

Australian/New Zealand Standard™

Road safety barrier systems and devices

Part 2: Road safety devices



AS/NZS 3845.2:2017

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Australian Motorcycle Council
Australian Steel Institute
Austroads
Concrete Institute of Australia
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Department of Transport and Main Roads, Qld
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Australian/New Zealand Standard™

Road safety barrier systems and devices

Part 2: Road safety devices

Originated as part of AS/NZS 3845:1999.
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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee CE-033, Road Safety Barriers, to supersede, in part, AS/NZS 3845:1999, *Road safety barrier systems*.

This Standard is Part 2 of a series of two Standards on road safety barrier systems and devices. This Part 2 sets out the requirements for both permanent and temporary safety devices that include bollards, longitudinal channelizing devices, truck or trailer mounted attenuators, rear underrun protection devices and sign support structures and poles. Part 1 sets out the requirements for permanent and temporary safety barrier systems that include longitudinal road safety barriers, terminals, crash cushions, interfaces including transitions, and longitudinal barrier gate systems.

Notes to the text contain information and guidance. They are not an integral part of the Standard.

Statements expressed in mandatory terms in Notes to Tables are deemed to be requirements of this Standard.

The term ‘informative’ has been used in this Standard to define the application of the appendices to which it applies. An ‘informative’ appendix is only for information and guidance.

FOREWORD

In 2006, the National Highway Cooperative Research Program of the US Transportation Research Board was revising the testing conditions documented in NCHRP Report 350. At this time, Standards Australia and Standards New Zealand decided to revise AS/NZS 3845:1999 in line with the American Association of State Highway and Transportation Officials (AASHTO) Manual for Assessing Safety Hardware (MASH).

At about the same time, the Safe System approach has become the underlying philosophy for road safety. It is recognized that road crashes are the major cause of societal suffering, preventable death and injury and a major cost burden of the order of tens of billions of dollars on health systems and society in general. Some governments have recognized this societal burden and, as a result, have adopted a safe system approach in their action plans to reduce deaths and injuries on roads. The Safe System approach is based on human injury tolerance to impact forces. The Safe System approach acknowledges that humans make errors, but that the road traffic system should be designed to increase the chances of road users surviving any accidents which do occur. Refer to OECD, [2008]. *Towards Zero: Ambitious road safety targets and the safe system approach*, International Transport Forum, ISBN 978-92-821-0195-7.

In a Safe System, if a road user travels in accordance with all traffic laws and on a safe road in a safe vehicle, but finds through no fault of their own they become involved in a crash, the crash should not result in death or serious injury. Similarly, if a driver does make an error then a Safe System should react to minimize the consequences of the error. In a Safe System, the regulatory system should strongly discourage socially unacceptable road use behaviour. Thus all road user training and behaviour management, vehicle development and regulation, and road design and traffic management systems should be considered as a holistic inter-related system and governed according to this paradigm. The Safe System comprises four major interconnected elements: safe use, safe roads and roadsides, safe vehicles and safe speeds.

Road safety devices contributing to safer roads

Road safety devices are integral components of the safer roads element of the Safe System approach. However, there are a limited number of ways in which road safety devices can operate. Some devices attempt to dissipate the kinetic energy of a vehicle crash by one or more of the following mechanisms:

- (a) Heat through friction.
- (b) Elastic movement of the device or components of the vehicle, or both.
- (c) Plastic deformation of portions of the device or the vehicle, or both.
- (d) Fracture of elements of the device or the vehicle, or both.
- (e) Physical displacement of the device or the vehicle, or both, such as lifting the vehicle.

Energy should not be dissipated in unexpected or uncontrolled ways. For instance, unintended snagging of a vehicle on an element of the device can cause violent rolling and yawing, which may result in fatal or serious injuries to vehicle occupants. The unintended snagging of a rider on an element of the device can cause fatal or serious injuries.

The majority of passenger vehicles have been designed to meet New Car Assessment Programmes (NCAP) and, in Australia, the Australian Design Rules (ADRs) with a reasonable crash survivability outcome for the occupants. This means that road environments can be designed by taking into consideration safer vehicle technology.

It should not be expected that a road safety device will provide complete protection for vehicle occupants over the wide range of variables that could apply in a crash, such as vehicle mass, dimensions, speed and orientation of the vehicle on impact. It should be recognized that the effect on vehicle occupants of impacting a road safety device should be more forgiving than the effect on vehicle occupants of impacting the hazard that it is shielding/supporting.

