Highway Structures & Bridges
Contract preparation

CP 400 Instructions for specifiers for CC 400 Permanent road restraint systems

(formerly)

Version NI/LIVE_2025-02-14

The 'SUMMARY' field is missing from the Document Information. Please populate this field before publication.

This document incorporates specific requirements for the Department for Infrastructure Northern Ireland. Alternative versions of this document are available for other Overseeing Organisations.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

This is a controlled document.

Contents

Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
CP 400	NI/LIVE_2025-02-14	Not available	Core document, England NAA, Northern Ireland NAA, Scotland NAA, Wales NAA	Change to policy, major revision, new document development

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
This document replaces Series NG 400 Road Restraint Systems - Vehicle and Pedestrian. This specification for highways works relates to permanent safety barriers, vehicle parapets, vehicle/pedestrian parapets, permanent terminals, permanent transitions, permanent crash cushions, pedestrian parapets, pedestrian guardrails, removeable barrier sections, vehicle arrester beds, anti-glare screens mounted on road restraint systems, and cattle grids.				

Previous versions

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change

Foreword

This document provides specifier instructions for the production of the works specific requirements for CC 400 Permanent road restraint systems.

This document does not form part of the works specification.

The works specification is made up of both the Specification for Highway Works and the works specific requirements completed by the Specifier.

This document is applicable for contracts throughout the UK, complemented by the additional specification requirements and contractual changes of each Overseeing Organisation.

Users are responsible for applying all appropriate documents applicable to their contract.

Users are responsible for archiving contract documentation in accordance with the user's quality management system.

1. General requirements for road restraint systems

Road restraint system product requirements

Protection against corrosion for road restraint systems

1.1 Protection against corrosion shall be in accordance with the road restraint system manufacturer's product description and installation instructions.

1.2 Any damage to galvanised protective coatings shall be repaired in accordance with BS EN ISO 1461 [Ref 8.N].

Cutting of road restraint system components

1.3 No drilling, cutting, including flame cutting, or welding of beams and posts shall be permitted after the corrosion protection has been applied unless such an approach is included within the road restraint system manufacturer's product description and installation instructions.

Materials, foundations and anchorages of road restraint systems

1.4 Materials and fabrication of components and fittings shall be as described in the road restraint system manufacturer's product description and installation instructions.

1.5 Where not on a structure, foundations and anchorages, including constituent materials, for road restraint systems shall be as described in the road restraint system manufacturer's product description and installation instructions.

1.6 Where on a structure, anchorages, including constituent materials, for road restraint systems shall be as described in the road restraint system manufacturer's product description and installation instructions.

Fabrication tolerances for road restraint systems

1.7 Fabrication tolerances, including tolerance on hole diameters, shall be as described in the road restraint system manufacturer's product description and installation instructions.

Road restraint systems product verification requirements

1.8 Verification shall be undertaken for the Quality Management system certificate demonstrating compliance with BS EN ISO 9001 [Ref 22.N]for the road restraint system manufacturer.

1.9 The frequency of inspecting the quality management system certificate of the road restraint system manufacturer shall be once per year.

1.10 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to the inspection of the quality management system certificate of the road restraint system manufacturer.

Road restraint systems product documentation requirements

1.11 The following Documentation shall be submitted for road restraint systems prior to the commencement of installation on site: road restraint system manufacturer's product description including drawings and specification for all materials, protective treatment systems and fasteners, installation instructions and provisions for repair, inspection and maintenance.

1.12 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to road restraint systems documentation required prior to installation.

Road restraint systems installation requirements

1.13 All road restraint systems shall be installed in accordance with the road restraint system manufacturer's product description and associated installation instructions.

1.14 All road restraint system components including protective treatments, coatings and threaded components shall be undamaged upon completion of the works.

Road restraint systems installation verification requirements

1.15 Verification shall be undertaken for the installation of every road restraint system product by visual inspection, to confirm that each road restraint system product has been installed in accordance with the road restraint system manufacturer's product description and associated installation instructions.

1.16 The frequency of visual inspection to confirm that every road restraint system product has been installed in accordance with the road restraint system manufacturer's product description and associated installation requirements shall be once for each installation, at the completion of the works.

1.17 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to visual inspection to confirm that every road restraint system product has been installed in accordance with the road restraint system

manufacturer's product description and associated installation instructions.

1.18 Verification shall be undertaken for the torque applied to all bolts to confirm that every bolt within the road restraint system product has been torqued in accordance with the road restraint system manufacturer's product description and associated installation instructions.

1.19 The frequency of checking the torque of all bolts to confirm that every bolt within the road restraint system product has been torqued in accordance with the road restraint system manufacturer's product description and associated installation instructions shall be once per bolt, and prior to the road being fully opened to traffic.

1.20 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to checking the torque of all bolts to confirm that every bolt within the road restraint system product has been torqued in accordance with the road restraint system manufacturer's product description and associated installation instructions.

1.21 Verification shall be undertaken for all road restraint system components by inspection to ensure that all components including protective treatments, coatings and threaded components are undamaged.

1.22 The frequency of inspection shall be once upon completion of the works.

1.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to inspection of all road restraint system components on completion of the works.

Road restraint systems installation documentation requirements

1.24 The following Documentation shall be submitted for road restraint systems after completion of installation on site: Confirmation from the installer of the road restraint system that each road restraint system has been installed in accordance with the road restraint system manufacturer's product description and associated installation instructions.

1.25 The requirements for Documentation in Section 2 of GC 101 [Ref 6.N] shall apply to road restraint systems documentation required after installation.

1.26 The following documentation shall be submitted for all road restraint system components prior to handover: Record of inspection confirming that all components including protective treatments, coatings and threaded components are undamaged.

1.27 The record of inspection confirming that all components including protective treatments, coatings and threaded components are undamaged shall comply with "Documentation" in Section 2 of GC 101 [Ref 6.N].

Replacement and repair of road restraint systems

1.28 The maintenance and/or repair of road restraint systems shall be undertaken in accordance with the road restraint system manufacturer’s installation instructions for the road restraint system, using components which are identical in design, specification and geometry to the components originally installed.

1.29 Where the road restraint system under replacement or repair is a legacy system, any replacement components shall comply with CC 401 [Ref 17.N].

2. General requirements for non-harmonised/non-designated road restraint products

General requirements for welding of non-harmonised/non-designated road restraint products

2.1 Welding shall not be used except where detailed on the non-harmonised/non-designated road restraint system manufacturer's product drawings.

Documentation requirements for welding of non-harmonised/non-designated road restraint products

2.2 The following Documentation shall be submitted for welding of non-harmonised/non-designated road restraint products prior to the commencement of installation on site: evidence that arc welding has been undertaken in accordance with BS EN 1011-1 [Ref 39.N] and arc welding of ferritic steels, stainless steels and aluminium alloys has been undertaken in accordance with BS EN 1011-2 [Ref 41.N], BS EN 1011-3 [Ref 42.N] and BS EN 1011-4 [Ref 40.N]respectively.

2.3 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to evidence that arc welding has been undertaken in accordance with the relevant parts of BS EN 1011.

Verification requirements for welding procedures for non-harmonised/non-designated road restraint products

2.4 Verification shall be undertaken for the welding procedures for welded steel non-harmonised/non-designated road restraint products by welding procedure tests in accordance with BS EN ISO 15614-1 [Ref 33.N]and pre-production welding tests in accordance with BS EN ISO 15613 [Ref 30.N].

2.5 The frequency of welding procedure qualification testing for welded steel non-harmonised/non-designated road restraint products shall be a minimum of once every 7 years.

2.6 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to welding procedure qualification testing for welded steel non-harmonised/non-designated road restraint products.

2.7 Verification shall be undertaken for the welding procedures for welded aluminium non-harmonised/non-designated road restraint products by welding procedure tests in accordance with BS EN ISO 15614-2 [Ref 34.N]and pre-production welding tests in accordance with BS EN ISO 15613 [Ref 30.N].

2.8 The frequency of welding procedure qualification testing for welded aluminium non-harmonised/non-designated road restraint products shall be a minimum of once every 7 years.

2.9 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to welding procedure qualification testing for welded aluminium non-harmonised/non-designated road restraint products.

2.10 Verification for the welding procedures for welded steel and aluminium non-harmonised/non-designated road restraint products shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

2.11 Sample components and/or joints for destructive welding procedure qualification testing shall represent the main assembly types.

2.12 Sample components and/or joints for destructive welding procedure qualification testing shall be selected by a Welding Inspector certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP), or an individual certified to BS EN ISO 17637 [Ref 12.N].

Documentation requirements for welding procedures for non-harmonised/non-designated road restraint products

2.13 The following Documentation shall be submitted for welding procedures for non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Written welding procedure specifications for all production procedures prepared in accordance with BS EN ISO 15607 [Ref 29.N] and BS EN ISO 15609-1 [Ref 31.N]for arc welding or BS EN ISO 15609-2 [Ref 32.N]for gas welding.

2.14 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to written welding procedure specifications.

2.15 The following Documentation shall be submitted for welded procedures for non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Test reports for welding procedure qualification testing, comprising welding procedure tests in accordance with BS EN ISO 15614-1 [Ref 33.N]for steels or BS EN ISO 15614-2 [Ref 34.N]for aluminium and pre-production welding tests in accordance with BS EN ISO 15613 [Ref 30.N].

2.16 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to test reports for welding procedure qualification testing.

2.17 Test reports for welding procedure qualification testing shall be approved by an Independent Inspecting Authority using Registered Welding Engineers or Registered Welding Quality Engineers.

Documentation requirements for welder qualification for non-harmonised/non-designated road restraint products

2.18 All personnel welding steel components shall hold certificates of approval to BS EN ISO 14732 [Ref 38.N]and BS EN ISO 9606-1 [Ref 21.N].

2.19 All personnel welding aluminium alloy components shall hold certificates of approval to BS EN ISO 9606-2 [Ref 20.N].

