1163 Rigid road safety barrier systems

1163 RIGID ROAD SAFETY BARRIER SYSTEMS

1 GENERAL

1.1 RESPONSIBILITIES

Objectives
General: Provide concrete safety barriers from precast units, fixed forms or slip forming, as documented or as directed. This worksection details the requirements for public domain, Type F and VCB rigid road safety barrier systems.

Performance
Patented safety barrier system or crash attenuator: To conform to the manufacturers specifications and instructions.

1.2 CROSS REFERENCES

General
Requirement: Conform to the following:
- 0136 General requirements (Construction).
- 0152 Schedule of rates – supply projects.
- 0161 Quality (Construction).
- 0167 Integrated management.
- 0319 Minor concrete works.
- 1101 Control of traffic.
- 1191 Pavement markings.
- 1192 Signposting.
- 1194 Non-rigid road safety barrier systems.

1.3 REFERENCED DOCUMENTS

Standards
General: The following documents are incorporated into this worksection by reference:

AS 1289 Methods of testing soils for engineering purposes.
AS 1289.5.4.1-2007 Soil compaction and density tests—Compaction control test—Dry density ratio, moisture variation and moisture ratio.
AS 1906 Retroreflective materials and devices for road traffic control purposes.
AS 1906.2-2007 Retroreflective devices (non pavement application).
AS 3610.1-2010 Documentation and surface finish
AS/NZS 3845: 1999 Road safety barrier systems.

Other publications for information or incorporated.

AUSTROADS
AGRD06-2010 Guide to road design – Part 6 Roadside design, safety and barriers

1.4 STANDARD

General
Standard: To AS/NZS 3845.

1.5 INTERPRETATION

Definitions
General: For the purposes of this worksection the following definitions apply:
- Rigid road safety barrier system: A road safety barrier system where there is no observable dynamic deflection. The deformation is contained in the impacting vehicle.
1.6 SUBMISSIONS

Approval
Submissions: To the Superintendent's approval.

Approvals

Calculations
- Survey set out for barrier systems.
- Curing compound application rate.

Materials
- Concrete.
- Reinforcement.
- Pre formed joint filler.
- Curing compound.

Execution details
- Process description for manufacture, supply and installation.

Documents
Submit the following for approval:

Design
Proprietary extrusion machine details.

Technical data:
- Concrete strength test results.
- Relative compaction test results.

1.7 HOLD POINTS AND WITNESS POINTS

Notice
General: Give notice so that the documented inspection and submissions may be made to the HOLD POINT table and the WITNESS POINT table.

HOLD POINTS table

<table>
<thead>
<tr>
<th>Clause title/Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
<th>Release by</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MATERIALS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concrete - Properties</td>
<td>Confirm concrete strength requirements for slip forming</td>
<td>5 working days before commencing works</td>
<td>Superintendent</td>
</tr>
<tr>
<td><strong>EXECUTION</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Existing underground services - Location</td>
<td>Locate services before placing footings, Dial before you dig</td>
<td>7 working days before commencing works</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Establishment - Method Statement</td>
<td>Process description for the manufacture, supply and installation of any road safety barrier system</td>
<td>7 working days before commencing works</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Establishment - Location of barriers</td>
<td>Safety barrier set out approval</td>
<td>2 working days before construction</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Manufacture of precast reinforced concrete - Procedures</td>
<td>Submit process details for manufacture of precast safety barriers</td>
<td>5 days before commencing manufacture</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Manufacture of precast reinforced concrete - Manufacturing records</td>
<td>Submit information on specific precast barriers</td>
<td>3 working days before use</td>
<td>Superintendent</td>
</tr>
<tr>
<td>Placing, compacting and finishing concrete</td>
<td>Submit proprietary extrusion machines for approval</td>
<td>5 working days prior to commencing works</td>
<td>Superintendent</td>
</tr>
</tbody>
</table>
- Slip forming

| Joints in concrete placed in-situ - Expansion joints | Jointing material for approval | 3 working days before ordering | Superintendent |
| Curing – General | Curing method and materials for approval | 3 working days before placing concrete | Superintendent |
| Signage and line marking at barrier - Removal of temporary traffic control devices | Inspection of permanent works before removal of temporary works | 24 hours before removal | Superintendent |

