Master Specification
Part RD-BF-C2

Wire Rope Safety Barrier Systems

September 2024

Government of South Australia
Department for Infrastructure and Transport

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Document Information

Document Information	
K Net Number:	13523966
Document Version:	1
Document Date:	30/09/2024

Document Amendment Record

Version	Change Description	Date
0	Initial issue	31/08/2023
1	Updated cover page	30/09/2024

Document Management

 This is a controlled document and it will be updated and reissued as approved changes are made.

Contents

RD-BF-C2 Wire Rope Safety Barrier Systems

1 General

a) This Master Specification Part specifies the requirements for wire rope safety barrier systems, including:

i) the documentation requirements, as set out in section 2;

ii) the supply of wire rope safety barrier components, as set out in section 3;

iii) the installation of wire rope safety barrier systems, as set out in section 4;

iv) the removal of existing wire rope safety barrier systems, as set out in section 5;

v) the Hold Point and Witness Point requirements, as set out in section 6; and

vi) the verification requirements and records, as set out in section 7.

b) Wire rope safety barrier systems must comply with the Reference Documents, including:

i) AGRD Part 6: Roadside Design, Safety and Barriers;

ii) AGRS Part 9: Roadside Hazard Management;

iii) AS 1554 Structural steel welding;

iv) AS 2700 Colour standards for general purposes;

v) AS 3569 Steel wire ropes - Product specification;

vi) AS/NZS 3845 Road safety barrier systems and devices;

vii) AS 4506 Metal finishing - Thermoset powder coatings;

viii) AS/NZS 4534 Zinc and zinc/aluminium-alloy coatings on steel wire;

ix) AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles;

x) AS/NZS ISO 9001 Quality management systems - Requirements; and

xi) GD 300 Accepted Safety Barrier Products (available from: https://dit.sa.gov.au/standards/standards_and_guidelines).

c) 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”.

2 Documentation

2.1 Pre-installation 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) a certificate showing that all components comply with AS/NZS 3845 Road safety barrier systems and devices from a NATA accredited laboratory;

ii) a copy of the manufacturer's instructions and procedures for the installation and maintenance of the wire rope safety barrier system;

iii) details of the country of manufacture;

iv) evidence that the components comply with the requirements of section 3; and

v) a copy of the current calibration certificate for the tensioning device, that complies with the requirements of section 4.1c).

b) The records required by section 2.1a) must be submitted at least 10 Business Days prior to the commencement of installation of the wire rope safety barrier system and will constitute a **Hold Point.** Installation of the relevant wire rope safety barrier system must not commence until the Hold Point has been released.

2.2 Quality Management Records

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:

a) the verification records required by Table RD-BF-C2 7-1;

b) evidence that:

i) the wire rope 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;

ii) set-out is compliant; and

iii) all clear distances behind barriers, minimum offsets from the roadway, and deflection of end terminals are compliant;

c) completed manufacturer's checklists; and

d) the relevant quality assurance records.

2.3 Maintenance Plan

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

a) for proprietary wire rope safety barrier systems, a copy of the manufacturer’s instructions and any procedure for the maintenance of the wire rope safety barrier system;

b) maintenance intervals; and

c) details of the testing and re-tensioning requirements for safe operations.

3 Supply of wire rope safety barrier components

a) Wire rope safety barrier systems must:

i) comply with the requirements of this section 3;

ii) meet the requirements of GD 300 Accepted Safety Barrier Products;

iii) have the same composition, mechanical properties and geometry as those used in the testing requirements set out in AS/NZS 3845 Road safety barrier systems and devices;

iv) be a 4-rope system; and

v) have a barrier performance level in accordance with the requirements of RD-BF-D1 “Design of Roadside Safety Barriers”.

b) Components of the wire rope safety barrier systems must:

i) be manufactured:

A. under a quality system certified to AS/NZS ISO 9001 Quality management systems - Requirements; and

B. in accordance with the relevant specification for the proprietary barrier system;

ii) have a Design Life of 20 years; and

iii) not be substituted with components from other wire rope safety barrier systems.

c) The rope used in wire rope safety barrier systems must be:

i) 19 mm in diameter;

ii) pre-stretched;

iii) right hand lay; and

iv) either:

A. galvanized at a minimum coating of 400 g/m^2 measured in accordance with AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles; or

B. coated with zinc-aluminium (zinc 95%, aluminium 5%) alloy to a minimum thickness of 270 g/m^2 measured in accordance with AS/NZS 4534 Zinc and zinc/aluminium-alloy coatings on steel wire.

d) All fittings for joining ropes or connecting ropes to anchor points must:

i) be swaged (cold pressed); and

ii) not use mechanical wedge fittings.

e) The posts used in the wire rope safety barrier systems must:

i) be hot dip galvanized in accordance with AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles;

ii) be powder coated to a minimum dry film thickness of 60 µm in accordance with AS 4506 Metal finishing - Thermoset powder coatings;

iii) meet all durability requirements for products exposed to atmospheric classification C as detailed in AS 4506 Metal finishing - Thermoset powder coatings;

iv) be stamped with date of manufacture, metal grade and the thickness of material; and

v) be manufactured with welding certified in accordance with AS 1554 Structural steel welding.

f) The Contractor must provide the original test certificates as part of the Quality Management Records from the manufacturer to demonstrate compliance with the specified requirements for:

i) mechanical properties of the steel in the wire ropes;

ii) chemical composition analysis of the steel in the wire rope safety barrier components; and

iii) rope protective coating thickness.

g) The Contractor must provide evidence (including details of the batch number displayed on the coil label) as part of the Quality Management Records that the tests have been undertaken on samples which are representative of the materials supplied.