2.20 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Certificates of approval for welder qualification by an Independent Inspecting Authority using Registered Welding Engineers, Registered Welding Quality Engineers or Welding Inspectors certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or or an individual certified to BS EN ISO 17637 [Ref 12.N].

2.21 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to Certificates of approval for welder qualification.

Requirements for non-destructive production weld verification testing for non-harmonised/non-designated road restraint products

2.22 Verification for welds to welded non-harmonised/non-designated road restraint products by non-destructive production weld testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

Documentation requirements for personnel conducting non-destructive testing for non-harmonised/non-designated road restraint products

2.23 Personnel conducting non-destructive testing (NDT) of welds shall be certified as competent in using the NDT equipment and in inspecting the weld groups under examination, in accordance with BS EN ISO 9712 [Ref 15.N].

2.24 The following Documentation shall be submitted for personnel conducting non-destructive testing for road restraint products prior to the commencement of delivery of the road restraint components to site: Evidence of training and qualification by the Certification Scheme for Weldment Inspection Personnel (CSWIP), or an individual certified to BS EN ISO 17637 [Ref 12.N].

2.25 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to Evidence of training and qualification by the

Certification Scheme for Weldment Inspection Personnel (CSWIP) or an individual certified to BS EN ISO 17637 [Ref 12.N].

Requirements for the visual inspection of welds for non-harmonised/non-designated road restraint products

2.26 All personnel visually inspecting welds shall hold certificates of approval to BS EN ISO 17637 [Ref 12.N]for the weld groups which they are inspecting.

2.27 The visual inspection shall confirm that:.

1. all welds are free of slag residues and sharp edges;
2. all surfaces are free of splatter, arc strikes and contaminants;

3. the apparent throat dimensions of butt welds and the apparent leg length and throat dimensions of fillet welds, as measured by a welding gauge, taking into account any known lack of fit are not less than those shown on fabrication drawings where averaged over any 50mm length;

4. local shortfalls in the apparent throat dimensions of butt welds and the apparent leg length and throat dimensions of fillet welds, as measured by a welding gauge, taking into account any known lack of fit do not exceed 1mm;

5. all welds are free of cold lap;

6. the surfaces of all welds are free from cracks, lack of fusion including overlap, and slag;

7. all welds are free of isolated discontinuous porosity where it is detrimental to the galvanising process; and

8. any undercuts to any welds do not result in a section loss of more than 5% over any 50 mm length of joint or exceed a depth equal to the lesser of 0.5 mm or 10% of the thickness of the thinner of the two connected elements.

Verification requirements for the visual inspection of welds for non-harmonised/non-designated road restraint products

2.28 Verification shall be undertaken for welds to welded non-harmonised/non-designated road restraint products by visual inspection in accordance with BS EN ISO 17637 [Ref 12.N].

2.29 The frequency of visual inspection of welds to welded non-harmonised/non-designated road restraint products shall be once for all welded joints prior to galvanising.

2.30 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to the visual inspection of welds to welded non-harmonised/non-designated road restraint products.

Documentation requirements for the visual inspection of welds for non-harmonised/non-designated road restraint products

2.31 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: inspection records for visual inspections in accordance with BS EN ISO 17637 [Ref 12.N].

2.32 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the inspection records for visual inspections.

Requirements for Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection (LPI) of welds for non-harmonised/non-designated road restraint products

2.33 Non-destructive MPI and LPI shall be undertaken on samples where the parent material thickness is greater than 20mm.

2.34 The MPI and LPI shall confirm that:.

1. the surfaces of all welds are free of cracks, lack of fusion and slag; and
2. the throat size complies with that shown on the fabrication drawings.

2.35 MPI and LPI testing shall be undertaken to all welds where, based on visual inspection, the presence of cracking, lack of fusion or the presence of slag is suspected, irrespective of the parent material thickness.

2.36 Where non-conformances are found during MPI or LPI, the sample size for MPI and LPI shall be doubled or increased to 100% inspection if doubling exceeds the batch size.

2.37 Where further non-conformances are found during MPI or LPI, the sample size for MPI and LPI shall be extended to include the whole batch.

2.38 Where welds are dressed by grinding to aid MPI or LPI the throat size and leg length shown on the fabrication drawings shall be maintained.

Verification requirements for Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection (LPI) of welds for non-harmonised/non-designated road restraint products

2.39 Verification shall be undertaken for welds to welded non-harmonised/non-designated road restraint products by non-destructive MPI in accordance with BS EN ISO 9934-1 [Ref 13.N].

2.40 The frequency of non-destructive MPI of welds within welded non-harmonised/non-designated road restraint products shall be once for all welded joints for batch sizes of up to 10 components, and a minimum of 10% of additional components thereafter.

2.41 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to non-destructive MPI of welds to welded non-harmonised/non-designated road restraint products.

2.42 Verification shall be undertaken for welds within welded non-harmonised/non-designated road restraint products by non-destructive LPI in accordance with BS EN ISO 3452-1 [Ref 14.N].

2.43 The frequency of non-destructive LPI of welds to welded non-harmonised/non-designated road restraint products shall be once for all welded joints for batch sizes of up to 10 components and a minimum of 10% of additional components thereafter.

2.44 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to non-destructive LPI of welds to welded non-harmonised/non-designated road restraint products.

Documentation requirements for Magnetic Particle Inspection (MPI) and Liquid Penetrant Inspection (LPI) of welds for non-harmonised/non-designated road restraint products

2.45 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: inspection records for MPI of welded joints.

2.46 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to inspection records for MPI.

2.47 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: inspection records for LPI of welded joints.

2.48 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to inspection records for LPI.

Requirements for ultrasonic testing of welds for non-harmonised/non-designated road restraint products

2.49 Ultrasonic testing of welds shall be undertaken on samples of butt welds where the parent material thickness is 8mm or greater.

2.50 Ultrasonic testing shall be undertaken to all butt welds where, based on visual inspection, the presence of cracking or lack of fusion is suspected, irrespective of the parent material thickness.

2.51 Ultrasonic testing shall confirm that:.

1. all welds are free of cracks;
2. the height of buried slag, lack of fusion or lack of penetration does not exceed 3 mm;

3. within 6 mm of the outer surface the individual lengths of buried slag, lack of fusion or lack of penetration do not exceed 10 mm; and

4. the net throat area loss, resulting from buried slag, lack of fusion or lack of penetration, over any 50 mm length of weld does not exceed 5% of the throat area shown on fabrication drawings.

2.52 Where non-conformances are found during ultrasonic testing, the sample size for ultrasonic testing shall be doubled or increased to 100% inspection if doubling exceeds the batch size.

2.53 Where further non-conformances are found during ultrasonic testing, the sample size for ultrasonic testing shall be extended to include the whole batch.

Verification requirements for ultrasonic testing of welds for non-harmonised/non-designated road restraint products

2.54 Verification shall be undertaken for butt welds in welded non-harmonised/non-designated road restraint products by non-destructive ultrasonic testing in accordance with BS EN ISO 17640 [Ref 11.N].

2.55 The frequency of non-destructive ultrasonic testing of butt welds to welded non-harmonised/non-designated road restraint products shall be once for batch sizes of up to 10 components and a minimum of 10% of additional components thereafter.

2.56 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to non-destructive ultrasonic testing of butt welds to welded non-harmonised/non-designated road restraint products.

Documentation requirements for ultrasonic testing of welds for non-harmonised/non-designated road restraint products

2.57 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Test records for ultrasonic testing of butt welded joints.

2.58 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to test records for ultrasonic testing of welded joints.

Requirements for destructive production weld verification testing for non-harmonised/non-designated road restraint products

2.59 For every sample component, each length of weld between weld ends or changes of direction shall be sectioned at intervals not exceeding 100 mm.

2.60 One side of each section shall be ground,filed, linished or machined to an appropriate finish such that the actual throat and leg dimensions can be measured and any discontinuities exposed.

2.61 Each section shall be examined and measured to confirm that:.

1. the true throat dimensions of butt welds and the true leg length and throat dimensions of fillet welds are not less than those shown on fabrication drawings where averaged over any 50 mm length;
2. local shortfalls in the actual throat dimensions of butt welds and the actual leg length and throat dimensions of fillet welds do not exceed 1 mm;

3. all welds are free of cold lap and cracks;

4. the surfaces of all welds are free of cracks, lack of fusion and slag;

5. the height of buried slag, lack of fusion or lack of penetration does not exceed 3 mm;

6. within 6 mm of the outer surface the individual lengths of buried slag, lack of fusion or lack of penetration do not exceed 10 mm;

7. the net throat area loss, as a result of buried slag, lack of fusion or lack of penetration, over any 50 mm length of weld, as a result of buried slag, lack and fusion or lack of penetration, does not exceed 5% of the throat area shown on fabrication drawings; and

8. undercuts do not result in a section loss of more than 5% over any 50 mm length of joint or exceed a depth equal to the lesser

of 0.5 mm or 10% of the thickness of the thinner of the two connected elements;

Sampling requirements for destructive production weld verification testing and fracture testing for non-harmonised/non-designated road restraint products

2.62 Sample components representative of the final components, and/or sample joints cut from components representative of the final components, shall be supplied for destructive testing.

2.63 Sample components and/or joints for destructive testing shall be selected by a Welding Inspector certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or an individual certified to BS EN ISO 17637 [Ref 12.N].

2.64 Sample components shall be selected on the basis that they represent the lower end of weld quality in the production batch.

2.65 Weld verification and fracture testing of welds to welded non-harmonised/non-designated road restraint products shall be carried out in accordance with BS EN ISO 9017 [Ref 4.N].

2.66 The frequency for destructive production weld verification testing and fracture testing of welds to welded non-harmonised/non-designated road restraint products shall be in accordance with table 2.66.