The AS/NZS 3845 series of Standards, the Austroads guides to road design and the operation of the Austroads safety barrier assessment process support each other. Austroads guides describe the road and roadside configurations that identify where road safety barriers may need to be installed and the appropriate longitudinal and transverse location of these barriers. This series of Standards sets out the requirements of road safety barrier systems and devices. Road Authorities may review the information specified by the Standards and consider the usefulness of road safety barrier systems and devices for use on their road network.

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STANDARDS AUSTRALIA/STANDARDS NEW ZEALAND

Australian/New Zealand Standard Road safety barrier systems and devices

Part 2: Road safety devices

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Part of the Standard sets out the requirements for both permanent and temporary road safety devices including—

- (a) bollards;
- (b) longitudinal channelizing devices;
- (c) truck or trailer mounted attenuators;
- (d) rear underrun protection devices; and
- (e) sign support structures and poles.

NOTE: Longitudinal road safety barriers, terminals, crash cushions, interfaces (including transitions) and longitudinal barrier gate systems are specified in AS/NZS 3845.1.

The intention of this Standard is to ensure that road safety devices are crashworthy when impacted by a vehicle under specified conditions.

This Standard includes the following:

- (i) Testing methods and data.
- (ii) Considerations in the evaluation process.
- (iii) Manufacturing requirements.
- (iv) Issues to be addressed in specifying road safety devices including documentation required.
- (v) Erection and maintenance practices necessary to achieve expected performance.
- (vi) Minimum site conditions (cross slope, placement of kerbs or similar) that enable the device to have acceptable performance when impacted.
- (vii) Steps to evaluate the nature of repairs necessary following a crash.

This Standard makes significant reference to MASH and NCHRP 350. It also references some relevant European CEN Standards.

1.2 EXCLUSIONS

Longitudinal barriers, terminals, transitions, crash cushions, and longitudinal barrier gates are covered in AS/NZS 3845.1.

This Standard does not apply to the following:

- (a) Road safety devices erected for special purposes, such as motor sport events that include vehicle, motorcycle or kart racing, concessional go-kart facilities or special permit vehicles.

- (b) Fences which are installed to control the movement of pedestrians and other road users that are not designed to be crashworthy.
- (c) Security bollards to protect against intentional criminally motivated impacts such as ram-raids.
- (d) Trailers with variable message signs attached.
- (e) Sign support structures and poles that are not designed to be crashworthy.

This Standard does not provide guidance on—

- (i) the comparative performance of road safety devices or the preferred type of road safety device to be installed; and
- (ii) procedures to position a road safety device, either longitudinally or transversely, or with design related issues considered in warrants and selection of road safety devices.

1.3 APPLICATION

The Standard does not specify which road safety devices are acceptable for use on a road network. The Standard does not specify the minimum performance level of acceptable road safety devices. The specification of the minimum performance level of a road safety device is at the discretion of the Road Authority.

NOTE: Road Authorities not belonging to Austroads may use the process defined in this Standard to decide whether a device is acceptable for their application.

This Standard shall be used in conjunction with other documents and Road Authority specifications. In particular, AS 1742 (for Australia) and TCD Manual Part 8: CoPTTM (for New Zealand) give guidance on the assessment and appropriate selection of road safety devices for temporary traffic management.

This Standard is not intended for application to existing installations or to road safety devices that previously have been evaluated and adopted for use on a road network.

Additionally, the Austroads *Guide to Road Design*, Part 6 contains guidance on the assessment of roadside hazards.

1.4 REFERENCED DOCUMENTS

AS

- 1348 Road and traffic engineering—Glossary of terms
- 1379 Specification and supply of concrete
- 1742 Manual of uniform traffic control devices
- 1742.2 Part 2: Traffic control devices for general use
- 1742.3 Part 3: Traffic control for works on roads

AS/NZS

- 1214 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD)
- 1554 Structural steel welding
- 1554.1 Part 1: Welding of steel structures
- 1594 Hot-rolled steel flat products
- 1595 Cold-rolled, unalloyed, steel sheet and strip
- 3678 Structural steel—Hot-rolled plates, floorplates and slabs
- 3679 Structural steel
- 3679.1 Part 1: Hot-rolled bars and sections

