

**DESIGN STANDARDS**  
**for**  
**URBAN INFRASTRUCTURE**  
**11 FENCES, GUARDRAILS AND BARRIERS**



# **11 FENCES, GUARDRAILS AND BARRIERS**

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## 11.1 Introduction

This standard covers the requirements for all classes of safety barriers and fences in the public realm except for barriers associated with bridges, which are covered in Design Standard 7.

## 11.2 Related codes of practice and guidelines

### 11.2.1 Industry standards

*AS/NZS 3845:1999 Road safety barrier systems*, Standards Australia.

*NCHRP Report 350 - Recommended Procedures for the Safety Performance Evaluation of Highway Features*, National Co-operative Highway Research Program.

*Considerations for the provision of safety barriers on rural roads*, National Association of Australian State Roads Authorities (now AUSTROADS), 1987.

*Guide to traffic engineering practice part 13 pedestrians*, AUSTROADS and Standards Australia, 1995.

*Guide to traffic engineering practice part 14 bicycles*, AUSTROADS and Standards Australia, 1999.

## 11.3 General requirements for barriers and fences

The decision to install protective barriers at any location should not be taken lightly. In almost every case it is preferable to permanently remove the hazard rather than accept the ongoing costs of a barrier. These ongoing costs must be carefully assessed and included in the financial analysis when making the decision to adopt a “protect against” rather than an “eliminate” solution.

Where barriers are required they shall also be designed to:

- allow rapid maintenance and replacement (e.g. cast in balusters are not acceptable);
- satisfy architectural and aesthetic requirements;
- be consistent with adjacent structures;
- exhibit high resistance to vandalism
- be durable against weathering and deterioration
- have a low whole-of-life cost.

Paint finishes should be selected on the basis of superior resistance to fading, vandal resistance and appropriateness for the surface they are coating. Graffiti coatings should be considered for surfaces likely to be affected by graffiti.

## 11.4 Common Problems

### 11.4.1 Hazard removal.

Designers should examine carefully the potential for removal of the hazard rather than installing safety barriers. The following treatments have been successfully applied to eliminate the need for barriers on both traffic routes and pedestrian or cycle routes.

- Extend culverts until the end is out of the clear zone. This is usually possible on the downstream side of the road and sometimes possible upstream.

- Convert culvert inlet to plantation sump. This is a possible treatment for those areas where the upstream end of the culvert can't be extended and pipe sizes are not too large.
- Widen the embankment and reduce the slope.
- Remove trees. This is possible even under the protection legislation if the trees are not native species and not classified as significant.
- Convert pole bases to slip bases. An isolated pole with a slip base is usually less of a hazard than the alternative long length of barrier.
- Relocate roadside furniture. Signs, poles transformers etc can often be relocated to positions outside the clear zone without affecting their performance.

#### **11.4.2 Insufficient Length.**

In many cases, short lengths of barrier have been installed to “protect” an isolated hazard. In most of these cases an analysis of vehicle path will show that, unless the vehicle turns sharply and approaches the hazard at right angles to its normal direction of travel, the barrier will not prevent the vehicle from striking the obstruction.

If the barrier is a flexible type such as the common W beam, it needs to be a minimum of 20 metres long to dissipate the energy of the collision through deflection of the rail. Shorter lengths are likely to be displaced from the ground and add to the severity of the accident.

#### **11.4.3 Deflection.**

Steel beam and wire rope safety barriers are designed to absorb the energy of a crash by deflecting. Vehicles may still impact obstacles that are very close to the back of the rails. Even if the vehicle does not contact the obstacle, the obstacle may interfere with the normal functioning of the rail by limiting the deflection.

#### **11.4.4 Access gaps.**

Areas where vehicles or pedestrians need to pass through the barriers need careful treatment. They will usually require the standard end treatment on both sides of the gap. There are some very poor examples of this where the smooth face of the barrier abruptly disappears and presents the vehicle with an untreated end.