Table 2.66 Sampling frequency requirements for destructive testing

Batch sizes and component types	Batch size	Frequency of destructive testing
Beam assemblies with transverse butt welds	Less than 100	One sample joint unless an identical sample joint from the same works has been destructively tested within the previous four weeks
Beam assemblies with transverse butt welds	100 or more	One sample joint for each subsequent sampling lot, not exceeding 100
Welded adjuster brackets		One sample for each sampling lot, not exceeding 300
Each type of post		One post for each sampling lot, not exceeding 1000
Each type of surface mounted post		One post for each sampling lot, not exceeding 100
Vehicle parapet posts	Up to 150	No test required, provided that records are produced of successful testing in accordance with BS EN ISO 9017 [Ref 4.N], carried out on

		posts of the same weld group within the previous three months. If no satisfactory record is available, one post sample is required
Vehicle parapet posts	150 to 300	One post
Vehicle parapet posts	More than 300	Two posts
Each type of anchor frame, vehicle parapet connection and connection piece		One sample at intervals not exceeding 6 months, for each of the manufacturer’s manufacturing plants
Welded vehicle parapet splices	Up to 150	One splice, unless successful testing has been carried out in accordance with BS EN ISO 9017 [Ref 4.N]within the previous 3 months on a similar splice(s), and the welding is to be carried out by the same personnel
Welded vehicle parapet splices	150 or more	Two splices, unless successful testing in accordance with BS EN ISO 9017 [Ref 4.N]has been carried out within the previous 3 months on a similar splice(s), and the welding is to be carried out by the same personnel
For other welded components		One sample at an interval not exceeding 12 months for each of the manufacturer’s manufacturing plants

Verification requirements for destructive production weld verification testing for non-harmonised/non-designated road restraint products

2.67 Verification shall be undertaken for welds to welded non-harmonised/non-designated road restraint products by destructive production weld verification testing.

2.68 The frequency of destructive production weld verification testing of welds to welded non-harmonised/non-designated road restraint products shall be in accordance with table 2.66.

2.69 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to destructive production weld verification testing of welds to welded non-harmonised/non-designated road restraint products.

2.70 Verification for welds to welded non-harmonised/non-designated road restraint products by destructive production weld verification testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

2.71 Verification for welds to welded non-harmonised/non-designated road restraint products by hardness survey shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

2.72 Verification shall be undertaken for welds to welded non-harmonised/non-designated road restraint products by fracture testing in accordance with BS EN ISO 9017 [Ref 4.N] on a length of weld not less than 50mm.

2.73 The frequency of fracture testing in accordance with BS EN ISO 9017 [Ref 4.N]of welds to welded non-harmonised/non-designated road restraint products shall be once to each joint type on each component sampled in accordance with table 2.66.

2.74 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to fracture testing in accordance with BS EN ISO 9017 [Ref 4.N]of welds to welded non-harmonised/non-designated road restraint products.

Documentation requirements for destructive production weld verification testing for non-harmonised/non-designated road restraint products

2.75 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Copies of the most recent certified destructive production weld verification test reports covering the component types to be supplied under the Contract.

2.76 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified destructive production weld verification test reports.

Requirements for macro-examination for non-harmonised/non-designated road restraint products

2.77 One representative section for each joint type for each component type shall be prepared for and subjected to macro-examination.

2.78 An additional macro-examination shall be made of each non-conforming weld.

2.79 A hardness survey of welds shall be undertaken on samples where the parent material thickness exceeds 20mm.

Verification requirements for macro-examination of non-harmonised/non-designated road restraint products

2.80 Verification shall be undertaken for welds to welded non-harmonised/non-designated road restraint products by hardness survey.

2.81 The frequency of hardness survey of welds to welded non-harmonised/non-designated road restraint products shall be once to each section prepared for macro-examination.

2.82 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to hardness survey of welds to welded non-harmonised/non-designated road restraint products.

2.83 Verification for welds to welded non-harmonised/non-designated road restraint products by fracture testing shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

Documentation requirements for macro-examination of non-harmonised/non-designated road restraint products

2.84 The following Documentation shall be submitted for welded non-harmonised/non-designated road restraint products prior to the commencement of delivery of the road restraint components to site: Copies of the most recent certified fracture test reports covering the component types to be supplied under the Contract.

2.85 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified fracture test reports.

Marking of non-harmonised/non-designated road restraint products

2.86 All components of non-harmonised/non-designated products, excluding fasteners, reinforcing rings and bars shall be clearly and marked with the manufacturer’s identification mark and digits indicating month and year of manufacture.

2.87 In addition to the marking requirements of BS EN ISO 898-1 [Ref 9.N], fasteners shall be clearly marked with the road restraint manufacturer's identification mark, and the fastener number referenced on the manufacturer’s product drawings.

2.88 All markings on components and fasteners of non-harmonised/non-designated products shall be legible for the economically reasonable working life of the product.

Non-harmonised/non-designated road restraint product requirements

2.89 The mechanical and chemical properties of the materials used for the production of non-harmonised/non-designated road restraints shall be within the limits of statistical variation for the material as detailed in the product description and associated installation instructions.

2.90 Verification shall be undertaken for the material used for the production of non-harmonised/non-designated road restraint products, by either.

1. tensile tests to destruction, to determine the yield/proof strength, ultimate strength and the percentage elongation of the material, or
2. verification of steel mill certificates showing chemical and mechanical properties of the materials used, or

3. verification of concrete compressive compliance testing and aggregate composition.

2.91 The frequency of destructive testing or verification of steel mill certificates shall be undertaken annually, or whenever the production technique is changed.

2.92 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to destructive testing or verification of steel mill certificates.

2.93 Where components are not manufactured within a 12 month period, the materials used for each production batch shall be verified when manufacturing recommences.

2.94 Verification for the material used for the production of non-harmonised/non-designated road restraint products shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 6.N].

2.95 All metallic reinforcement shall be subject to the same controls as metallic road restraint systems.

Protection against corrosion for non-harmonised/non-designated road restraint products

2.96 The surface preparation and protection against corrosion of all steel components of non-harmonised road restraint products shall be compliant with CC 486 [Ref 19.N].

Concrete used for non-harmonised/non-designated road restraint products

2.97 Unless specifically indicated otherwise by the vehicle restraint system manufacturer’s installation instructions, structural concrete, where

used as part of a non-harmonised/non-designated road restraint product, shall comply with the requirements of CC 482 [Ref 37.N].

2.98 Unless specifically indicated otherwise by the vehicle restraint system manufacturer’s installation instructions, concrete used for the foundations of non-harmonised/non-designated safety barrier posts and end anchorages shall comply with "Concrete for Ancillary Purposes" in Section 2 of CC 495 [Ref 10.N].

Fasteners for non-harmonised/non-designated road restraint systems

2.99 All fasteners for non-harmonised/non-designated road restraint systems shall be compliant with BS EN ISO 898-1 [Ref 9.N].

3. Vehicle restraint systems

3.1 Vehicle restraint systems shall comply with "General requirements for road restraint systems" in Section 1 of this document.

Quality management requirements for permanent vehicle restraint systems

3.2 Permanent vehicle restraint systems shall be supplied, installed, repaired, maintained, and serviced by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 6.N].

Durability requirements for permanent vehicle restraint systems

3.3 The following Documentation shall be submitted for vehicle restraint systems prior to the commencement of incorporation into the works: declaration of serviceable life from the supplier of the vehicle restraint system, where the product is not within the scope of BS EN 1317-5 [Ref 18.N].

3.4 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the declaration of serviceable life for the vehicle restraint system.

3.5 The serviceable life for steel components of vehicle restraint systems shall , except where stated in the Works Specific Requirement (WSR) for the relevant products in Sections 4 to 9 of this document, be obtained without the need for maintenance, other than that resulting from accidental damage or any local restoration of protective treatments.

3.6 The following Documentation shall be submitted and agreed for any additional protective treatments prior to the components arriving on site: drawing showing the location of additional protective treatments, and justification for the inclusion of the additional protective treatments.

3.7 The drawings showing the location of additional protective treatments and justification for the inclusion of the additional protective treatments shall comply with the requirements of "Documentation" in Section 2 of GC 101 [Ref 6.N].

Installation requirements for vehicle restraint systems

General installation requirements for vehicle restraint systems

3.8 All vehicle restraint systems shall be erected to present a flowing alignment.

3.9 The overall installation alignment of all vehicle restraint systems shall not depart from the prescribed alignment described by the vehicle restraint system manufacturer's product description and associated installation instructions where given, or otherwise, by more than ±30 mm in alignment on plan, and by more than ±15 mm in any 10 m length from the straight or required radius.

3.10 The vertical alignment of all vehicle restraint systems shall not depart from the prescribed alignment described by the vehicle restraint system manufacturer's product description and associated installation instructions where given, or otherwise, ±30 mm.

3.11 Notwithstanding the manufacturing tolerances permitted for individual beams, the cumulative length tolerance shall be such that beams and posts can be positioned in accordance with the vehicle restraint system manufacturer’s installation instructions.

Excavation requirements for concrete foundations and anchor blocks for vehicle restraint systems

3.12 Excavations for concrete foundations and anchor blocks shall comply with the vehicle restraint system manufacturer’s installation instructions where given, or otherwise "Earthworks around structures, foundations, and pipes" in Section 12 of CC 601 [Ref 5.N].

Installation requirements for vehicle restraint system post sockets

3.13 Post sockets shall be kept free of detritus using, for example a non-structural and impermeable filler which has a working life which is the same or greater than that of the vehicle restraint system.

3.14 Post socket caps shall not be installed around posts to stop the ingress of detritus into post sockets.

3.15 The height of the post sockets above ground level shall be in accordance with the vehicle restraint system manufacturer's installation instructions.

3.16 Post sockets shall not protrude above ground level at locations where vehicular access is required across the top of the sockets.