WITNESS POINTS table – On-site activities

<table>
<thead>
<tr>
<th>Clause title/Item</th>
<th>Requirement</th>
<th>Notice for inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic safety - General</td>
<td>Protect concrete barriers from impact by general traffic for a period of 7 days</td>
<td>Progressive</td>
</tr>
<tr>
<td>Quality requirements – Concrete strength</td>
<td>Strength results to be submitted</td>
<td>Progressive</td>
</tr>
<tr>
<td>Installation - Dowelled base fixings</td>
<td>Provide dowels fixed in place for inspection</td>
<td>Prior to installing barriers</td>
</tr>
<tr>
<td>Installation - Compaction of foundations</td>
<td>Provide the compacted base for inspection with relative compaction test results</td>
<td>Prior to installing barriers</td>
</tr>
<tr>
<td>Installation - Electrical conduits</td>
<td>Location of conduits subject to approval</td>
<td>24 hours before placing conduits</td>
</tr>
<tr>
<td>Placing, compacting and finishing concrete - Fixed form construction</td>
<td>Immediately carry out any necessary repairs</td>
<td>Progressive</td>
</tr>
<tr>
<td>Curing – Curing compound</td>
<td>Certificate of compliance required</td>
<td>Prior to use</td>
</tr>
</tbody>
</table>

2 PRE-CONSTRUCTION PLANNING

2.1 TESTING

Certificates of compliance
Certificates of compliance: Provide Certificates from a NATA registered laboratory. Perform all phases of any particular test at one laboratory. Tests to be carried out within 12 months of the submission date.

2.2 PLANNING

Work methods
- Document extent.
- Method statement.
- Programming of concrete barriers.
- Select method of execution.
3 MATERIALS

3.1 CONCRETE

Properties
Standard: To AS 1379.
Concrete: Supply and placement of concrete, steel reinforcement, formwork, tolerances, construction joints and protection conform with 0319 Minor concrete works except as specified in this worksection.
Minimum concrete strength: 30 MPa at 28 days for cast-in-situ formed concrete or precast concrete.
Slip form strength: Obtain approval for minimum strength for slip forming prior to commencing works. This is a HOLD POINT.
Aggregate size: 20 mm maximum nominal size.
Slump: Conform to the following specified slump at the point of placement:
- Extrusion: 15 mm.
- Slip forming: 25 mm.
- Fixed forms: 75 mm.
Ready mixed concrete: If ready-mixed concrete is used, mix and deliver the concrete to conform with AS 1379.

3.2 REINFORCEMENT

General
Drawings: Reinforcing steel as shown on the drawings.
Cover: The minimum cover to the nearest concrete surface is 50 mm unless documented otherwise on the drawings.
Supports: Do not use wire, timber or coarse aggregate to support reinforcing steel. Use either concrete or plastic.

4 EXECUTION

4.1 PROVISION FOR TRAFFIC

General
Requirement: Conform to 1101 Control of traffic.

4.2 EXISTING UNDERGROUND SERVICES

Location
Services laid in proximity to the barrier system: Locate prior to placement of footings and protect services from damage. This is a HOLD POINT.
Location: DIAL 1100 BEFORE YOU DIG is a free service, from anywhere in Australia, for locating underground pipe and cables (possible within two working days). See www.1100.com.au.

4.3 TRAFFIC SAFETY

General
Traffic control: To 1101 Control of traffic.
Material stacks: Locate any temporary stacks of new or surplus material associated with the works clear of the traffic flow and behind the line of the safety barrier system being removed, under construction or to be constructed.
Works program: Manage the sequence for construction to ensure that there are no traffic hazards or safety issues for road users.
Protection from traffic: Protect constructed concrete barriers from impact by general traffic for a period of 7 days. This is a WITNESS POINT.
4.4 ESTABLISHMENT

Method Statement
Submit: Prior to the installation of any road safety barrier system, submit a process description for the manufacture, supply and installation of road safety barrier systems for approval. Include the source of any precast manufacturing or proprietary items. This is a **HOLD POINT**.

Location of barriers
Set out: Set out the work so that all road safety barriers are located to conform with the drawings or as directed. Peg or paint mark the start and finish points and line of safety barrier. This is a **HOLD POINT**.

4.5 MANUFACTURE OF PRECAST REINFORCED CONCRETE

Precast reinforced concrete
General: Conform to dimensions and details as shown on the drawings to conform with the requirements for rigid road safety barrier systems in AS 3845.
Location of manufacturer: Precast concrete units may be supplied by an offsite manufacturer, or manufactured onsite by the Contractor.
Procedures
Method statement for the precast units: Submit the proposed methods of manufacture, including handling, transport, storage and erection, program of manufacture and delivery details. This is a **HOLD POINT**.
Manufacturing records
Records: Submit the following information prior to erecting the precast concrete safety barriers:
- Unit number or other identification mark.
- Date and time of casting.
- Concrete temperature and ambient temperature.
- Date and time of lifting from the mould.
- Quality and type of concrete materials.
- Details of curing prior to lifting from mould.
- Details of curing while stacked in the casting yard.
- The date of transport to the site.
- Any non-conformance or defect and any remedial works carried out. This is a **HOLD POINT**.