#### **11.4.5 Foundations.**

Performance problems can arise when the foundation conditions do not comply with the standard specified for a particular type of barrier. Examples include concrete paving around the bases of posts on W beam rails which prevents the designed deflection on impact or posts which are too close to the embankment to provide sufficient soil pressure to limit movement to design values.

### **11.5 Vehicle Barriers**

#### **11.5.1 General**

Selection of sites for the installation of vehicle safety barriers is to be based on the document *Considerations for the provision of safety barriers on rural roads*. Due consideration should be given to clause 3.4.1 of this document which states that barriers should only be installed when the consequences of impact with the unshielded hazard are greater than the consequences of impact with the barrier. In making this assessment, designers should bear in mind also the probability of impact with a fairly compact hazard compared with the

probability of impact with the much longer length of barrier that may be needed to shield the hazard.

Selection of type of barrier and structural design of barriers should be based on *AS/NZS 3845:1999*. Installation drawings for barriers and transitions between different types of barrier should also be based on this standard.

Traffic barrier types should be chosen taking into account the following:

- the level of risk that the barrier itself presents as a hazard;
- level of risk involved in the event of vehicles leaving the carriageway;
- containment of vehicles within the structure or roadway;
- minimising accelerations and smoothly re-directing errant vehicles;
- protection of adjacent land users.
- protection of other users (e.g. cyclists, pedestrians, equestrians etc.);
- maintaining sight lines (by widening or modifying alignments as appropriate).

### 11.5.2 Rigid barriers other than concrete barriers.

Although *AS/NZS 3845:1999* refers to barriers comprised of rails on posts in the section on

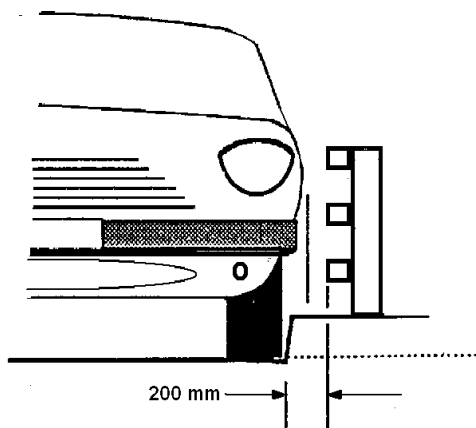


Figure 11.1

rigid barriers, it does not contain any illustrations of this type of barrier when illustrating the use of rigid barriers. This has led to some confusion as to the applicability of clause 3.9 when the rigid barrier system is post and rail as opposed to continuous concrete. All the illustrated rigid concrete barriers have some form “kerb” within their shape.

Research by the RTA has indicated that barriers should only be aligned with the face of kerb in speed zones of 70 kph and lower. It is desirable to place the barrier 200mm behind the kerb to allow for the overhang of the body beyond the wheels as depicted in Figure 11.1.

### 11.5.3 Terminals

Terminals shall comply with the evaluation criteria of NCHRP Report 350, Test Level 3, or be listed by the Federal Highway Administration (FHWA) of the US Department of Transport, for use on the National Highway System (NHS) at Test Level 3 or higher.

#### 11.5.3.1 Flexible Rails

Note that the Breakaway Cable Terminals as depicted on the old Standard Drawings GW/SD/DC/07 and GW/SD/DC/08 do not comply with the requirements of *AS/NZS 3845:1999* and must not be used.

The Modified Eccentric Loader Terminal (MELT) or Slotted Breakaway Cable Terminal as described in *AS/NZS 3845:1999* may be used in locations which meet the minimum installation and site requirements of Table B3.

Alternatively proprietary terminals may be used in accordance with the requirements of their NCHRP 350 test certificates.

### 11.5.3.2 Non-Gating Terminals

Non gating terminals are those which do not allow penetration or pocketing during impacts near the nose. They will generally be used at the ends of rigid barriers or other rigid obstructions such as bridge piers or parapets.

Designers should bear in mind when specifying non-gating terminals that they are available in various degrees of reusability with large differences in the number of components that need to be replaced following an impact. In general, the terminals having a larger proportion of sacrificial components will have a lower installation cost but a higher maintenance cost and a higher restoration cost after impact. There are systems available which will fully recover without replacement of any components but these are generally more expensive to install.