Installation requirements for driven vehicle restraint system posts

3.17 Where vehicle restraint system posts are driven into the ground, no visible damage shall occur to the posts.

Verification requirements for driven vehicle restraint system post foundations

3.18 Verification shall be undertaken for the strength of the ground for driven post foundations for safety barriers, terminals, transitions, removable barrier systems and crash cushions by testing of posts and foundations in accordance with the vehicle restraint system manufacturer's installation instructions, at the location where the posts are to be installed, in the direction of anticipated deflection, and at a location where the ground is likely to have least resistance, such as close to the edge of an embankment or in the proximity of a filter drain.

3.19 The frequency of post foundation testing for driven posts shall be in accordance with the vehicle restraint system manufacturer's installation instructions or as stated within the WSR for the relevant products specified in Sections 4 to 9 of this document, whichever is the most frequent.

3.20 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to driven post foundation testing.

3.21 The frequency of post foundation testing for driven posts shall not be less than once every 100 m, unless a greater frequency is stated within the WSR.

3.22 The frequency of post foundation testing for driven posts shall not be less than once within the length of the installation where the length of the installation is less than 100 m, unless a greater frequency is stated within the WSR.

3.23 The following Documentation shall be submitted for the driven post foundation tests of safety barriers, terminals, transitions, removable barrier sections and crash cushions prior to the commencement of full installation: results of the driven post foundation tests, carried out in accordance with the vehicle restraint system manufacturer's installation instructions.

3.24 Documentation for the driven post foundation tests shall be submitted prior to the installation of the vehicle restraint system.

3.25 On completion of the driven post foundation tests any visibly damaged posts shall be replaced, and the finished ground reinstated.

Anchorages and attachment systems for vehicle restraint systems

Product requirements for anchorages and attachment systems for vehicle restraint systems

3.26 Unless specifically indicated by the vehicle restraint system manufacturer’s installation instructions, where vehicle restraint system posts are to be installed on top of a structure, a stainless steel anchorage/attachment system shall be used.

3.27 Unless specifically indicated by the vehicle restraint system manufacturer’s installation instructions, where vehicle restraint system posts are to be installed on surface mounted posts, a stainless steel anchorage/attachment system shall be used.

3.28 The following Documentation shall be submitted for anchorages and attachment systems prior to the commencement of incorporation into the works: evidence that anchorages and attachment systems, are capable of resisting the applied load effects resulting from impact with the proposed vehicle restraint system, as described by the vehicle restraint manufacturer's product drawings and/or associated installation instructions, unless otherwise covered under the conformity assessment mark and its supporting documentation.

3.29 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the proposed anchorages and attachment systems.

3.30 Where the performance of a vehicle restraint system is reliant on the failure of the attachment system, the anchorages shall be capable of resisting the ultimate tensile loads resulting from failure of the attachment system so that an anchorage does not fail within the section embedded within the supporting structure, and is able to be reused in the event of the need to replace the parapet that has suffered impact damage.

3.31 The following Documentation shall be submitted for vehicle restraint systems where the performance of the vehicle restraint systems is reliant on the failure of the attachment system, prior to the commencement of incorporation into the works: evidence that the anchorages are capable of resisting the ultimate tensile loads resulting from failure of the attachment system so that an anchorage does not fail within the section embedded within the supporting structure, and is able to be reused in the event of the need to replace the parapet that has suffered impact damage.

3.32 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the aforementioned evidence.

3.33 The service life of the anchorage system shall match or exceed that of the attached vehicle restraint system.

Installation requirements for anchorages and attachment systems for vehicle restraint systems

3.34 Anchorage and attachment systems shall be installed in accordance with the vehicle restraint system manufacturer’s installation instructions.

3.35 Unless specified otherwise in the vehicle restraint system manufacturer’s installation instructions, direct metal to metal contact between dissimilar materials within the attachment system and anchorage shall be prevented by the use of non-conductive sleeves, washers or coatings to prevent bimetallic corrosion.

3.36 Unless specified otherwise by the vehicle restraint system manufacturer’s installation instructions or where surface mounted posts are attached to a steel base, the base plate shall be bedded on mortar complying with "Bedding Mortar" in Section 1 of CC 495 [Ref 10.N].

3.37 Unless specified otherwise by the vehicle restraint system manufacturer’s installation instructions, the threads of steel anchorages shall be lined with an anti-seize coating.

3.38 All voids shall be sealed with a non-structural and impermeable filler which has a working life which is the same or greater than that of the vehicle restraint system, to prevent ingress of moisture and deleterious substances.

3.39 For anchorages in drilled or cored holes, holes shall be located to ensure that steel reinforcement will not be encountered.

3.40 For anchorages in drilled or cored holes, bridge deck waterproofing systems shall not be damaged during drilling or coring, and installation unless otherwise specified and repaired as per the agreed contract and with suitable witnessed rectification being undertaken as defined in the quality plan.

3.41 Any chemical bond within the connection of the vehicle restraint system and the supporting structure shall comply with BS 8539 [Ref 2.N].

Verification requirements for anchorages and attachment systems for vehicle restraint systems

3.42 Verification shall be undertaken for the tensile capacity of anchorages in drilled or cored holes for vehicle restraint systems, except crash cushions, by on-site tensile load testing in accordance with the manufacturer's instructions where given, or otherwise in accordance with BS 8539 [Ref 2.N].

3.43 The frequency of on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, except crash cushions, shall be

1 anchorage per post anchorage group for the first 5 post anchorage groups installed, and then 1 anchorage per 5 post anchorage groups that are installed thereafter.

3.44 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, except crash cushions.

3.45 Verification shall be undertaken for the tensile capacity of anchorages in drilled or cored holes for crash cushions by on-site tensile load testing in accordance with the manufacturer's instructions where given, or otherwise in accordance with BS 8539 [Ref 2.N].

3.46 The frequency of on-site tensile load tests for anchorages in drilled or cored holes for crash cushions shall be two per product unless otherwise stated in CC 400/WSR/009.

3.47 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to on-site tensile load tests for anchorages in drilled or cored holes for crash cushions.

3.48 Where anchorages are tested they shall be loaded incrementally in tension in accordance with BS 8539 [Ref 2.N], except that the anchorages are to be capable of resisting a test load equal to 10% above the nominal tensile load applied to the anchorage at failure of the vehicle restraint system, in lieu of testing to failure.

3.49 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems where the failure of the attachment system is the failure mode of the vehicle restraint system, the nominal tensile load for the tests shall be 90% of the yield load of the attachment system unless otherwise indicated in the vehicle restraint system manufacturer’s installation instructions.

3.50 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, incremental loads shall be held for not less than half a minute, and the test load for not less than five minutes.

3.51 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, readings shall be taken immediately after applying load.

3.52 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, readings following the application of an incremental load shall also be taken within half a minute of the load being applied.

3.53 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, readings following the application of the test load shall also be taken within five minutes of the load being applied.

3.54 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, any total movement of the anchorage exceeding 1.0 mm shall constitute a test non-conformity.

3.55 When conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, any evidence of slip during loading, as demonstrated by a significant change in the slope of the load/extension curve, shall constitute a test non-conformity.

3.56 If a non-conformity is found during on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems, the rate of testing shall be doubled until the suitability of the anchorages is established.

3.57 Any anchorage which fails the on-site tensile load tests for anchorages in drilled or cored holes for vehicle restraint systems shall be replaced and retested.

3.58 The following Documentation shall be submitted for anchorages in drilled or cored holes for vehicle restraint systems prior to the completion of the works: The results of on-site tensile load testing of anchorages in drilled or cored holes for vehicle restraint systems.

3.59 The results of on-site tensile load testing of anchorages in drilled or cored holes for vehicle restraint systems shall comply with "Documentation" in Section 2 of GC 101 [Ref 6.N].

4. Permanent safety barriers

Permanent safety barrier requirements

4.1 Permanent Safety Barriers shall comply with "General requirements for road restraint systems" in Section 1 of this document.

4.2 Permanent Safety Barriers shall comply with "Vehicle restraint systems" in Section 3 of this document.

4.3 Permanent safety barriers shall be compliant with BS EN 1317-5 [Ref 18.N].

4.4 The permanent safety barriers shall meet the performance characteristics as stated in table 4.4.

Table 4.4 Minimum performance characteristics for permanent safety barriers

BS EN 1317-5 [Ref 18.N]essential characteristic	Minimum performance class
Containment level	Refer to WSR
Impact severity	Refer to WSR
Normalised working width	Refer to WSR
Normalised dynamic deflection	Refer to WSR
Normalised vehicle intrusion (higher and very high containment level safety barriers only)	Refer to WSR
Durability	Minimum economically reasonable working life: 1. metal permanent safety barriers: 20 years; 2. metal components of multi-material safety barriers, excluding reinforcement: 20 years; 3. concrete permanent safety barriers: 50 years; 4. concrete components of multi-material safety barriers: 50 years; 5. plastic permanent safety barriers: 10 years;

	6. plastic components of multi-material safety barriers: 10 years; 7. wooden components of combined metal/wood permanent safety barriers: 10 years
Resistance to snow removal	No Performance Determined

4.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 6.N] shall apply to permanent safety barriers.

Schedule for permanent safety barriers

4.6 Permanent safety barriers shall be supplied and installed as specified in CC 400/WSR/004.

Permanent safety barriers							
Permanent safety barrier ID	**Permanent safety barrier location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference (s)**	**Single or double sided**	**Min set back**	**Length of need**	**Total length of permanent safety barrier**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the permanent safety barrier, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the permanent safety barrier location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a value, from options Single sided, Double sided, to identify whether the safety barrier is to be single or double sided.

f) Enter a number in units of m, to identify the minimum set back of the permanent safety barrier, refer to CD 127 [Ref 3.N].

g) Enter a number in units of m, to identify the length of need of full height permanent safety barrier.

h) Enter a number in units of m, to identify the total length of need of full height permanent safety barrier.

