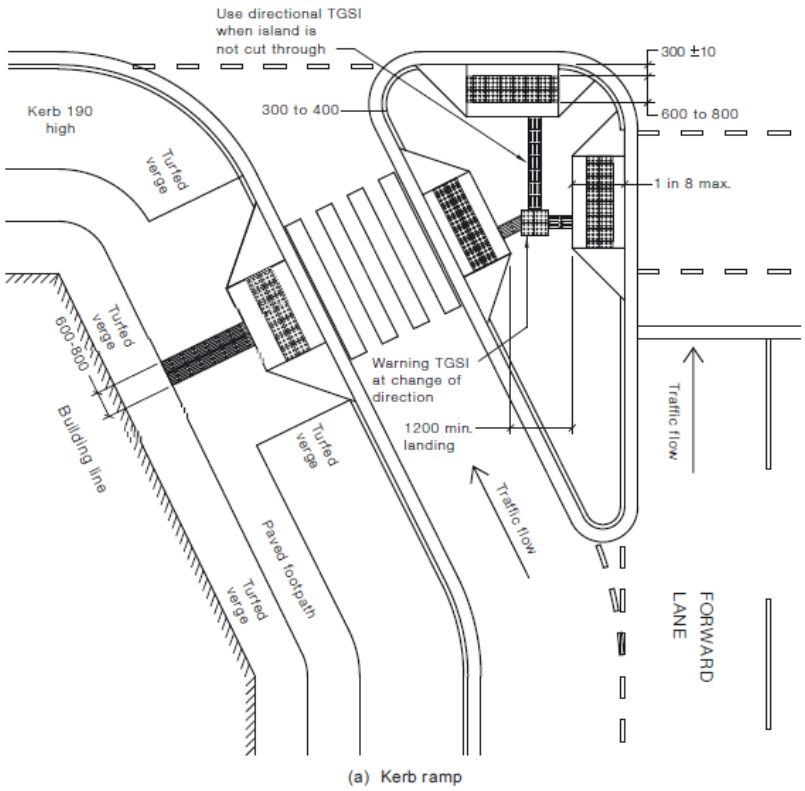


Figure 35: Slip lane crossing with raised island

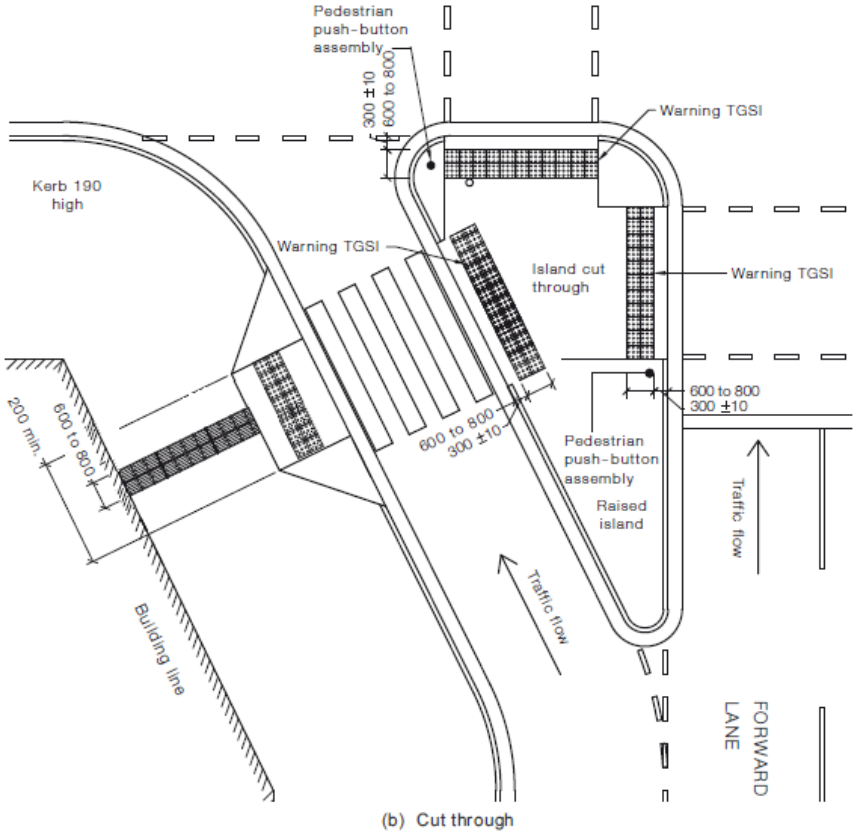


Figure 36: Slip lane crossing with island cut through

3.4.5 Luminance Contrast

The provision of sufficient luminance contrast in the choice of TGSIs improves access to information for pedestrians with vision impairments who are able to see to some degree.

