

Master Specification

Part RD-BF-C1

Supply and Installation of Steel Beam Safety Barrier Systems

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RD-BF-C1 Supply and Installation of Steel Beam Safety Barrier Systems

1 General

- a) This Master Specification Part specifies the requirements for the supply and installation of steel beam safety barrier systems, including:
- i) the documentation requirements, as set out in section 2;
 - ii) the requirements for the supply of steel beam safety barrier components, as set out in section 3;
 - iii) the requirements for the installation of steel beam safety barrier systems, as set out in section 4;
 - iv) the requirements for the removal of existing barriers, as set out in section 5;
 - v) the Hold Point requirements, as set out in section 6; and
 - vi) the verification requirements and records, as set out in section 7.
- b) The supply and installation of steel beam safety barrier systems must comply with the Reference Documents, including:
- i) AGRS Part 2: Safe Roads;
 - ii) AS 1214 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD);
 - iii) AS 1365 Tolerances for flat-rolled steel products;
 - iv) AS 1391 Metallic materials - Tensile testing - Method of test at room temperature;
 - v) AS/NZS 1594 Hot-rolled steel flat products;
 - vi) AS 1627.1 Metal finishing - Preparation and pretreatment of surfaces, Part 1: Removal of oil, grease and related contamination;
 - vii) AS 1627.2 Metal finishing - Preparation and pretreatment of surfaces, Part 2: Power tool cleaning;
 - viii) AS 3569 Steel wire ropes - Product specification;
 - ix) AS/NZS 3750.7 Paints for steel structures, Part 7: Aluminium paint;
 - x) AS/NZS 3750.9 Paints for steel structures, Part 9: Organic zinc-rich primer;
 - xi) AS/NZS 3845.1 Road safety barrier systems and devices, Part 1: Road safety barrier systems;
 - xii) AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles;
 - xiii) AS/NZS ISO 9001 Quality management systems - Requirements;
 - xiv) Department Standard Drawings (available from: https://dit.sa.gov.au/standards/standards_and_guidelines); and
 - xv) GD 300 Accepted Safety Barrier Products (available from: https://dit.sa.gov.au/standards/standards_and_guidelines).
- c) In addition to the requirements of this Master Specification Part, delineators must comply with the requirements set out in RD-LM-S3 "Supply of Guide Posts and Delineators", and RD-LM-C3 "Installation of Guide Posts and Delineators".

- d) All bridge approach barriers must be installed in accordance with the Department Standard Drawings.

2 Documentation

2.1 Construction Documentation

In addition to the requirements of PC-CN3 “Construction Management”, the Construction Documentation must include:

- a) details of the country of manufacture;
- b) for proprietary steel beam safety barrier systems, a copy of the manufacturer’s instructions and any procedure for installation and maintenance of the steel beam safety barrier system; and
- c) evidence that at the time of installation, the personnel supervising the installation of the steel beam safety barrier system will have attended training in the installation of terminals, conducted by the manufacturer, within the previous 2 years.

2.2 Quality Management Records

- a) In addition to the requirements of PC-QA1 “Quality Management Requirements” or PC-QA2 “Quality Management Requirements for Major Projects” (as applicable), the Quality Management Records must include:
 - i) the verification records required by Table RD-BF-C1 7-1;
 - ii) evidence that:
 - A. the steel beam safety barrier system has been installed in accordance with the manufacturer’s requirements and the Contract Documents, including the Construction Documentation, Design Drawings (if applicable) and the Department Standard Drawings;
 - B. set-out is compliant;
 - C. the components of the steel beam safety barrier systems comply with the manufacturer’s requirements; and
 - D. all clear distances behind barriers, minimum offsets from the roadway, and deflection of end terminals are compliant;
 - iii) certified copies of manufacturer’s test certificates for all materials, or evidence that the supplied components comply with the manufacturer’s requirements. For non-proprietary steel beam safety barrier system components, the test certificates sheets must include:
 - A. chemical properties and results of tensile and elongation tests, and
 - B. NATA laboratory test certification confirming that the tests comply with AS/NZS 3845.1 Road safety barrier systems and devices, Part 1: Road safety barrier systems and all other relevant Reference Documents; and
 - iv) for galvanized steel components, a manufacturer’s certificate of compliance certifying that the zinc coating mass is in accordance with the requirements of AS/NZS 3845.1 Road safety barrier systems and devices, Part 1: Road safety barrier systems and AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles (as applicable).
- b) For the purposes of section 2.2a)ii), evidence must include a completed manufacturer’s checklist and quality assurance records, and may include time-stamped photographs and survey results.