AS/NZS

- 3845 Road safety barrier systems and devices
- 3845.1 Part 1: Road safety barrier systems
- 4671 Steel reinforcing materials
- 4672 Steel prestressing materials
- 4672.1 Part 1: General requirements
- 4672.2 Part 2: Testing requirements
- 4676 Structural design requirements for utility services poles
- 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

NZS

- 3109 Concrete construction

AS/NZS ISO

- 31000 Risk management—Principles and guidelines

EN

- 1317 Road restraint systems (series)

CEN/TS

- 1317 Road restraint systems
- 1317-8 Part 8: Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers

UNE

- 135900-1 Standard on the evaluation of performance of the protection systems for motorcyclists on safety barriers and parapets, Part 1: Terminology and test procedures
- 135900-2 Standard on the evaluation of performance of the protection systems for motorcyclists on safety barriers and parapets, Part 2: Performance classes and acceptance criteria

Austroads Guide to Road Design

- Part 6: Roadside design, safety and barriers

American Association of State Highway and Transportation Officials (AASHTO) *Manual for Assessing Safety Hardware* (MASH), Washington DC, 2009 (Publication code MASH-1)

Laboratoire d'essai INRETS Équipements de la Route (1998): Protocole d'Évaluation de Dispositifs de Protection pour Motocyclistes {(Motorcyclist Friendly Devices Assessment Protocol. In French.)}, 1998.

The National Cooperative Highway Research Program (NCHRP) Report 350, '*Recommended Procedures for the Safety Performance Evaluation of Highway Features*' (NCHRP 350), Ross, Sicking, Zimmer and Michie, Washington DC, 1993, U.S. Department of Transportation Federal Highway Administration

New Zealand Transport Agency (2012), *Traffic Control Devices Manual*, Part 8: *Code of Practice for Temporary Traffic Management* (CoPTTM)

New Zealand Transport Agency (2002), Vehicle Dimensions and Mass Rule

1.5 DEFINITIONS

For the purpose of this Standard, the definitions given in AS 1348 and those below apply.

1.5.1 Attachments

Accessories that are not an integral part of the road safety device such as signs.

1.5.2 Bollard

A short vertical post designed to obstruct the passage of a motor vehicle while allowing a pedestrian or cyclist to pass by.

NOTE: Bollards can be used as a single post or a series of bollards, referred to as an array.

1.5.3 Crash test

A test carried out in controlled conditions in which a production model test vehicle or a surrogate test vehicle impacts a road safety barrier system or device.

1.5.4 Dynamic deflection

The largest transverse deflection of any part of a road safety barrier system or deflection in any direction of a road safety device recorded during a full-scale crash test.

1.5.5 Entities

The following are the entities that may be involved in the design, manufacture and installation of the components of a road safety barrier system, road safety devices or crash cushions. A single entity may fulfil the role of one or more of the following definitions:

- (a) *System Designer* The entity that has designed the system or device and had it tested to suit a particular application.
- (b) *System Owner* The entity that has the property rights to the system or device through their ownership of the patent.
- (c) *System Manufacturer* The entity that manufactures the system or device components.
- (d) *System Supplier* The entity that supplies the system or device.
- (e) *Installation Designer* The entity that designs the length, location and types of components of a system or device to be installed on a section of the road network. The Installation Designer designs the system or device to suit the particular conditions of the section of road network.
- (f) *Road Authority* The entity that is responsible for the section of the road network where a system or device is installed.
- (g) *System Installer* The entity that installs the system or device.

1.5.6 Feature

Refers to a specific element of a highway or road. It may be a hardware item and its associated foundation, such as a sign or device installation, or it may be a geometric element, such as a side slope or a ditch cross-section.

1.5.7 Longitudinal Channelizing Device (LCD)

Device used to inhibit access by pedestrians to a work zone and other hazardous areas or to delineate vehicle paths.

NOTE: These devices do not necessarily possess any crash redirection or energy dissipating characteristics.

1.5.8 May

Indicates the existence of an option.

1.5.9 Pole

A vertical structure that is a utility pole, a lighting column or supports traffic lights or signs.

1.5.10 Proprietary device

A road safety device that is the subject of patent or other intellectual property rights within Australia and New Zealand.

1.5.11 Public domain device

A road safety device that is not the subject of patent or other intellectual property rights within Australia and New Zealand.

NOTE: These devices are also referred to as non-proprietary road safety devices.

1.5.12 Rear underrun protection device (RUPD)

An energy-absorbing device permanently fixed to the rear chassis of any truck or trailer of an articulated truck that is used to reduce the occupant impact severity in an impacting vehicle.