Designers must carefully specify the chosen type of terminal to ensure that systems having higher whole of life costs are not substituted during the construction phase.

### 11.5.4 Interfaces between different classes of barrier

See Clause 2.3.12 of *AS/NZS 3845:199* for a discussion of this issue.

Where two different road safety barrier systems are combined together, a transition zone, which facilitates a merge between the systems in a manner which avoids pocketing and snagging during a collision, shall be provided.

Note that the flexible to rigid transitions depicted on the old NCDC standard drawings 1026/88 and 1027/88 must not be used.

### 11.5.5 Vehicle – Vehicle Separation

Barriers used for separating opposing streams of traffic must be selected bearing in mind the likely deflection of the barrier system during an accident. Where medians are very narrow, rigid concrete barriers with appropriate end treatments are preferred. On wider medians that still require barriers, wire rope type barriers are preferred over back to back flexbeam.

### 11.5.6 Vehicle – Pedestrian / Cyclist Separation

Under no circumstances should any form of flexible barrier be used to separate vehicles from pedestrians or cyclists. Flexible barriers dissipate the excess energy from an errant vehicle through deformation that can be quite considerable. The presence of a barrier can give pedestrians a false sense of security when the behaviour of the barrier actually means that they are less safe than if the barrier did not exist. (In effect the barrier can act as a very wide bumper bar).

Transit SA has developed guidelines covering the use of specially designed bollards to provide protection of roadside dining areas from impact by errant vehicles (see 11.8 Further Reading). At least three companies can supply bollards that comply with these guidelines. Although there is currently no legislative requirement in the ACT to use such devices, it may be advisable to consider these in circumstances where high volumes of traffic are in close proximity to densely used pedestrian areas.

### 11.5.7 Exclusion of Vehicles from Public Areas

#### 11.5.7.1 Use of 225 mm kerbs as vehicle barriers

In situations where long lengths of vehicle barriers will be required for playing fields and open space, the use of high kerbs (225 mm) as vehicle barriers rather than the more expensive alternative of standard kerbing with continuous log barriers is preferred. The economic

advantages are clear and, in most situations, aesthetic and maintenance advantages will also be gained.

Margins of playing fields abutting roads and car parks are examples of such areas. Other areas of open space offering potential for short-cutting the road system, or gaining access to residential blocks need careful assessment to enable a decision on the use of high kerbs.

Care should be taken in the use of high kerbs that hazards are not created. The use of non-standard kerbs could, in some locations, constitute a hazard where members of the public normally expect to find standard kerbs. Simple examples are where elderly people or children step off a kerb and are thrown off balance onto the roadway, or where the occupants of vehicles open car doors onto an unexpectedly high kerb.

Particular attention will be required to ensure occupants who do not anticipate non-standard kerbs do not inadvertently damage cars when using car parks around playing fields and open space. Nose-in parking is preferable to parallel parking as a means of reducing the likelihood of this type of accident.

Pram crossings and maintenance access driveways across high kerbs constitute a potential illegal vehicular entry point. Dense landscape planting around such points may effectively block vehicle access. Sturdy staking preferably with steel pickets will be necessary until the trees reach a size when they create a solid barrier. A lockable chain or similar device will allow tractor entry for maintenance.

Standard kerb crossings can not be used on high kerbs. Crossings whether for vehicles or pedestrians (including people with disabilities) will need to be properly designed to ensure that they comply with appropriate standards.

#### **11.5.7.2 Bollards**

Bollards may be used to control or prevent vehicle access to public places or to provide visual enhancement to a space and their style should be compatible with other street furniture in the area.

Bollards that form the sole means of preventing vehicular access should be spaced at 1.6 metre centres. This should prevent most cars sold in Australia from driving between them.

They should be approximately 1 metre in height and include a reflective panel if sited in a vehicle domain such as a car park. The space between a bollard and a gutter or kerb should allow for pedestrian movement (including people with disabilities) and for vehicle overhangs and door openings.