2.3 Maintenance Plan

In addition to the requirements of PC-CN2 “Asset Handover”, the Maintenance Plan must include:

- a) for proprietary steel beam safety barrier systems, a copy of the manufacturer’s instructions and any procedure for the maintenance of the steel beam safety barrier system; and
- b) maintenance intervals.

3 Supply of steel beam safety barrier components

3.1 General

- a) Components of the steel beam safety barrier system, including motorcycle barrier components, must be:
 - i) manufactured under a quality system certified to AS/NZS ISO 9001 Quality management systems - Requirements; and
 - ii) an accepted product in accordance with GD 300 Accepted Safety Barrier Products.
- b) The Contractor must provide evidence as part of the Quality Management Records that demonstrate compliance with the requirements of 3.1a).
- c) Testing must be undertaken on components which are representative of the materials supplied for the Works, and evidence of such testing provided as part of the Quality Management Records.
- d) Timber posts must not be used in steel beam safety barrier systems.

3.2 Identification

- a) All steel rails, posts and plastic components of a steel beam safety barrier system must be permanently marked with the following information:
 - i) name or mark of the manufacturer;
 - ii) strength and base metal thickness of steel rails and posts; and
 - iii) a traceable identification number.
- b) The permanent marking required by section 3.2a) must be in text not more than 20 mm high and be in an unobtrusive and readily accessible position.

3.3 Metal components rails

- a) For proprietary steel beam safety barrier systems, steel for the rails must be manufactured in accordance with the manufacturer’s requirements and the Reference Documents.
- b) For steel rails other than proprietary steel beam safety barrier systems:
 - i) the steel rails must be manufactured from steel which meets the requirements of AS/NZS 1594 Hot-rolled steel flat products, Grade HA350;
 - ii) the mechanical properties of the base metal must comply with the following requirements and be tested in accordance with AS 1391 Metallic materials - Tensile testing - Method of test at room temperature:
 - A. minimum yield strength: 350 MPa;
 - B. minimum tensile strength: 430 MPa; and
 - C. minimum elongation in 80 mm 16%; and
 - iii) the base metal must comply with the following tolerances and be measured in accordance with AS 1365 Tolerances for flat-rolled steel products:

- A. base metal thickness: 2.7 mm \pm 0.1 mm;
 - B. mill tolerance on strip width: +2.5 mm, -0.0; and
 - C. maximum mill camber tolerance on 2000 mm length: 4.0 mm.
- c) For steel beam safety barriers erected as barrier railing on bridges and major culverts, the base material must comply with the following tolerances and be measured in accordance with AS 1365 Tolerances for flat-rolled steel products:
- i) base metal thickness: 3.5 mm \pm 0.1 mm;
 - ii) mill tolerance on strip width: +2.5 mm, -0.0; and
 - iii) maximum mill camber tolerance on 2,000 mm length: 8.0 mm.

3.4 Other components

- a) In addition to the requirements of this Master Specification Part, for a proprietary steel beam safety barrier system, all components must comply with the manufacturer's requirements.
- b) Steel posts and blocks other than those from proprietary steel beam safety barrier systems, must be manufactured from steel which meets the following requirements of AS/NZS 1594 Hot-rolled steel flat products:
- i) Grade HA300; and
 - ii) HU300,
- with a base material thickness of 4.3 mm \pm 0.1 mm.
- c) Bullnoses other than those as part of a proprietary steel beam safety barrier system must be manufactured from steel which meets the requirements of AS/NZS 1594 Hot-rolled steel flat products, Grade HA350.
- d) Cables other than as part of a proprietary steel beam safety barrier system must comply with the requirements of AS 3569 Steel wire ropes - Product specification.