Permanent safety barriers (continued)								
Permanent safety barrier ID	**Containment level**	**Impact severity**	**Normalised working width**	**Max value of normalised working width where <W1**	**Normalised dynamic deflection**	**Normalised vehicle intrusion (higher and very high containment level barriers only)**	**Max value of normalised vehicle intrusion where <VI1**	**Max height**
(a)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)

i) Enter a value, from options N1, N2, H1, H4a, to identify the minimum containment level class of the permanent safety barrier.

j) Enter a value, from options A, B, to identify the maximum impact severity level for the permanent safety barrier.

k) Enter a value, from options <W1, W1, W2, W3, W4, W5, W6, W7, W8, to identify the maximum normalised working width class for the permanent safety barrier.

l) Enter a number in units of m, to specify the maximum value of normalised working width for the permanent safety barrier, where it is less than 0.6m.

m) Enter a number in units of m, to identify the maximum normalised dynamic deflection for the permanent safety barrier.

n) Enter a value, from options <VI1, VI1, VI2, VI3, VI4, VI5, VI6, VI7, VI8, VI9, to identify the maximum normalised vehicle intrusion class for higher and very high containment level permanent safety barriers.

o) Enter a number in units of m, to specify the maximum value of normalised vehicle intrusion, where it is less than 0.6m for higher and very high containment permanent safety barriers.

p) Enter a number in units of m, to identify the maximum height of permanent safety barrier that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

q) Enter a number in units of m, to identify the minimum height of permanent safety barrier, if applicable.

Permanent safety barriers (continued)						
Permanent safety barrier ID	**Motorcyclist protection system required**	**Ground conditions**	**Contractor to provide test equipment for post foundation testing**	**Contractor to conduct post foundation testing**	**Frequency of post foundation testing**	**Loading and anchorage requirements**
(a)	(r)	(s)	(t)	(u)	(v)	(w)

r) Enter a value, from options Yes, No, to identify whether an additional motorcyclist protection system is to be attached to the permanent safety barrier.

s) Enter text, to identify the type of ground conditions at the installation location.

t) Enter a value, from options Yes, No, to identify whether the Contractor will be providing the equipment for post foundation testing.

u) Enter a value, from options Yes, No, to identify whether the Contractor will be conducting the post foundation testing.

v) Enter text, to define the frequency of post foundation testing as described in the manufacturer's product description and associated installation instructions.

w) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

Permanent safety barriers (continued)					
Permanent safety barrier ID	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Vulnerable road user protection**	**Environmental requirements**	**Additional requirements**
(a)	(x)	(y)	(z)	(aa)	(ab)

Permanent safety barriers (continued)					
Permanent safety barrier ID	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Vulnerable road user protection**	**Environmental requirements**	**Additional requirements**

x) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for permanent safety barriers.

y) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

z) Enter text, to identify any additional measures required to reduce the risk of injury to pedestrians, equestrians and other vulnerable users.

aa) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the permanent safety barrier.

bb) Enter text, to define any additional requirements.

Requirements for motorcyclist protection systems attached to permanent safety barriers

4.7 Motorcyclist protection systems attached to permanent safety barriers shall be compliant with Clause 8.4 of PD CEN/TS 17342 [Ref 26.N].

Documentation requirements for motorcyclist protection systems attached to permanent safety barriers

NI/4.8 The following Documentation shall be submitted for motorcyclist protection systems attached to permanent safety barriers prior to the commencement of incorporation into the works: certified results of impact testing.

NI/4.9 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified results of impact testing for motorcyclist protection systems attached to permanent safety barriers.

4.10 The Documentation shall demonstrate that the motorcyclist protection system meets the specification requirements.

4.11 The Documentation shall demonstrate that the motorcyclist protection systems has been assessed with the permanent safety barrier to which it is to be attached..

4.12 Certified results of impact testing shall comprise the following.

1. test result certificate from an accredited laboratory;
2. test report in accordance with PD CEN/TS 17342 [Ref 26.N];

3. video or high speed film of impact test annotated showing date, test number and performance class;

4. still photographs of complete installation prior to impact including anchorage points;

5. still photographs of vehicle before and after impact and full drawings of tested items;

6. certification from the manufacturer that the item tested complies with the drawings supplied.

5. Vehicle parapets

Vehicle parapet requirements

5.1 Vehicle parapets shall comply with "General requirements for road restraint systems" in Section 1 of this document.

5.2 Vehicle parapets shall comply with "Vehicle restraint systems" in Section 3 of this document.

5.3 Vehicle parapets shall be compliant with BS EN 1317-5 [Ref 18.N].

5.4 The vehicle parapets shall meet the performance characteristics as stated in table 5.4.

Table 5.4 Minimum performance characteristics for vehicle parapets	
BS EN 1317-5 [Ref 18.N]essential characteristic	Minimum performance class
Containment level	Refer to WSR
Impact severity	Refer to WSR
Normalised working width	Refer to WSR
Normalised dynamic deflection	Refer to WSR
Normalised vehicle intrusion (higher and very high containment level vehicle parapets only)	Refer to WSR
Durability	Minimum economically reasonable working life: 1. metal vehicle parapets: 30 years; 2. metal components of multi-material vehicle parapets, excluding reinforcement: 30 years 3. concrete vehicle parapets: 120 years; 4. concrete components of multi-material vehicle parapets: 120 years
Resistance to snow removal	No Performance Determined

5.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 6.N] shall apply to vehicle parapets.

Schedule for vehicle parapets

5.6 Vehicle parapets shall be supplied and installed as specified in CC 400/WSR/005.

Vehicle parapets							
Vehicle parapet ID	**Vehicle parapet location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference(s)**	**Min set back**	**Length of need**	**Containment level**	**Impact severity**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the permanent parapet, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the vehicle parapet location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a number in units of m, to identify the minimum set back of the vehicle parapet, refer to CD 127 [Ref 3.N].

f) Enter a number in units of m, to identify the length of need of vehicle parapet.

g) Enter a value, from options N1, N2, H1, H4a, to identify the minimum containment level class of the vehicle parapet.

h) Enter a value, from options A, B, to identify the maximum impact severity level for the vehicle parapet.

Vehicle parapets (continued)								
Vehicle parapet ID	**Normalised working width**	**Max value of normalised working width where <W1**	**Normalised dynamic deflection**	**Normalised vehicle intrusion (higher and very high containment level parapets only)**	**Max value of normalised vehicle intrusion where <VI1**	**Max height**	**Minimum height above the adjacent paved surface**	**Cladding/ mesh requirements**
(a)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)

i) Enter one or more values, from options <W1, W1, W2, W3, W4, W5, W6, W7, W8, to identify the maximum normalised working width class for the vehicle parapet.

j) Enter a number in units of m, to specify the maximum value of normalised working width for the vehicle parapet, where it is less than 0.6m.

k) Enter a number in units of m, to identify the maximum normalised dynamic deflection for the vehicle parapet.

l) Enter a value, from options <VI1, VI1, VI2, VI3, VI4, VI5, VI6, VI7, VI8, VI9, to identify the maximum normalised vehicle intrusion class for higher and very high containment level vehicle parapets.

m) Enter a number in units of m, to specify the maximum value of normalised vehicle intrusion, where it is less than 0.6m.

n) Enter a number in units of m, to identify the maximum height of vehicle parapet that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

o) Enter a value, from options 1.0m, 1.5m, 1.8m, to identify the minimum height of the vehicle parapet, refer to CD 377 [Ref 23.N].

p) Enter a value, from options none, mesh, partial cladding (lower), full cladding, to determine whether cladding or mesh is to be affixed to the vehicle parapet.

Vehicle parapets (continued)						
Vehicle parapet ID	**Aesthetic requirements**	**Suicide prevention measures required**	**Compliance with Clauses 4.32 to 4.40 of CD 377 [Ref 23.N]**	**Compliance with Clause 4.42 of CD 377 [Ref 23.N]**	**Supporting plinth details**	**Loading and anchorage requirements**
(a)	(q)	(r)	(s)	(t)	(u)	(v)

q) Enter text, to specify any aesthetic requirements for the vehicle parapet.

r) Enter text, to detail any suicide prevention measures which are required to be incorporated into, or attached to, the vehicle parapet.

s) Enter a value, from options Yes, No, to identify whether the requirements of the "Verges on bridge and structures" clauses of CD 377 [Ref 23.N]are compliant.

t) Enter a value, from options Yes, No, to identify whether the requirements for the "plinth upstand" clause of CD 377 [Ref 23.N] are compliant.

u) Enter text, to identify the material and/or width and/or height of the supporting plinth.

v) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

Vehicle parapets (continued)					
Vehicle parapet ID	**Max length of anchorages**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Environmental requirements**	**Additional requirements**
(a)	(w)	(x)	(y)	(z)	(aa)

w) Enter a number in units of m, to specify the maximum length of anchorages to be used for installation.

x) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for the vehicle parapet.

y) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

z) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the vehicle parapet.

aa) Enter text, to define any additional requirements.

6. Vehicle/pedestrian parapets

Vehicle/pedestrian parapet requirements

6.1 Vehicle/pedestrian parapets shall comply with "General requirements for road restraint systems" in Section 1 of this document.

6.2 Vehicle/pedestrian parapets shall comply with "Vehicle restraint systems" in Section 3 of this document.

6.3 The pedestrian restraint requirements for a vehicle/pedestrian parapet shall comply with "Pedestrian restraint systems" in Section 10 of this document.

6.4 Metal vehicle/pedestrian parapets shall be compliant with BS 7818 [Ref 35.N].

6.5 Vehicle/pedestrian parapets shall be compliant with BS EN 1317-5 [Ref 18.N].

6.6 The vehicle/pedestrian parapets shall meet the performance characteristics as stated in table 6.6.

Table 6.6 Minimum performance characteristics for vehicle/pedestrian parapets	
BS EN 1317-5 [Ref 18.N]essential characteristic	Minimum performance class
Containment level	Refer to WSR
Impact severity	Refer to WSR
Normalised working width	Refer to WSR
Normalised dynamic deflection	Refer to WSR
Normalised vehicle intrusion (higher and very high containment level vehicle/pedestrian parapets only)	Refer to WSR
Durability	Minimum economically reasonable working life: 1. metal vehicle/pedestrian parapets: 30 years; 2. metal components of combined metal/concrete vehicle/pedestrian parapets:

	30 years 3. concrete vehicle/pedestrian parapets: 120 years; 4. concrete components of combined metal/concrete vehicle/pedestrian parapets: 120 years
Resistance to snow removal	Refer to WSR

6.7 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 6.N] shall apply to vehicle/pedestrian parapets.