NOTES:

- 1 These devices are also referred to as truck underrun barriers (TUBs).
- 2 See Appendix G for guidance on the testing of RUPDs.

1.5.13 Shall

Indicates that a statement is mandatory.

1.5.14 Should

Indicates a recommendation.

1.5.15 Sign support structure

A structure which supports road or traffic signs.

1.5.16 Test level (TL)

Categorizes the impact severity of a crash test matrix and is defined in terms of vehicle type and mass, speed and impact angle.

1.5.17 Test vehicle

A vehicle used in a crash test to evaluate the impact performance of a test article.

1.5.18 Traffic control device

Devices such as longitudinal channelizing devices, delineators and other similar devices used to guide and control traffic, including pedestrians, motor vehicle drivers and cyclists. These devices are usually placed adjacent to or along the highways, roads, traffic facilities and other public areas that require traffic control.

1.5.19 Truck or trailer mounted attenuator (TMA)

An energy-absorbing device attached to the rear of a truck or trailer, designed to reduce the impact severity for the occupants of the truck, the impacting vehicle and other road users. Within specified impact conditions, a TMA is designed to bring a vehicle impacting the rear of the truck or trailer to a controlled stop.

NOTES:

- 1 Trailer mounted attenuators are attenuators that, rather than being mounted to a truck, are mounted on a trailer which can then be attached to a truck.
- 2 For commentary on this Clause (1.5), see Paragraph A5 of Appendix A.

1.6 NOTATIONS

Where non-dimensional ratios are involved, the numerator and denominator are expressed in identical units.

The dimensional units for length, stress and energy in all expressions and equations are to be taken as millimetres (mm), megapascals (MPa) and kilojoules (kJ) respectively, unless specifically noted otherwise.

1.7 GENERAL REQUIREMENTS FOR ROAD SAFETY DEVICES

Road safety devices shall be—

- (a) supported by technical literature and assembly instructions that clearly illustrate the essential mode of operation;
- (b) maintained and repaired in a manner that reflects the specified requirements; and
- (c) returned into service following a crash only after an evaluation and effective execution of repairs.

1.8 USE OF SUBSTITUTED MATERIALS AND OTHER COMPONENTS

Substitution of materials or products not specifically referred to in this Standard shall only occur with the agreement of both the respective Road Authority and the System Owner in accordance with Clause 4.4.

1.9 VULNERABLE ROAD USERS

When specifying a road safety device, vulnerable road users shall be considered.

Consideration shall be given to the likelihood of pedestrians and cyclists impacting with either side of the road safety device. Road safety devices used near footpaths or cycle paths should not have features that are potential trip or snag hazards.

The design of road safety devices shall minimise edges or protrusions that could injure vulnerable road users, where possible.

NOTES:

- 1 A road safety device designed to arrest a test vehicle will not be optimal when impacted by a cyclist or motorcyclist. A road safety device that is designed to reduce the likelihood of injury to the occupant of a vehicle could increase the risk of injury to a cyclist or motorcyclist.
- 2 For commentary on this Clause (1.9), see Paragraph A9 of Appendix A.

1.10 MAINTENANCE AND INSTALLATION

1.10.1 Maintenance

For maintenance of road safety devices, the following shall be applied:

- (a) Replace like with like, provided the damaged road safety device conforms to the current edition of this Standard.
- (b) If a significant proportion of a road device that does not conform to the current edition of this Standard is damaged, consider replacing with a device compliant with the current edition.
- (c) Public domain devices shall be maintained in accordance with the Road Authority requirements.
- (d) Proprietary devices shall be maintained in accordance with the System Owner's published requirements and in accordance with Road Authority specifications.

- (e) Metallic components subjected to the effects of fire may be retained in service provided the galvanized coating is undamaged.

1.10.2 Installation

Installation requirements for road safety devices are as follows:

- (a) Public domain devices shall be installed in accordance with Road Authority requirements.
- (b) Proprietary devices shall be installed in accordance with the System Owner's published requirements and any conditions imposed by a Road Authority with the latter taking precedence.
- (c) Installation shall proceed in a manner which reduces the risks to travelling public and workers.
- (d) Where site conditions (e.g. weak soil conditions) dictate non-standard installations prior to installation, direction shall be provided by the System Owner.

NOTE: For commentary on this Clause (1.10), see Paragraph A10 of Appendix A.