4 Installation of wire rope safety barrier systems

4.1 General

a) Wire rope safety barrier system components must be transported, handled, and installed to prevent damage and must not be left with splits, burrs, or sharps after installation.

b) Wire rope safety barrier systems must be installed in accordance with the Construction Documentation, including the manufacturer's product manual.

c) The current calibration certificate (provided as part of the Quality Management Records) for the tensioning device must not be dated more than 12 months earlier than the date of installation of the wire rope safety barrier system.

d) Where the Contractor is unable to install the wire rope safety barrier system in accordance with the requirements of this Master Specification Part (for example, an obstruction prevents the installation of posts or anchor blocks):

   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 the Hold Point has been released; or

   ii) this 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).

4.2 Location

a) Wire rope safety barrier systems must be located such that:

   i) the distance between the hinge of any embankment and the post footings is not less than 0.6 m;

   ii) the distance between the hinge of any embankment and the anchor blocks is not less than 1.0 m; and

   iii) where the post footings are located between 1.6 m and 0.6 m from the hinge point, the post spacing does not exceed 2.0 m.

b) Wire rope safety barrier systems must not be located:

   i) at or near the bottom of V-drains; and

   ii) on a lateral slope greater than 1:10.

c) Wire rope safety barrier systems must not be connected to semi-rigid or rigid barriers, or bridge ends unless they are interfaced with a more rigid barrier using an overlap system in accordance with the manufacturer's specifications.

d) Where the manufacturer's standard post spacing is used, the operation of the wire rope safety barrier system must not be compromised if installed on:

   i) a horizontal curve with a radius of less than 600 m; and

   ii) on a sag vertical curve with a radius less than 3,000 m.

4.3 Post footings and terminals

a) Concrete post footings and anchor blocks must be constructed cast in place in accordance with the manufacturer's specifications and the requirements of this section 4.3.

b) Unless soil testing has been conducted to determine otherwise (which must be provided as part of the Quality Management Records if carried out), the post footing and anchor block size must be the maximum size specified by the manufacturer' specifications.

c) Completion of the excavation for anchor blocks, and prior to pouring concrete, constitutes a **Hold Point**. Pouring of the concrete for post the footings and anchor blocks must not commence until the Hold Point has been released.

d) Prior to pouring concrete for post footings and anchor blocks, the Contractor must digitally record photographs which can clearly demonstrate that the required dimensions have been achieved. The photographs must form part of the Quality Management Records.

e) Excavated material must be removed off site or, where allowed by the Contract Documents, incorporated into the Works elsewhere.

f) Concrete must be Grade N32 at a minimum and must comply with the requirements of ST-SC-S1 “Normal Class Concrete”.

g) Anchor block reinforcement must:

i) comply with ST-SC-S6 “Steel Reinforcement”; and

ii) have a clear cover to reinforcement of at least 50 mm.

h) Anchor blocks and post footings must be constructed such that they are free draining and that drainage water does not undermine the footing or the anchor block.

i) Where soil tests have not been carried out, the Contractor must conduct pull-over testing in accordance with the manufacturer's specifications.

j) After initial tensioning, movement of the anchor blocks must be measured and then monitored until the 6 month inspection.

k) Any instance of:

i) the total movement of the anchor block exceeding 25 mm; or

ii) at the 6 month inspection conducted in accordance with section 4.3j), evidence that the blocks are continuing to move and are exceeding 25 mm total movement,

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 require the anchor block to be removed, soil condition re-checked and a new anchor block to be designed and installed.

l) Upon completion of the initial tensioning, and at 6 months after the initial tensioning of the wire rope safety barrier system, the Contractor must complete or update an anchor block movement report, which must be submitted as part of the Quality Management Records.

4.4 Post colour and delineation

Post colour and delineators must comply with the requirements of Table RD-BF-C2 4-1.

Table RD-BF-C2 4-1 Post colour and delineation

Narrow medians less than 4.5 m	Situations other than narrow medians less than 4.5 m
All posts to be white (G14 in accordance with AS 2700 Colour standards for general purposes).	Post must be green (G61 in accordance with AS 2700 Colour standards for general purposes) except for every fourth post, which must be white (G14 in accordance with AS 2700 Colour standards for general purposes).
For posts spaced between 2.0 m and 2.5 m, every fourth post must be affixed with a delineator.	For posts spaced between 2.0 m and 2.5 m, every white post must be affixed with a delineator.
For all post spacings excluding those spaced between 2.0 m and 2.5 m, delineators must be affixed at 8.0 m to 10.5 m intervals.	For all post spacings excluding those spaced between 2.0 m and 2.5 m, delineators must be affixed at 150 m intervals.