Schedule for vehicle/pedestrian parapets

6.8 Vehicle/pedestrian parapets shall be supplied and installed as specified in CC 400/WSR/006.

Vehicle/pedestrian parapets						
Vehicle/ pedestrian parapet ID	**Vehicle/ pedestrian parapet location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference (s)**	**Min set back**	**Length of need**	**Containment level**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the vehicle/pedestrian parapet, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the vehicle/pedestrian parapet location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a number in units of m, to identify the minimum setback of the vehicle/pedestrian parapet, refer to CD 127 [Ref 3.N].

f) Enter a number in units of m, to to identify the length of need of vehicle/pedestrian parapet.

g) Enter a value, from options N1, N2, H1, H4a, to identify the minimum containment level class of the vehicle/pedestrian parapet.

Vehicle/pedestrian parapets (continued)							
Vehicle/ pedestrian parapet ID	**Impact severity**	**Normalised working width**	**Max value of normalised working width where <W1**	**Normalised dynamic deflection**	**Normalised vehicle intrusion (higher and very high containment level vehicle/pedestrian parapets only)**	**Max value of normalised vehicle intrusion where <VI1**	**Max hei ht**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

h) Enter one or more values, from options A,B, to identify the maximum impact severity level for the vehicle/pedestrian parapet.

i) Enter a value, from options <W1, W1, W2, W3, W4, W5, W6, W7, W8, to identify the maximum normalised working width class for the vehicle/pedestrian parapet.

j) Enter a number in units of m, to identify the maximum value of normalised working width for the vehicle/pedestrian parapet, where it is less than 0.6m.

k) Enter a number in units of m, to identify the maximum normalised dynamic deflection for the vehicle/pedestrian parapet.

l) Enter a value, from options <VI1, VI1, VI2, VI3, VI4, VI5, VI6, VI7, VI8, VI9, to identity the maximum normalised vehicle intrusion class for higher and very high containment level vehicle/pedestrian parapets.

m) Enter a number in units of m, to identify the maximum value of normalised working width for the vehicle/pedestrian parapet, where it is less than 0.6m.

n) Enter a number in units of m, to identify the maximum height of vehicle/pedestrian parapet that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

o) Enter a value, from options 1.0m, 1.5m, 1.8m, to identify the minimum height of the vehicle/pedestrian parapet, refer to CD 377 [Ref 23.N].

Vehicle/pedestrian parapets (continued)						
Vehicle/ pedestrian parapet ID	**Cladding/ mesh requirements**	**Aesthetic requirements**	**Suicide prevention measures required**	**Compliance with Clauses 4.32 to 4.40 of CD 377 [Ref 23.N]**	**Compliance with Clause 4.42 of CD 377 [Ref 23.N]**	**Supporting plinth details**
(a)	(p)	(q)	(r)	(s)	(t)	(u)

p) Enter a value, from options none, mesh, partial cladding (lower), full cladding, to determine whether cladding or mesh is to be affixed to the vehicle/pedestrian parapet.

q) Enter text, to specify any aesthetic requirements for the vehicle/pedestrian parapet.

r) Enter text, to detail any suicide prevention measures which are required to be incorporated into, or attached to, the vehicle/pedestrian parapet.

s) Enter a value, from options Yes, No, to identify whether the requirements of the "Verges and bridge and structures" clauses of CD 377 [Ref 23.N]are compliant.

t) Enter a value, from options Yes, No, to identify whether the requirements for the "plinth upstand" clause of CD 377 [Ref 23.N]are compliant.

u) Enter text, to identify the material and/or width and/or height of the supporting plinth.

Vehicle/pedestrian parapets (continued)						
Vehicle/ pedestrian parapet ID	**Loading and anchorage requirements**	**Max length of anchorages**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Environmental requirements**	**Additional requirements**
(a)	(v)	(w)	(x)	(y)	(z)	(aa)

v) Enter text, to define any particular requirements or restrictions of the vehicle/pedestrian parapet with respect to the structure or

foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the vehicle/pedestrian parapet.

w) Enter a number in units of m, to specify the maximum length of anchorages to be used for the installation of the vehicle/pedestrian parapet.

x) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for vehicle/pedestrian parapets.

y) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system for the vehicle/pedestrian parapet.

z) Enter text, to define any environmental requirements that can affect the choice, positioning, and type of material, for the vehicle/pedestrian parapet.

aa) Enter text, to define any additional requirements.

Vehicle/pedestrian parapet documentation requirements

NI/6.9 The following Documentation shall be submitted for the pedestrian aspects of vehicle/pedestrian parapets prior to the commencement of incorporation into the works: either.

1. written confirmation that any metal vehicle/pedestrian parapet complies with BS 7818 [Ref 35.N]; or
2. written confirmation that any concrete vehicle/pedestrian parapet complies with BS 5400-4 1990 [Ref 36.N].

NI/6.10 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to written confirmation of compliance with BS 7818 [Ref 35.N]or BS 5400-4 1990 [Ref 36.N]for vehicle/pedestrian parapets.

6.11 The Documentation submitted shall demonstrate that the pedestrian aspects of the proposed vehicle/pedestrian parapet meet the specification requirements.

7. Permanent terminals

Permanent terminal requirements

7.1 Terminals shall comply with "General requirements for road restraint systems" in Section 1 of this document.

7.2 Terminals shall comply with "General requirements for non-harmonised/non-designated road restraint products" in Section 2 of this document.

7.3 Terminals shall comply with "Vehicle restraint systems" in Section 3 of this document.

7.4 Terminals shall be compliant with BS EN 1317-1 [Ref 28.N]and either DD ENV 1317-4 2002 [Ref 16.N] or PD CEN/TS 1317-7 [Ref 27.N].

Schedule for permanent terminals

7.5 Permanent terminals shall be supplied and installed as specified in CC 400/WSR/007.

Permanent terminals						
Permanent terminal ID	**Permanent terminal location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference (s)**	**Min set back(s)**	**Terminal alignment**	**Performance class**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.
b) Enter text, to identify the location of the permanent terminal, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the permanent terminal location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter text, to identify the minimum set back(s) of the permanent terminal, refer to CD 127 [Ref 3.N]. Where the permanent terminal is installed such that traffic passes on both sides, and the set back

to the permanent terminal differs on the two carriageways, both set backs are to be stated.

f) Enter a value, from options Flared, Reduced Flare, Straight, to identify the alignment of the terminal.

g) Enter a value, from options T80/3 (formerly P1), T80/2 (formerly P2), T80, T100/1 (formerly P3), T100, T110/1 (formerly P4), T110, to identify the minimum performance class of the permanent terminal.

Permanent terminals (continued)								
Permanent terminal ID	**Energy absorbing**	**Direction of traffic past terminal**	**Single or double sided**	**Approach or departure end**	**Max height**	**Impact severity**	**Lateral displacement x class**	**Lateral displacement y class**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)

h) Enter a value, from options Yes, No, to identify whether the permanent terminal is to be energy absorbing.

i) Enter a value, from options One, Two, to identify whether the permanent terminal can be struck in one direction only (enter One), e.g. on a motorway, or in both directions (enter Two), e.g. on a single carriageway road.

j) Enter a value, from options Single, Double, to identify whether the permanent terminal is to have another road restraint system connected to it on one side, or both sides.

k) Enter a value, from options Approach, Departure, to identify if the terminal will be installed on the approach end or the departure end of the road restraint system.

l) Enter a number in units of m, to identify the maximum height of permanent terminal that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

m) Enter a value, from options A, B, to identify the maximum impact severity level for the permanent terminal.

n) Enter a value, from options x1, x2, x3, to identify the maximum lateral displacement class for the permanent terminal on the approach side of the terminal.

o) Enter a value, from options y1, y2, y3, y4, to identify the maximum lateral displacement class for the permanent terminal on the departure side of the terminal.

Permanent terminals (continued)						
Permanent terminal ID	**Exit box class**	**Max dead and impact loads**	**Attached vehicle restraint system(s)**	**Ground conditions**	**Contractor to provide test equipment for post foundation testing**	**Contractor to conduct post foundation testing**
(a)	(p)	(q)	(r)	(s)	(t)	(u)

p) Enter a value, from options Z1, Z2, Z3, Z4, to identify the maximum exit box class for the permanent terminal.

q) Enter text, to define the maximum dead and impact loading limits that can be applied by the permanent terminal onto a supporting structure, where installed on a supporting structure.

r) Enter text, to identify the vehicle restraint system(s) to which the terminal will be attached.

s) Enter text, to identify the type of ground conditions at the installation location.

t) Enter a value, from options Yes, No, to identify whether the Contractor will be providing the equipment for post foundation testing.

u) Enter a value, from options Yes, No, to identify whether the Contractor will be conducting the post foundation testing.

Permanent terminals (continued)					
Permanent terminal ID	**Frequency of post foundation testing**	**Loading and anchorage requirements**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Vulnerable road user protection**
(a)	(v)	(w)	(x)	(y)	(z)

v) Enter text, to define the frequency of post foundation testing as described in the manufacturer's product description and associated installation instructions.

w) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

x) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for permanent terminals.

y) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

z) Enter text, to identify any additional measures required to reduce the risk of injury to pedestrians, equestrians and other vulnerable users.

Permanent terminals (continued)		
Permanent terminal ID	**Environmental requirements**	**Additional requirements**
(a)	(aa)	(ab)

aa) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the permanent terminal.

bb) Enter text, to define any additional requirements.