SECTION 2 DEVICE DOCUMENTATION

2.1 SCOPE OF SECTION

This Section specifies the documentation that is required to accompany road safety devices so that the necessary information is produced and made available to those owning, specifying, supplying, constructing, manufacturing, installing, maintaining and refurbishing such devices.

2.2 DOCUMENTATION ACCOMPANYING ROAD SAFETY DEVICES

The System Owner or System Supplier of a road safety device shall provide the following documentation:

- (a) Details of testing demonstrating the crash performance of the device (see Clause 2.3).
- (b) Details of performance characteristics and limitations on use of the device (see Clause 2.4).
- (c) Requirements for, and guidance on, the fabrication, installation and maintenance of the device (see Clauses 2.5 and 2.6).
- (d) Details of tolerances (see Clause 2.5.1).
- (e) Details of properties of plastic materials.

NOTE: For details of properties of plastic materials, see Paragraph C2.3 of Appendix C.

NOTE: Road Authorities and other entities may have additional requirements.

2.3 CRASH PERFORMANCE STATEMENT

All road safety devices shall be crash tested in accordance with the procedures specified in this Standard. The following aspects shall be included in the documentation supplied with the road safety devices:

- (a) Details of the article tested including the installation configuration (including alignment and proximity to drains, embankments, kerbs and the like) together with details of the site conditions (including soil type, soil grading and soil moisture content, air temperature and surface type) at the time it was tested.
- (b) The test criteria and outcome based on the evaluation described in Section 4.
- (c) The working width and the dynamic deflection width for all tests.
- (d) Details shall be provided of any special requirements for installation of the road safety device.

NOTES:

- 1 For devices that behave as projectiles or unrestrained objects, the total distance travelled until rest and the trajectory and behaviour of travel should be documented.
- 2 For commentary on this Clause (2.3), see Paragraph B2.3 of Appendix B.

2.4 CHARACTERISTICS AND LIMITATIONS

2.4.1 General

Characteristics and limitations include, but are not limited to, those mentioned in Clauses 2.4.2 to 2.4.5.

2.4.2 Geometric and site constraints

Any combinations of vertical and horizontal geometry that render the road safety device less effective, or reduce the efficiency of the road safety device, shall be documented. If there are any details available where the range of applications can be extended by modifications, these details shall be documented.

For transverse details, the following shall be documented:

- (a) Range of cross-falls that the device can be installed on.
- (b) Any limitations on the effectiveness of the device due to the proximity of drains, kerbs and gutters.

2.4.3 Attributes to reduce injury risks to vulnerable road users

A road safety device shall be designed to limit injury to vulnerable road users.

Qualities which may reduce injuries include some or all of the following:

- (a) Smooth unbroken surfaces without openings or sharp edges.
- (b) Lack of points that will snag.
- (c) Protection against impact with posts.
- (d) Locating attachments, such as reflectors, where they are less likely to be impacted.

These qualities shall be part of the basic design or obtained by fitting additional components.

Any crash testing undertaken with attachments or additional components shall be documented.

NOTE: For commentary on this Clause (2.4.3), see Paragraph B4.3 of Appendix B.

2.4.4 Operational temperature range

The temperature range over which the road safety device is expected to perform without any reduction in effectiveness shall be documented.

NOTE: For commentary on this Clause (2.4.4), see Paragraph B4.4 of Appendix B.

2.4.5 Environment

The materials and components used in the road safety device and the expected design life of the components shall be documented.

Impacts of the environment, such as fire, wind, vibration, flooding, snow drifts and coastal areas which may—

- (a) reduce the performance of the device;
- (b) reduce the life of the device;
- (c) place limitations on where it can be used; or
- (d) require specific maintenance requirements,

shall be documented.

Any susceptibility of the device to specific chemical spills shall be documented.

NOTE: For commentary on this Clause (2.4.5), see Paragraph B4.5 of Appendix B.

2.5 FABRICATION AND INSTALLATION

2.5.1 Tolerances

Tolerances shall be provided in the documentation and shall include the following:

- (a) *Fabrication tolerances* Includes tolerances for fabricated elements (e.g. base metal thickness for galvanized or metal coated components, wall thickness for moulded components, etc.).
- (b) *Installation tolerances* Includes tolerances for key elements of the device (e.g. height, post spacings, etc.).