3.5 Galvanizing

- a) All steel components in the steel beam safety barrier system must be hot-dip galvanized after fabrication, and must comply with:
- i) for bolts, nuts and washers, AS 1214 Hot-dip galvanized coatings on threaded fasteners (ISO metric coarse thread series) (ISO 10684:2004, MOD); and
 - ii) for all other components other than bolts, nuts and washers, AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles.
- b) The requirements of section 3.5a) do not apply where alternative requirements are stated in the manufacturer's requirements or GD 300 Accepted Safety Barrier Products.
- c) For steel beam barrier systems, the minimum zinc coating per side for all internal and external surfaces must be as follows:
- i) for beams and terminals, 390 g/m²; and
 - ii) for steel posts and blocks, 500 g/m².
- d) Galvanized coatings for steel beam barrier systems must be:
- i) smooth, adherent and of uniform colour; and
 - ii) free from stains, gross surface imperfections, markings, runs, blisters, irregularities or inclusions.
- e) Care must be taken during storage, handling, loading and delivery of galvanized steel components to avoid wet-storage staining or damage to the zinc coating.

3.6 Curved rail

The following requirements apply to the curving of steel rails forming part of steel beam safety barrier systems:

- a) where curving is undertaken after galvanizing has been completed, it must be carried out in such a manner that the galvanizing is not damaged;
- b) an appropriate radius for curved rails must be determined;
- c) shop curving must be undertaken where the required deflection exceeds 160 mm over a 4.0 m section of barrier; and
- d) the curved radius must be permanently marked on the rear of the barrier in a manner that does not damage the galvanizing.

3.7 Damage

- a) All components of the steel beam safety barrier system must:
 - i) be free from visible damage or deformation;
 - ii) be transported, handled, and installed to avoid damage; and
 - iii) not to be left with splits, burrs, or sharp edges after installation.
- b) Where damage to galvanizing has occurred, components of steel beam safety barrier systems must be repaired as follows:
 - i) surfaces must be cleaned to bare metal by power tool cleaning to a minimum of Class St2 in accordance with AS 1627.2 Metal finishing - Preparation and pretreatment of surfaces, Part 2: Power tool cleaning;
 - ii) cleaned surfaces must be degreased using solvent cleaning in accordance with AS 1627.1 Metal finishing - Preparation and pre-treatment of surfaces, Part 1: Removal of oil, grease, and related contamination;
 - iii) 2 coats of organic zinc rich primer must be applied, in accordance with AS/NZS 3750.9 Paints for steel structures, Part 9: Organic zinc-rich primer, to a minimum total dry film thickness of 100 µm; and
 - iv) a final coat of aluminium paint in accordance with the requirements of AS/NZS 3750.7 Paints for steel structures, Part 7: Aluminium paint must be applied to all repairs. This method of repair must be restricted to individual areas not exceeding 40 cm² for any single repair and a total 0.1% of the surface area of any face for multiple repairs.

4 Installation of steel beam safety barrier systems

4.1 Experience and certification of personnel

Except for steel beam safety barrier systems listed as public domain in GD 300 Accepted Safety Barrier Products, steel beam safety barrier systems must be installed under the constant supervision of a person who has experience in the installation of the manufacturer's barriers and terminals. This person must be on Site at all times while the system is being installed.

4.2 General

- a) For the purposes of this section 4, references to "posts" is a reference to posts installed as part of a steel beam safety barrier system.
- b) Posts must be installed in a manner that does not damage the post or any attached soil plate, and may involve pre-drilling holes to loosen the soil or excavating a hole to the required depth.

- c) The Contractor must reinstate any disturbed pavement or ground around installed posts so that it is in a tight, dense condition and has the same resistance to water penetration as the surrounding surface.
- d) Any damage to the pavement or road seal caused by the Contractor's machinery will be deemed a Non-Conformance and subject to the processes as detailed in PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable), which may result in reinstatement to the satisfaction of the Principal.

4.3 Driving of posts

- a) Where driving is used to install posts and the ground has subsided due to the driving process, the surface must be back filled to the natural surface level.
- b) Driving of posts must:
 - i) be appropriately guided and held during initial stages of driving;
 - ii) not be bent or sprung into position;
 - iii) not include use of significant horizontal force to correct any tendency for a post running off line; and
 - iv) include use of a driving head positioned over the post to minimise damage to the top of the post.
- c) Posts that are run off line or become twisted during driving must be removed and replaced with a new post.

4.4 Backfill of post holes

- a) Where excavation is carried out by the Contractor as part of the installation of a post, it must be backfilled and compacted with Type A material or PM 2/20 so that the permeability of the backfill is not less than the surrounding material.
- b) For the purposes of compliance with section 4.4a), compaction in layers not exceeding 150 mm at OMC to not less than 95% is deemed to be acceptable, and 1% cement may be added to this backfill.
- c) When a lateral force of 100 kg is applied in any direction within the top 200 mm of the post, the Contractor must ensure that the movement of the post at ground level must not exceed 3 mm.