Bollards must be visible to motorists, cyclists and pedestrians. Bollards should not be a hazard to people with disabilities. They should not be located in the natural desired pedestrian path.

Bollards are prone to vandalism and to unauthorised removal particularly if there is a strong desire for vehicle access to a location. They should have sufficient foundation strength to resist being pushed by a large 4\*4 vehicle.

#### **11.5.7.3 Log Barriers**

Although log barriers have been extensively used in many areas of the ACT, their use is no longer favoured. They tend to be prone to vandalism and deliberate damage by vehicles and have high maintenance costs as a result. In addition they are a safety hazard to pedestrians because their low height makes them difficult to see particularly at night.

They present a spearing hazard to vehicles when subject to impact end on which means that they should not be used adjacent to roads. Log barriers also present a major obstruction to mowing operations.

Designers who wish to use log barriers on a project should ensure that their designs address these issues when seeking permission for use.

## **11.6 Cycle and Pedestrian Barriers**

### **11.6.1 Barriers adjacent to cycle paths**

The need for barriers and the design of barriers adjacent to cyclepaths should be assessed using the provisions in *Guide to traffic engineering practice part 14*. Particular attention must be paid to ensuring adequate clearance from the barrier to the path.

Removal of the hazard should be investigated and the decision to install barriers should consider the whole of life costs of both the barrier and the removal of the hazard.

### **11.6.2 Barriers in public areas used by pedestrians**

In paved areas or areas within 5 metres of a pedestrian path, continuous protective balustrade shall be provided at changes in level greater than 1 metre (or 5 risers in the case of a stairway) unless the level difference is via an embankment of slope less than 1 vertical to 2 horizontal.

In areas likely to be used by large numbers of children and where the lower level has a hard surface such as concrete or gravel, barriers must be fitted with protective infills designed to prevent children from being able to climb over, squeezing through or from getting their heads stuck. The minimum acceptable level of protection uses vertical bars with maximum clear spacing of 110mm. Such bars shall be designed to a standard substantial enough to prevent damage by vandals. The use of horizontal members alone shall not be permitted.

In areas of public open space more than 5 metres from a pedestrian path but which meet the other criteria above for needing a barrier, designers should assess the most appropriate form of protection. Possible measures include simple one or two rail fences, bollards, landscape planting (incorporating temporary fencing until landscape is established, increased wall height or combinations of these. It is important that whatever measure is adopted helps delineate the hazard to users of the area and does not introduce an additional hazard (for example low walls or kerbs hidden in long grass could be a trip hazard particularly in low light conditions).

## **11.7 Fences and gates**

### **11.7.1 Fences**

In areas where a fence is the most appropriate way of restricting access for management purposes, a standard stock proof fence is preferred. Brush fencing or other highly flammable fences must not be used.

The standard stock proof fence is comprised of 5 wires (2barbed, 3 Plain) combined with suitable mesh supported on intermediate posts at 40 metres maximum spacing with star picket droppers at 4 metre spacing. Corner posts and gateposts should be equivalent to 250-mm timber.

### **11.7.2 Gates**

In locations where access is required for maintenance vehicles, the preferred gate is the Ranger style as illustrated in Standard drawings DS11-1 and DS11-2. The gate as shown in

DS11-2 is a heavy duty style designed to resist deliberate impact by drivers of larger four wheel drive vehicles seeking access to off road areas. It should generally only be necessary in more isolated areas or in areas where there is a history of damage to the standard gates.

Other styles of gate may be permissible provided they are compatible with the surrounding landscape, constructed of durable materials, are lockable and are vandal resistant to a high degree.

## **11.8 Further reading**

*Road planning and design manual*, Queensland Main Roads Department, 2000.

*Road design guide*, New South Wales Roads and Traffic Authority, 1996.

*Roadside dining protection – a guideline for local authorities in South Australia*, Transport SA, 13 November 2000. (available online at <http://www.dhs.sa.gov.au/crash-barriers/>)

## **11.9 Standard drawings**

<b>Title</b>	<b>Drawing Number</b>
Standard Ranger Gate	DS11-01
Vehicle Access Gate (Heavy Duty)	DS11-02