2.5.2 Assembly and component identification

The System Supplier shall furnish the assembly instructions, a bill of materials complete with an identification code and description and specification for all items.

The bill of materials item reference shall be reconcilable with assembly instructions.

Any concerns about the integrity or identification of a particular item shall be clarified before attempting assembly.

The items supplied for a road safety device and the assembly thereof shall be consistent with those used in crash tested configurations.

2.5.3 Foundation

Documentation of the foundation support necessary for the road safety device to operate effectively shall be provided and shall include the following:

- (a) The ground conditions that are not appropriate and soil types that do not suit the road safety device including foundations for posts, footings and anchors (i.e. soil materials that are likely to reduce the design life of posts and expansive clays that may render the device foundations unstable).
- (b) The horizontal extent of foundation support necessary, such as the minimum distance required to hinge points on embankments.

NOTE: For commentary on this Clause (2.5.3), see Paragraph B5.3 of Appendix B.

2.5.4 Attachments

There shall be no attachments to a road safety device unless it can be shown by crash testing or by assessment as a modification (see Clause 4.4) that it is suitable,

Any permissible attachments such as delineators, signs, lighting posts and fences for pedestrians shall be documented.

Attachments that can be fitted to protect motorcyclists impacting the road safety device shall be assessed in accordance with Clause 4.3.5.

NOTE: For commentary on this Clause (2.5.4), see Paragraph B5.4 of Appendix B.

2.6 MAINTENANCE

2.6.1 Components vulnerable to vandalism

If the road safety device contains components that are vulnerable to vandalism (i.e. easily damaged or removed) and that are likely to affect device performance if damaged, these components shall be highlighted in the documentation.

NOTE: For commentary on this Clause (2.6.1), see Paragraph B6.1 of Appendix B.

2.6.2 Maintenance requirements

Documentation shall be provided that covers the following:

- (a) Periodic maintenance requirements, e.g. requirement for checking of tension in cables or checking of bolt tension.
- (b) Post-crash repair. This shall include information on how to assess if device components can be re-used and, if repair is an option, how this is to be done.
- (c) Particular cleaning agent if required.
- (d) Repair methods to be used where components are damaged through general wear and tear.

SECTION 3 SUPPLY, ERECTION AND MAINTENANCE

3.1 SCOPE OF SECTION

This Section sets out the requirements for supply, erection, maintenance, repair and dismantling of road safety devices. The requirements apply where relevant to proprietary devices and to public domain devices.

3.2 SUPPLY AND ERECTION

3.2.1 Materials

The material requirements specified in Clauses 3.2.2, 3.2.3, 3.2.4, 3.2.5 and 3.2.6 shall apply to all road safety device types unless specified elsewhere within the relevant Section of this Standard.

The device documentation shall specify the material properties required. Some of the materials may be imported or may be substituted with local equivalents, subject to the requirements of Clause 4.4.

3.2.2 Steel and other metal materials

All cold rolled products shall comply with AS/NZS 1595 and structural steel products shall comply with AS/NZS 1594, AS/NZS 3678 or AS/NZS 3679.1, as applicable.

Welds shall be category GP or SP in accordance with AS/NZS 1554.1.

All galvanizing of steel used in road safety devices shall comply with AS/NZS 4680 or AS/NZS 1214, as appropriate.

Other metal materials, not specified herein, shall comply with the appropriate Australian or New Zealand Standard. If such a Standard is not available, they shall comply with specifications or Standards issued by bodies accredited by an authority, such as the American Society for Testing and Materials (ASTM).

NOTE: For commentary on this Clause (3.2.2), see Paragraph C2.2 of Appendix C.

3.2.3 Plastic

All plastic used shall be UV stabilised.

NOTES:

- 1 Data should be provided on the flammability of plastics or any other combustible component used and any special precautions necessary to reduce the risks associated with fire.
- 2 For commentary on this Clause (3.2.3), see Paragraph C2.3 of Appendix C.

3.2.4 Concrete

All concrete required shall comply with AS 1379 for Australia or NZS 3109 for New Zealand.

Additional requirements for concrete are contained in other Sections of this Standard.

3.2.5 Reinforcement

The amount of reinforcement required within the road safety device shall be not less than the reinforcement used on the crash tested article unless approved as a modification in accordance with Clause 4.4.

Reinforcing bar and fabric shall comply with AS 4671.

Prestressing strand and all steel stressing wire, tendons and stress bars shall comply with AS/NZS 4672.1 and AS/NZS 4672.2, as appropriate.