4.6 QUALITY REQUIREMENTS

Concrete strength
Testing: Sample and test concrete at a NATA registered laboratory.
Method: Provide a pair of cylinders tested for compressive strength for every 50 m$^3$ of concrete placed.
Timing: Submit the 28 day strength results. This is a **WITNESS POINT**.

4.7 INSTALLATION

General
Method: Unless otherwise stated on the drawings, the barrier may be precast, constructed in fixed forms or slip-formed to the dimensions and details as shown on the drawings.

Connections to non-rigid barriers
Connections: If a non-rigid road safety barrier will be connected to a rigid road safety barrier, cast anchorage assemblies into the road safety barrier to the dimensions and details shown on the drawings. All other components for non-rigid road safety barriers are specified in 1194 Non-rigid road safety barrier systems.

Preparation of the base
Cleaning: Clean the base of all loose materials and dust before any works are commenced.

Dowelled base fixings
Location: Safety barriers constructed on new or existing pavements.
Cored holes: Provide 25 mm diameter 200 mm in length dowels in fine concrete or cement-mortar-filled holes at regular staggered spacings to conform with AS 3845 and as shown on the drawings.
Dowels: Dowel sizing and location as shown on the drawings. This is a WITNESS POINT.

Precast spacings: If precast units are used, accurately align and space the cored holes.

Compaction of foundations
Firm base: Shape and compact the foundation material to form a firm base.

Relative compaction: Other than for barriers constructed on pavement courses, achieve relative compaction of 95% to conform with AS 1289.5.4.1 for standard compactive effort. Submit test results. This is a WITNESS POINT.

Pavement courses: If barriers placed on pavement courses, compact the foundation to the requirements of the respective pavement course.

Electrical conduits
Cables location: For safety barriers containing street lighting standards, locate the conduit carrying electrical cables in the base rather than in the barrier, as detailed on the drawings, unless otherwise approved. This is a WITNESS POINT.

Keyed conduit trench: Unless shown otherwise on the drawings, the conduit trench forms a key and no dowels are required for slip-formed barriers.

Precast safety barrier segments
Mortar pad: After debonding the concrete surface, construct a (nominal) 10mm cement mortar pad beneath the barrier full width and length.

4.8 PLACING, COMPACTING AND FINISHING CONCRETE

General
Continuous: Place concrete continuously between the ends of the concrete safety barrier systems or between construction joints or within a precast safety barrier segment.

Placement: Except at properly formed construction joints, do not place fresh concrete against concrete that has taken its initial set.

Compaction: Compact concrete thoroughly.

Formwork design: Conform to AS 3610 section 4.

Formwork construction: Conform to AS 3610.1.

Concrete finish: Finish surfaces uniform in appearance with a class 3 surface finish to AS 3610.1 unless otherwise shown on drawings or directed.

Cracks: Construct/supply finished concrete barriers free of any cracks other than of movement joints no wider than 0.05 mm at any point on the surface at the completion of the curing period.

Rejected: Barriers with cracks wider then 0.05 mm will be rejected.

Fixed form construction
Tamping: Tamp unformed surfaces to bring a layer of fines to the surface and then screed to the documented level.

High/low spots: Immediately following compaction and screeding, test unformed surfaces for high or low spots and make any necessary corrections before the concrete hardens.

Repairs: Immediately after stripping the forms, use an approved method to perform any necessary repairs to the formed surfaces. This is a WITNESS POINT.

Hand finishing
Concrete finish: If hand finishing is required for slip form construction, provide a barrier of uniform appearance.

Slip forming
Submit: Prior to extruding any concrete safety barrier, submit evidence that the proposed proprietary machine can extrude the barrier shape to conform with the specification and drawings. This is a HOLD POINT.

4.9 ALIGNMENT AND LEVEL

Finish and appearance
Top and face of the barrier: True to line with the top surface of uniform width, free from humps, sags and other irregularities.

Line and level tolerance
Design line: Within ± 50 mm of the plan location as shown on drawings.
Design levels: Within $\pm 20$ mm of the design levels as shown on the drawings.

**Surface tolerance**
Test: $\pm 5$ mm surface deviation from the edge of a 3 m straight edge laid on top of or along any face of the barrier except at grade changes or curves in which case the faces are to transition uniformly.