4.5 Posts

a) Posts must be installed such that:

i) the alignment of the completed barrier does not deviate from the intended line of the barrier by more than ±20 mm at any point;

ii) the alignment in elevation of the top of the barrier posts does not deviate in any 10 m length by more than ±10 mm from the line of sight along the tops of posts;

iii) spacing of posts does not deviate from the spacing specified in the Design Documentation by more than ±50 mm;

iv) the rounded edges of posts are presented to the direction of traffic flow; and

v) excluder washers are fitted at the base of all posts to prevent soil ingress.

b) All posts must be installed in sleeves in concrete footings.

c) The Contractor must not:

i) drill, cut or weld posts; and

ii) use driven sleeve posts.

4.6 Tensioning

a) Ropes must be tensioned:

i) when the ambient temperature is between 0°C and 40°C; and

ii) in accordance with the manufacturer's instructions.

b) The Contractor must undertake initial tensioning of each rope no earlier than 14 days after pouring the last anchor block which will be affected by tension in the ropes.

c) Upon completion of the initial tensioning, the Contractor must complete a tension report, which must be submitted as part of the Quality Management Records within 10 Business Days of completion of the tensioning, and will constitute a **Hold Point**. The roadway must not be opened to traffic until the Hold Point has been released.

d) 6 months after the initial tensioning of the wire rope safety barrier system, the Contractor must:

i) undertake verification testing by checking the tension in each rope for compliance with the requirements of this Master Specification Part including the manufacturer's specifications; and

ii) re-tension the ropes where required to comply with the requirements of this Master Specification Part including the manufacturer's specifications.

e) Upon completion of the 6-month verification testing and re-tensioning (where applicable), the Contractor must update the tension report, which must be submitted as part of the Quality Management Records within 10 Business Days of completion of the verification testing and will constitute a **Witness Point**.

4.7 Engagement at anchors, turn buckles and tension fittings

a) Upon completion of the initial tensioning, ropes must be engaged in accordance with the requirements of Table RD-BF-C2 4-2.

b) The Contractor must ensure that:

i) all hot dip galvanized swaged ends and tension fittings are fully wrapped with Denso tape; and

ii) turn buckles are located at least 100 mm from any post.

Table RD-BF-C2 4-2 Rope engagement

Location	Measure of engagement
Anchor point with threaded swage	≥10 mm past the last nut
Turn buckle	Maximum 30 mm and minimum 10 mm outside any nut

5 Removal of existing wire rope safety barrier systems

a) Unless specified otherwise in the Contract Documents, existing safety barriers removed prior to installation of the new wire rope barrier system are the property of the Contractor. The removed components must not be disposed of in landfill.

b) Where excavation is carried out by the Contractor as part of the removal of an existing w-beam or wire rope post, the Contractor must ensure that the hole is 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.

c) For the purposes of compliance with section 5b), 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.

6 Hold Points and Witness Points

a) Table RD-BF-C2 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.

b) Table RD-BF-C2 6-2 details the review period or notification period, and type (documentation or construction quality) for each Witness Point referred to in this Master Specification Part.

Table RD-BF-C2 6-1 Hold Points

Section reference	Hold Point	Documentation or construction quality	Review period or notification period
2.1b)	Submission of pre-installation Quality Management Records	Documentation	5 Business Days review
4.1d)i)	Unable to install the steel beam safety barrier system in accordance with the requirements of this Master Specification Part	Construction quality	Immediate notification
4.3c)	Completion of the excavation for anchor blocks, and prior to pouring concrete	Construction quality	24 hours notification
4.6c)	Tension report	Documentation	10 Business Days review

Table RD-BF-C2 6-2 Witness Points

Section reference	Witness Point	Documentation or construction quality	Review period or notification period
4.6e)	Updated tension report	Documentation	10 Business Days review

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-C2 7-1 have been complied with.

Table RD-BF-C2 7-1 Verification requirements

Section reference	Subject	Record to be provided
3	Properties of wire rope safety barrier system components	Test results of representative samples of components
		Coil batch number (obtained from the coil label)
		Date of manufacture, grade and metal thickness stamped on the posts
4.3i)	Post footing and terminals	Pull over failure load results where applicable
4.3b)	Post footing and terminals	Soil test results where Contractor proposes alternative size anchor block
4.3d)	Post footing and terminals	Photographic records of anchor block and post footing dimensions
4.3l)	Post footing and terminals	Anchor block movement report at initial tensioning, and updated at the 6 month inspection
4.6e) and 4.6e)	Tensioning	Tension report at initial tensioning, and updated at the 6 month inspections
2.2b) to 2.2d)	Records	Evidence of compliant installation