4.5 Rock drilling

- a) Where installation of posts is prevented due to rock, rock-drilling equipment must be used to achieve the required depth.
- b) If rock is encountered during the installation of posts, the Contractor must provide notification to the Principal immediately and propose an alternative methodology for the installation of the posts, which will constitute a **Hold Point**. Installation of these posts must not continue until the Hold Point has been released.
- c) For the purpose of this section 4.5, "rock" means material that prevents the post driver pushing the post to its correct depth when penetration of not more than 5 mm from 5 consecutive blows is encountered with a 500 kg weight falling 3 m or causes noticeable damage to the post during installation.

4.6 Tolerances

- a) The steel beam safety barrier system must form a smooth line vertically and horizontally when viewed along the line of the system, free from humps, sags or other irregularities. Tolerances for erection of the steel beam safety barrier must be as follows:
 - i) horizontal placement of steel barrier ± 10 mm;

- ii) vertical placement of steel barrier +20 mm and -0.0 mm; and
 - iii) rotational deviation of post $\pm 5^\circ$.
- b) In addition to the tolerances set out in section 4.6a), the departure from a line drawn between the tops of any 3 posts must not exceed 25 mm vertically.

4.7 Installation to specification

- a) Where the Contractor is unable to install the steel beam safety barrier system in accordance with the requirements of this Master Specification Part (for example, an obstruction prevents the installation of a post):
- i) and viable options are provided in the manufacturer's product manual, the Contractor must propose to adopt such options, which will constitute a **Hold Point**. Installation must not continue until this Hold Point has been released; or
 - ii) this will be deemed a Non-Conformance, and subject to the processes as detailed a in PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable).
- b) Prior to pouring concrete for steel beam safety barrier footings, the Contractor must digitally record photographs which can clearly demonstrate that the specified dimensions of the excavation have been achieved, which must be provided as part of the Quality Management Records.

5 Removal of existing barriers

- a) Existing steel beam safety barrier systems removed by the Contractor prior to the installation of new steel beam safety barrier systems:
- i) will become the property of the Contractor;
 - ii) must not be disposed of in landfill; and
 - iii) any holes or depressions must be backfilled in accordance with the requirements of sections 4.4a) and 4.4b) and the following:
 - A. the Contractor must reinstate any disturbed pavement or ground around removed posts so that it is in a tight, dense condition and has the same resistance to water penetration as the surrounding surface; and
 - B. any damage to the pavement or road seal caused by the Contractor's machinery will be deemed a Non-Conformance and subject to the processes as detailed a in PC-QA1 "Quality Management Requirements" or PC-QA2 "Quality Management Requirements for Major Projects" (as applicable), which may result in reinstatement to the satisfaction of the Principal.
- b) Removal of existing safety barrier system includes:
- i) dismantling or demolition of existing safety barriers, transitions, and terminal;
 - ii) extracting all posts, anchors and other in-ground components and materials;
 - iii) removing all components and waste material from the Site;
 - iv) cleaning, backfilling and mechanically compacting all excavation and holes formed by the extraction of posts, anchors and other in-ground components and materials; and
 - v) stacking or disposing of components and waste materials.

6 Hold Points

Table RD-BF-C1 6-1 details the review period or notification period, and type (documentation or construction quality) for each Hold Point referred to in this Master Specification Part.

Table RD-BF-C1 6-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
4.5b)	Rock encountered during the installation of posts	Construction quality	Immediate notification
4.7a)i)	Unable to install the steel beam safety barrier system in accordance with the requirements of this Master Specification Part	Construction quality	Immediate notification

7 Verification requirements and records

The Contractor must supply written verification as part of the Quality Management Records that the requirements listed in Table RD-BF-C1 7-1 have been complied with.

Table RD-BF-C1 7-1 Verification requirements

Section reference	Subject	Record to be provided
3.1a)	Compliance	Evidence of manufacture under a quality system and is an accepted safety barrier product
3.1c)	Testing	Evidence that testing has been undertaken on components which are representative of the materials supplied
4.7b)	Excavation of footings	Photographic record of excavation prior to placing concrete