Documentation requirements for permanent terminals

NI/7.6 The following Documentation shall be submitted for permanent terminals prior to the commencement of incorporation into the works: certified results of impact testing.

NI/7.7 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified results of impact testing for permanent terminals.

7.8 The Documentation submitted shall demonstrate that the proposed permanent terminal meets the specification requirements.

7.9 Certified results of impact testing shall comprise the following.

1. test result certificate from an accredited laboratory; and

2. test report in accordance with either DD ENV 1317-4 2002 [Ref 16.N]or PD CEN/TS 1317-7 [Ref 27.N]; and

3. video or high speed film of impact test annotated showing date, test number and performance class; and

4. still photographs of complete installation prior to impact including anchorage points; and

5. still photographs of vehicle before and after impact and full drawings of tested items; and

6. certification from the manufacturer that the item tested complies with the drawings supplied.

8. Permanent transitions

Permanent transition requirements

8.1 Transitions shall comply with "General requirements for road restraint systems" in Section 1 of this document.

8.2 Transitions shall comply with "General requirements for non-harmonised/non-designated road restraint products" in Section 2 of this document.

8.3 Transitions shall comply with "Vehicle restraint systems" in Section 3 of this document.

8.4 Transitions shall be compliant with BS EN 1317-1 [Ref 28.N]and either DD ENV 1317-4 2002 [Ref 16.N], or Assessment Method A1 in PD CEN/TR 1317-10 [Ref 24.N], or Assessment Method A2 in PD CEN/TR 1317-10 [Ref 24.N].

Schedule for permanent transitions

8.5 Permanent transitions shall be supplied and installed as specified in CC 400/WSR/008.

Permanent transitions					
Permanent transition ID	**Permanent transition location**	**Drawing/ model reference(s)**	**RRRAP/Risk assessment reference(s)**	**Single or double sided**	**Vehicle restraint system on approach end of transition**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the permanent transition, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the permanent transition location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a value, from options Single sided, Double sided, to identify whether the transition is to be single or double sided.

f) Enter text, to identify the vehicle restraint system at the approach end of the transition, in the direction of traffic on the carriageway closest to the transition.

Permanent transitions (continued)						
Permanent transition ID	**Vehicle restraint system on departure end of transition**	**Special transition requirements**	**Ground conditions**	**Contractor to provide test equipment for post foundation testing**	**Contractor to conduct post foundation testing**	**Frequency of post foundation testing**
(a)	(g)	(h)	(i)	(j)	(k)	(l)

g) Enter text, to identify the vehicle restraint system at the departure end of the transition, in the direction of traffic on the carriageway closest to the transition.

h) Enter text, to identify any particular requirements or restrictions of the transition with respect to a connected structure, or conversely, requirements or restrictions of the structure with respect to the connected transition.

i) Enter text, to identify the type of ground conditions at the installation location.

j) Enter a value, from options Yes, No, to identify whether the Contractor will be providing the equipment for post foundation testing.

k) Enter a value, from options Yes, No, to identify whether the Contractor will be conducting the post foundation testing.

l) Enter text, to define the frequency of post foundation testing as described in the manufacturers product description and associated installation instructions.

Permanent transitions (continued)					
Permanent transition ID	**Loading and anchorage requirements**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Vulnerable road user protection**	**Environmental requirements**
(a)	(m)	(n)	(o)	(p)	(q)

m) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

n) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for permanent transitions.

o) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

p) Enter text, to identify any additional measures required to reduce the risk of injury to pedestrians, equestrians and other vulnerable users.

q) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the permanent transition.

Permanent transitions (continued)	
Permanent transition ID	**Additional requirements**
(a)	(r)

r) Enter text, to define any additional requirements.

Documentation requirements for permanent transitions

NI/8.6 The following Documentation shall be submitted for permanent transitions prior to the commencement of incorporation into the works: certified results of impact testing.

NI/8.7 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified results of impact testing for permanent transitions.

8.8 The Documentation shall demonstrate that the permanent transition meets the specification requirements.

8.9 Certified results of impact testing shall comprise the following.

1. test result certificate from an accredited laboratory; and
2. test report in accordance with DD ENV 1317-4 2002 [Ref 16.N] or PD CEN/TR 1317-10 [Ref 24.N]; and

3. video or high speed film of impact test annotated showing date, test number and performance class; and

4. still photographs of complete installation prior to impact including anchorage points; and

5. still photographs of vehicle before and after impact and full drawings of tested items; and

6. certification from the manufacturer that the item tested complies with the drawings supplied.

9. Permanent crash cushions

Permanent crash cushion requirements

9.1 Crash cushions shall comply with "General requirements for road restraint systems" in Section 1 of this document.

9.2 Crash cushions shall comply with "Vehicle restraint systems" in Section 3 of this document.

9.3 Crash cushions shall be compliant with BS EN 1317-5 [Ref 18.N].

9.4 The crash cushions shall meet the performance characteristics as stated in table 9.4.

Table 9.4 Minimum performance characteristics for crash cushions	
BS EN 1317-5 [Ref 18.N]essential characteristic	Minimum performance class
Performance level	Refer to WSR
Impact severity	Refer to WSR
Redirection zone	Refer to WSR
Lateral displacement	Refer to WSR
Durability	Minimum economically reasonable working life of all components: 20 years

9.5 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 6.N] shall apply to crash cushions.

Schedule for permanent crash cushions

9.6 Crash cushions shall be supplied and installed as specified in CC 400/WSR/009.

Crash cushions						
Crash cushion ID	**Crash cushion location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference(s)**	**Performance level**	**Re-directive or non re-directive**	**One-directional or bi-directional**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.

b) Enter text, to identify the location of the crash cushion, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the crash cushion location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a value, from options 110, 100, to identify the minimum performance level of the crash cushion.

f) Enter a value, from options Re-directive, Non re-directive, to identify whether the crash cushion is re-directive or non re-directive.

g) Enter a value, from options One-directional, Bi-directional, to identify whether the crash cushion can be impacted in one direction (one-directional) or both directions (bi-directional).

Crash cushions (continued)							
Crash cushion ID	**Impact severity**	**Redirection zone**	**Lateral displacement**	**Min set back(s)**	**Max height**	**Ground conditions**	**Contractor to provide test equipment for post foundation testing**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)

h) Enter a value, from options A, B, to identify the maximum impact severity level for the crash cushion.

i) Enter a value, from options Z1, Z2, Z3, Z4, to identify the space available for vehicle redirection in the event of an impact.

j) Enter a value, from options D1, D2, D3, D4, D5, D6, D7, D8, to identify the space available for the crash cushion to deform into in the event of an impact.

k) Enter text, to identify the minimum set back(s) of the crash cushion, refer to CD 127 [Ref 3.N]. Where the crash cushion is installed such that traffic passes on both sides, and the set back to the permanent crash cushion differs on the two carriageways, both set backs are to be stated.

l) Enter a number in units of m, to identify the maximum height of crash cushion that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

m) Enter text, to identify the type of ground conditions at the installation location.

n) Enter a value, from options Yes, No, to identify whether the Contractor will be providing the equipment for post foundation testing.

Crash cushions (continued)						
Crash cushion ID	**Contractor to conduct post foundation testing**	**Frequency of post foundation testing**	**Frequency of on-site tensile load tests for anchorages in drilled or cored holes**	**Loading and anchorage requirements**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**
(a)	(o)	(p)	(q)	(r)	(s)	(t)

o) Enter a value, from options Yes, No, to identify whether the Contractor will be conducting the post foundation testing.

p) Enter text, to define the frequency of post foundation testing as described in the manufacturer's product description and associated installation instructions.

q) Enter text, to define the frequency of on-site tensile load tests for anchorages in drilled or cored holes as described in the manufacturer's product description and associated installation instructions.

r) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

s) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for permanent crash cushions.

t) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

Crash cushions (continued)			
Crash cushion ID	**Vulnerable road user protection**	**Environmental requirements**	**Additional requirements**
(a)	(u)	(v)	(w)

u) Enter text, to identify any additional measures required to reduce the risk of injury to pedestrians, equestrians and other vulnerable users.

v) Enter text, to define any environmental requirements that can affect the choice, positioning and type or material for the crash cushion.

w) Enter text, to define any additional requirements.

10. Pedestrian restraint systems

General requirements for pedestrian restraint systems

10.1 Pedestrian restraint systems shall comply with "General requirements for road restraint systems" in Section 1 of this document.

10.2 Pedestrian restraint systems shall comply with "General requirements for non-harmonised/non-designated road restraint products" in Section 2 of this document.

10.3 Metal pedestrian restraint systems shall be compliant with BS 7818 [Ref 35.N].

Pedestrian restraint documentation requirements

NI/10.4 The following Documentation shall be submitted for pedestrian restraint systems prior to the commencement of incorporation into the works: either.

1. written confirmation that any metal pedestrian restraint system complies with BS 7818 [Ref 35.N]; or
2. written confirmation that any concrete pedestrian restraint system complies with BS 5400-4 1990 [Ref 36.N].

NI/10.5 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to written confirmation of compliance with BS 7818 [Ref 35.N]or BS 5400-4 1990 [Ref 36.N]for pedestrian restraint systems.

Quality management requirements for pedestrian restraint systems

10.6 Pedestrian restraint systems shall be designed and/or supplied, installed and repaired by organisations registered to and operating in compliance with a quality management scheme in accordance with "Quality management schemes" in Section 7 of GC 101 [Ref 6.N].

Durability requirements for pedestrian restraint systems

10.7 The following Documentation shall be submitted for pedestrian restraint systems prior to the commencement of incorporation into the works: declaration of serviceable life from the supplier of the pedestrian restraint system.

10.8 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the statement of serviceable life for the pedestrian restraint system.

10.9 The serviceable life for metal pedestrian parapets and pedestrian guardrails, and metal components of combined metal and concrete pedestrian parapets and pedestrian guardrails shall , except where stated in the WSR for the products specified in Sections 11 and 12 of this document, be obtained without the need for maintenance, other than that resulting from accidental damage and/or any restoration of protective treatments.