### 4.10 JOINTS IN CONCRETE PLACED IN-SITU

#### Contraction joints
Fixed or slip forms: Straight, square ($\pm 5^\circ$) to the line of the barrier.
Depth: 50 ($\pm 5$) mm on all exposed surfaces at 4 m spacing.
Method: Sawn or formed.
Sawing: Saw joints before uncontrolled cracking begins and within 12 hours after placing the concrete.

#### Expansion joints
Type: Straight, square ($\pm 5^\circ$) to the line of the barrier.
Width and spacing: As shown on the drawings.
Sealant: Fill with a preformed joint filler of bituminous fibreboard or an approved equivalent. This is a **HOLD POINT**.

#### Pavement joints
Matching: If the barrier is cast on concrete pavement, continue the contraction, isolation, tied or expansion joints in the pavement through the barrier to form a continuous joint through both structures.
Adjacent to pavement
Match: If the barrier is cast adjacent to a concrete pavement, form the contraction joints at 4 m centres.

#### Precast units
Connections: Place precast units so that all connections are tight, secure and true in line and level.

### 4.11 CURING

**General**
Method: Cure concrete placed in safety barriers by either steam curing, moisture curing or by spraying an approved curing compound on all exposed surfaces of the fresh concrete.
Submission: Submit the proposed method and materials for curing for approval prior to use. This is a **HOLD POINT**.
Protection: Protect exposed surfaces from rain or other damage, until hard set has occurred.
Curing time: Maintain the curing membrane intact in a continuous and unbroken film for 7 days after placing the concrete.
Damage: Make good any damage to the membrane by respraying the affected area as soon as the damage occurs.

#### Curing compound
Slip-formed barriers: Provide wax emulsion, hydrocarbon resin or water borne curing compounds in conformance with AS 3799 Class A Type 1, Class B Type 1-D or Class Z Type 1-D respectively.
Compliance: Provide a certificate of compliance for the curing compound from a laboratory with appropriate NATA registration. This is a **WITNESS POINT**.
Application rate: Apply the curing compound in a fine spray to provide even coverage at a rate of 0.2 l/m² or the rate determined on the test certificate to achieve 95 % water retention, whichever is the greater.
Equipment on site: Keep equipment and materials for the curing operations on site at all times during slip-forming of the barrier.

### 4.12 DELINEATORS

**Fixing**
Standards: Conform to AS 1906.2.
Method: Fix with brackets to the concrete safety barrier as shown on the drawings.
Arrangement and colour
Approaching colour: Arrange the delineators so that drivers approaching from either direction will see only red reflectors on their left side and white reflectors on their right.

4.13 SIGNAGE AND LINE MARKING AT BARRIER

Permanent signage, and longitudinal line marking
Provide: Provide permanent signage, and longitudinal line marking adjacent to the concrete safety barrier to conform with 1191 Pavement markings and 1192 Signposting.

Removal of temporary traffic control devices
Inspect: Do not remove temporary traffic control devices installed for the control of traffic before the concrete safety barrier, permanent signing and longitudinal line marking have been inspected and approved. This is a HOLD POINT.

4.14 LIMITS AND TOLERANCES

Application
Summary: The limits and tolerances applicable to this worksection are summarised in Summary of limits and tolerances table.

Summary of limits and tolerances table

<table>
<thead>
<tr>
<th>Activity</th>
<th>Limits/Tolerances</th>
<th>Worksection Clause/ subclause</th>
</tr>
</thead>
<tbody>
<tr>
<td>For cast-in-situ formed concrete or precast concrete</td>
<td>Strength 28 days: 30 MPa</td>
<td>Concrete</td>
</tr>
<tr>
<td></td>
<td>Max aggregate size: 20 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slump:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 15 mm for extrusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 25 mm for slip forming</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- 75 mm for fixed forms</td>
<td></td>
</tr>
<tr>
<td>Compaction of foundations</td>
<td>Relative compaction: 95%</td>
<td>Installation</td>
</tr>
<tr>
<td>Concrete formed finish</td>
<td>Class 3 to AS 3610</td>
<td>Placing, compacting and finishing</td>
</tr>
<tr>
<td>Line and level tolerance</td>
<td>Line: ± 50 mm from plan location</td>
<td>Alignment and level</td>
</tr>
<tr>
<td></td>
<td>Levels: ± 20 mm from design level</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface: ± 5 mm from straight edge</td>
<td></td>
</tr>
<tr>
<td>Contraction joints</td>
<td>50(± 5) mm deep at 4 m spacing</td>
<td>Joints in concrete placed in-situ</td>
</tr>
</tbody>
</table>