Luminance contrast is defined as the light reflected from one component or surface (the TGSIs), compared to the light reflected from another component or surface (the surrounding surface) and is measured as the difference between the luminance reflectance values (LRVs) of the different components or surfaces.

If measured in a laboratory, a tristimulus colorimeter or spectrophotometer is usually used to determine luminance values. If measured on site, a single lens reflex luminance meter or photometer is usually used to determine luminance values. Details of the methodology for the measurement of luminance contrast can be found in AS 1428.1 or AS/NZS 1428.4.1.

TGSIs shall achieve the following minimum luminance contrast when compared with the surrounding surface in accordance with AS/NZS 1428.4.1:

- not less than 30% for integrated TGSIs (i.e. tactile tiles);
- not less than 45% for discrete TGSIs where individual studs are of a single colour; and
- not less than 60% for discrete TGSIs which are composite / two-tone.

As the luminance contrast is a comparison of the amount of light reflected from the TGSI product compared to the amount of light reflected from the surrounding surface, the choice of tile colour should be dependent on the colour of the surrounding surface. For example, ivory or yellow TGSIs may not be appropriate on light coloured concrete, whereas they may be appropriate on black coloured asphalt.

Figure 37: Tactile studs with insufficient luminance contrast to their base surface

Figure 38: Tactile studs with sufficient luminance contrast to their base surface

Figure 39: TGSI luminance contrast and integrity not maintained

3.4.6 Installation Requirements

Warning and directional TGSIs shall be installed in accordance with AS/NZS 1428.4.1 so that they:

- have no likelihood of edges lifting;
- have a top surface of no more than 4 mm to 5 mm above the base surface;
- have a base surface of no more than 3 mm above the surface of the surrounding ground with all exposed external edges chamfered; and
- are located away from service pits and the like.

Warning and directional tactile ground surface indicators are required to achieve the following slip-resistance ratings per AS 4586 *'Slip resistance classification of new pedestrian surface materials'*:

- for TGSIs on kerb ramps (gradient steeper than 1:14) – slip resistance rating of P5 or R12; and
- for TGSIs on landings and pathways (gradient less than 1:14) – slip resistance rating of P4 or R11.

3.5 Push button assemblies

Audio-tactile pedestrian push buttons provide audible and tactile cues in addition to the visual cues provided to pedestrians at signalised intersections. They are used by pedestrians with vision impairments, and other disabilities, to help identify which pedestrian crossing phase is active.

Tactile and audible accessible features must be provided in accordance with AS 1742.14.

Push button assemblies shall comply with the following:

- be provided at each end of a marked pedestrian crosswalk, including on the pedestrian refuge (normally mounted on traffic signal posts);
- be located within the 'zone of common reach' which is 300 mm – 400 mm horizontally from the accessible path (where an accessible location is not readily available, then a second pole with an assembly may be provided);
- installed at a height of 1000 mm (± 100 mm) from the ground's surface;
- include audio-tactile devices that emit a sound and a vibration during the 'walk' display and a different sound and vibration during the 'don't walk' display;
- not be located closer than 2 m from another audio tactile pedestrian push button (to avoid confusion of where the sound is coming from); and
- be mounted on the side of the pole with a horizontal arrow legend on the face of the button indicating the direction it applies (mounted on the back of the pole with a vertical arrow legend on the face of the button indicating the direction it applies is also acceptable).

Note:
There is a common misconception that the 'zone of common reach' (300 mm – 400 mm) is measured from the closest edge of the warning TGSIs. This is not necessarily the case. The 'zone of common reach' is measured from the edge of the accessible path that all pedestrians (including wheelchair users and users of mobility aides) can access without obstruction (i.e. accessible floor space).

Figure 40: Push button assembly

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