3.2.6 Other materials

Other materials not specifically mentioned shall be in accordance with the relevant Australian, New Zealand or International Standard.

3.2.7 Storage and damage

All components of road safety devices shall be stored, transported, stacked, handled and installed in such a way as to prevent permanent damage, particularly to threaded components and components, such as wire ropes, that are prone to damage from twisting and kinking. Critical elements that are vulnerable to damage shall be packaged in a manner that provides protection.

NOTE: For commentary on this Clause (3.2.7), see Paragraph C2.7 of Appendix C.

3.2.8 Traceability of components

Unless exempted by the Road Authority, all critical components shall be permanently and legibly marked with the name of the System Manufacturer and the date of manufacture to allow the product to be traced.

3.2.9 Setting out

The location of any services that may conflict with the road safety device installation shall be determined prior to commencing installation.

NOTE: For commentary on this Clause (3.2.9), see Paragraph C2.9 of Appendix C.

3.2.10 Sequence of work

Where a road safety device is being installed on a road that is open to traffic, arrangements shall be made to the sequence of construction to minimize the hazard to road users and workers.

3.2.11 Component damage at installation

When installing road safety devices, care shall be taken to avoid any damage to existing structures or utilities, or both, and to ensure that the device will work as intended.

The installation process shall not cause damage to the components, such that it reduces the effective operation of the road safety device or its design life, or introduces sharp tearing edges; nor shall it cause damage to any pavement layer located in the immediate vicinity of the device. If the pavement or components are damaged, they shall be replaced or repaired to meet the relevant specifications.

3.2.12 Construction of foundations, footings and anchorages

Road safety devices shall be placed on formed foundations complying with the documentation accompanying the device.

Where the sides of any excavation act as the form work for any concrete work, then the sides of the excavation shall match the dimensions of the footing or anchorage. Any cutting of existing seals or asphalt to accommodate the footings or anchorage shall be done so that it does not damage the surfacing.

The existing ground conditions shall be assessed against the documentation supplied, prior to installation to ensure that the device will perform as designed.

NOTE: For commentary on this Clause (3.2.12), see Paragraph C2.12 of Appendix C.

3.3 MAINTENANCE

3.3.1 General

In order for road safety devices to perform, they need to be maintained and regularly inspected. In determining frequency of maintenance inspections of road safety devices, the following shall be considered:

- (a) The device's documentation.
- (b) The operating environment.
- (c) The traffic volumes and composition.
- (d) The risk at the sites.
- (e) In the case of temporary devices, the duration of deployment.

During the maintenance inspection, an assessment shall be made of any changes that may have occurred which will alter the frequency of inspections required, or the elements to be inspected. Particular attention shall be given to any changes in the volume of traffic or its speed, and whether the vehicle adopted for the original design remains appropriate.

Road safety devices shall be inspected by a competent person and the outcome of the inspection documented on a routine basis to identify incidental damage that has occurred in unreported crashes.

The installation shall be examined to determine whether there are site issues that have increased the risk of a collision with the device, or the severity of such a collision. Particular attention shall be given to debris that may reduce the friction supply for other vehicles in the vicinity, or increase the hazard for pedestrians.

Following any road works that change the geometry of the road, other works in the road corridor which alter the nature of hazards being protected, or other activities that modify the operating environment of the device, a review shall be carried out by a competent person and the results documented to ensure that the need for the device remains and that the device complies with the manufacturer's operational specifications.

The required maintenance is a function of the device type and road authorities should develop a maintenance inspection schedule for each device type based on supplied information and risk profile.

NOTE: For commentary on this Clause (3.3.1), see Paragraph C3.1 of Appendix C.

3.3.2 Removal of debris

The road safety device should be kept clear of all rubbish and debris that are likely to affect the performance of the device.

NOTE: This includes any foreign objects, such as excess sealing chip or tree branches that could affect the performance of the road safety device because of the possibility that they may disable, or substantially reduce the effectiveness of elements of the device, or cause corrosion that will lock up the device.

3.3.3 Removal of road grime and graffiti

Routine maintenance for removal of road grime and graffiti shall be required at certain road safety device locations particularly those at worksites or permanent installations where there is high pedestrian usage.

NOTE: Whilst mainly an aesthetic issue, the build-up of grime or the application of graffiti may reduce effectiveness of the device.

3.3.4 Devices utilising ballast, road attachment or interconnected units

Where a road safety device relies on ballast, as is the case for water filled devices or sand barrels, inspections shall be carried out by a competent person and the results documented to ensure that the correct ballast is present.

Where a road safety device relies on attachment to the road surface to function to the required test level, an inspection of all attachment points by a competent person and documenting of the results shall be part of the maintenance inspection.

Devices that comprise interconnected units shall be inspected by a competent person and the results documented to ensure that they are interconnected in accordance with the device's documentation.

Installations shall be checked by a competent person and the results documented for any unsuitable decrease in road safety, e.g. ballast spill onto the carriageway or missing components required for surface attachment.

NOTE: For commentary on this Clause (3.3.4), see Paragraph C3.4 of Appendix C.

3.4 DISMANTLING AND DISPOSAL OR RECYCLING

Dismantling of the road safety device shall be in accordance with documentation for the device.

Some device components may be able to be recycled or re-used. If components are to be re-used then care shall be taken during the dismantling and storage to ensure no damage occurs. Damaged components shall be made good before being re-used.

Disposal procedures for plastic components shall be in accordance with environmental regulations.

If in doubt about the suitability of re-using the components, the System Owner shall be consulted.

3.5 POST-CRASH ASSESSMENT AND REPAIR

3.5.1 General

Before a road safety device is installed, action plans may be prepared for assessing and repairing the road safety devices in case they are damaged.

Assessment of the damage to a road safety device shall be undertaken by a competent person as soon as is practicable after a crash. Crash sites shall not be left in a condition that increases the risk to other traffic to unsuitable levels.

NOTE: For commentary on this Clause (3.5.1), see Paragraph C5.1 of Appendix C.

3.5.2 Damage

Following assessment by a competent person, if there is any doubt about the re-useability of a component, then it shall be replaced. Decisions to leave damaged components in service shall be documented.

3.5.3 Refurbishment

Either as part of repair to a road safety device damaged or as part of some maintenance activity, devices shall be refurbished so as to maintain performance.

NOTE: For commentary on this Clause (3.5.3), see Paragraph C5.3 of Appendix C.

SECTION 4 SUITABILITY

4.1 SCOPE OF SECTION

This Section describes the processes and requirements to evaluate the suitability of a road safety device for Australian and New Zealand roads. The suitability of a device is primarily based on full-scale crash testing but is also based on the consideration of a number of other attributes.

4.2 GENERAL

This Section provides details of full-scale testing requirements, and evaluation requirements for new road safety devices or modifications and substitution of components to establish whether a road safety device is suitable for use on Australian and New Zealand roads, unless detailed elsewhere in the standard.

The Standard does not specify the minimum performance level of acceptable road safety devices. The decision to accept and use a road safety device is at the discretion of the Road Authority.

This Standard is not intended for application to existing installations or to road safety devices that previously have been evaluated and adopted for use on a road network.

Road safety devices developed prior to this Standard and accepted for use by Road Authorities are not required to be re-evaluated in accordance with Clause 4.3 unless required by the Road Authority.

NOTE: For commentary on this Clause (4.2), see Paragraph D2 of Appendix D.

4.3 TESTING

4.3.1 Scope of clause

This Clause covers the requirements for the following types of crash testing:

- (a) Testing of new road safety devices.
- (b) Performance validation of existing road safety devices following changes in components.
- (c) Verification of performance of road safety devices due to site specific issues.

4.3.2 Manual for Assessing Safety Hardware (MASH)

MASH shall be the basis of testing procedures for road safety devices. Road safety devices may be evaluated in accordance with Clause 4.3.4 if tested to test procedures other than MASH.

NOTES:

- 1 The testing specified is a basic set of requirements that a road safety device has to meet to demonstrate satisfactory impact performance. The testing is, by no means, all-inclusive and does not test all possible crash configurations. Tests other than those specified in MASH may be required to cover specific impact conditions or road features (e.g. kerbs, drains, etc.) or road safety device attributes.
- 2 With the exception of Item (c) of Clause 4.3.1, test procedures are not designed to replicate any specific set of circumstances. Rather, the tests are arranged so that they provide a representation of a set of circumstances, in terms of ground support, temperature conditions and vehicle types. This recognises that the number of variables in a crash test of road safety devices can be high and performance can only be gauged when as many factors as possible are kept sensibly constant.
- 3 For commentary on this Clause (4.3.2), see Paragraph D3.2 of Appendix D.