10.10 The following Documentation shall be submitted for the prior approval of any additional protective treatments, prior to the commencement of components arriving on site: drawing(s) showing the location of additional protective treatments, and justification for the inclusion of the additional protective treatments.

10.11 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the drawings showing the location of additional protective treatments and justification for the inclusion of the additional protective treatments.

Aesthetic requirements for pedestrian restraint systems

10.12 The following Documentation shall be submitted for pedestrian restraint systems prior to the commencement of manufacture of the pedestrian restraint system: drawings and specifications relating to the aesthetic requirements for the pedestrian restraint system.

10.13 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to aesthetic requirements for the pedestrian restraint system.

Anchorages and attachment systems for pedestrian restraint systems

Product requirements for anchorages and attachment systems for pedestrian restraint systems

10.14 Unless specifically indicated by the pedestrian restraint system manufacturer’s installation instructions, where pedestrian restraint system posts are to be installed on top of a structure, a stainless steel anchorage/attachment system shall be used.

10.15 Unless specifically indicated by the pedestrian restraint system manufacturer’s installation instructions, where pedestrian restraint system posts are to be installed on surface mounted posts, a stainless steel anchorage/attachment system shall be used.

10.16 The following Documentation shall be submitted for anchorages and attachment systems prior to the commencement of incorporation into the works: evidence that the anchorages are capable of resisting the design

loads specified in the WSR for the relevant products in specified Sections 11 and 12 of this document.

10.17 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to the evidence that the anchorages are capable of resisting the design loads specified in the WSR for the relevant products in specified Sections 11 and 12 of this document.

10.18 The service life of the anchorage system shall match or exceed that of the attached pedestrian restraint system.

Installation requirements for anchorages and attachment systems for pedestrian restraint systems

10.19 Anchorage and attachment systems shall be installed in accordance with the pedestrian restraint system manufacturer’s installation instructions.

10.20 Unless specified otherwise indicated in the pedestrian restraint system manufacturer’s installation instructions, direct metal to metal contact between dissimilar materials within the attachment system and anchorage shall be prevented by the use of non-conductive sleeves, washers or coatings to prevent bimetallic corrosion.

10.21 Unless specified otherwise in the pedestrian restraint system manufacturer’s installation instructions, the base plate of the pedestrian restraint system shall be bedded on mortar complying with "Bedding Mortar" in Section 1 of CC 495 [Ref 10.N].

10.22 Unless specified otherwise by the pedestrian restraint system manufacturer’s installation instructions, the threads of steel anchorages shall be lined with an anti-seize coating.

10.23 All voids shall be sealed with a non-structural and impermeable filler which has a working life which is the same or greater than that of the pedestrian restraint system, to prevent ingress of moisture and deleterious substances.

10.24 For anchorages in drilled or cored holes, holes shall be located to ensure that steel reinforcement will not be encountered.

10.25 For anchorages in drilled or cored holes, bridge deck waterproofing systems shall not be damaged during drilling or coring, and installation unless otherwise specified and repaired as per the agreed contract and with suitable witnessed rectification being undertaken as defined in the quality plan.

10.26 Any chemical bond within the connection of the pedestrian restraint system and the supporting structure shall comply with BS 8539 [Ref 2.N].

Verification requirements for anchorages and attachment systems for pedestrian restraint systems

10.27 Verification shall be undertaken for the tensile capacity of anchorage for anchorages in drilled or cored holes for pedestrian restraint systems by on-site tensile load testing in accordance with the pedestrian restraint system manufacturer's installation instructions where given, or otherwise in accordance with BS 8539 [Ref 2.N].

10.28 The frequency of on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems shall be 1 anchorage per post anchorage group for the first 5 post anchorage groups installed, and then 1 anchorage per 5 post anchorage groups that are installed thereafter.

10.29 The requirements for "Verification" in Section 14 of GC 101 [Ref 6.N] shall apply to on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems.

10.30 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, the nominal tensile load shall be as determined by the manufacturer of the pedestrian restraint system.

10.31 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, incremental loads shall be held for not less than half a minute, and the test load for not less than five minutes.

10.32 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, readings shall be taken immediately after applying load.

10.33 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, readings following the application of an incremental load shall also be taken within half a minute of the load being applied.

10.34 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, readings following the application of the test load shall also be taken within five minutes of the load being applied.

10.35 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, any total movement of the anchorage exceeding 1.0mm shall constitute a test non-conformity.

10.36 When conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, any evidence of slip

during loading, as demonstrated by a significant change in the slope of the load/extension curve, shall constitute a test non-conformity.

10.37 If a non-conformity is found during on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems, the rate of testing shall be doubled until the suitability of the anchorages is established.

10.38 Any anchorage which fails the on-site tensile load tests for anchorages in drilled or cored holes for pedestrian restraint systems shall be replaced and retested.

10.39 The following Documentation shall be submitted for anchorages in drilled or cored holes for pedestrian restraint systems prior to the completion of the works: The results of on-site tensile load testing of anchorages in drilled or cored holes for pedestrian restraint systems.

10.40 The results of on-site tensile load testing of anchorages in drilled or cored holes for pedestrian restraint systems shall comply with "Documentation" in Section 2 of GC 101 [Ref 6.N].

Replacement and repair of pedestrian restraint systems

10.41 The maintenance and/or repair of pedestrian restraint systems shall be undertaken in accordance with the pedestrian restraint system manufacturer’s installation instructions for the pedestrian restraint system, using components which are identical in design, specification and geometry to the components originally installed.

10.42 Where the pedestrian restraint system under replacement or repair is a legacy system, any replacement components shall comply with CC 401 [Ref 17.N].

11. Pedestrian parapets

Pedestrian parapet requirements

11.1 Pedestrian parapets shall comply with "Pedestrian restraint systems" in Section 10 of this document.

Schedule for pedestrian parapets

11.2 Pedestrian parapets shall be supplied and installed as specified in CC 400/WSR/011.

Pedestrian parapets							
Pedestrian parapet ID	**Pedestrian parapet location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference (s)**	**Min set back**	**Length of need**	**Minimum height above the adjacent paved surface**	**Designation**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the pedestrian parapet, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the pedestrian parapet location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a number in units of m, to identify the minimum setback of the pedestrian parapet, refer to CD 127 [Ref 3.N].

f) Enter a number in units of m, to identify the length of need of pedestrian parapet.

g) Enter a number in units of m, to identify the minimum height of the top rail above the adjacent paved surface.

h) Enter a value, from options Class 3, Class 4, to identify the minimum loading class of the pedestrian parapet.

Pedestrian parapets (continued)						
Pedestrian parapet ID	**Parapet use**	**Infill type**	**Infill class**	**Fabrication material**	**Surface preparation and protection against corrosion to comply with CC 486 [Ref 19.N]**	**Additional infill requirements**
(a)	(i)	(j)	(k)	(l)	(m)	(n)

i) Enter a value, from options Pedestrian, Cyclist, Equestrian, to identify the use of the pedestrian parapet.

j) Enter a value, from options Full height vertical infill, Part height vertical infill, Mesh infill, Solid infill, None, to identify the pedestrian parapet infill requirements.

k) Enter one or more values, from options Class C, Class D, to identify the minimum loading class of the pedestrian parapet infill.

l) Enter text, to to identify the fabrication material (steel or aluminium alloy) for the pedestrian parapet, including grade.

m) Enter a value, from options Yes, No, to identify whether the surface preparation and protection against corrosion of all steel pedestrian parapets and steel components of combined metal and concrete pedestrian parapets is to comply with CC 486 [Ref 19.N].

n) Enter text, to define any additional requirements for the infill such as environmental barrier or visibility requirements.

Pedestrian parapets (continued)					
Pedestrian parapet ID	**Aesthetic requirements**	**Suicide prevention measures required**	**Plinth requirements**	**Compliance with Verges and bridge structures requirements of CD 377**	**Holding down bolt requirements**
(a)	(o)	(p)	(q)	(r)	(s)

o) Enter text, to specify any aesthetic requirements for the pedestrian parapet.

p) Enter text, to detail any suicide prevention measures which are required to be incorporated into, or attached to, the pedestrian parapet.

q) Enter text, to identify if a continuous plinth or upstand of 50mm in height with a tolerance of -0/+50mm is provided in accordance with Requirements for pedestrian restraint systems in Section 8 of CD 377 [Ref 23.N]and detail the plinth width where provided.

r) Enter a value, from options Yes, No, to identify whether the requirements given in Verges on bridges and structures in Section 4 of CD 377 [Ref 23.N]are met.

s) Enter text, to identify the type of holding down bolts (if required), foundations method of fixing, and whether a passively safe support system is required.

Pedestrian parapets (continued)						
Pedestrian parapet ID	**Supporting plinth details**	**Loading and anchorage requirements**	**Max length of anchorages**	**Nominal tensile load for on-site anchorage load tests**	**Additional corrosion protection system**	**Environmental requirements**
(a)	(t)	(u)	(v)	(w)	(x)	(y)

t) Enter text, to identify the material and/or width and/or height of the supporting plinth.

u) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

v) Enter a number in units of m, to define any limit on the maximum length of anchorages used for installation.

w) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian parapets.

x) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

y) Enter text, to define any environmental requirements that can affect the choice, positioning, and type of material, for the pedestrian parapet.

Pedestrian parapets (continued)	
Pedestrian parapet ID	**Additional requirements**
(a)	(z)

z) Enter text, to define any additional requirements.

12. Pedestrian guardrails

Pedestrian guardrail requirements

12.1 Pedestrian guardrail requirements shall comply with "Pedestrian restraint systems" in Section 10 of this document.

Schedule for pedestrian guardrails

12.2 Pedestrian guardrails shall be supplied and installed as specified in CC 400/WSR/012.

Pedestrian guardrails							
Pedestrian guardrail ID	**Pedestrian guardrail location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference (s)**	**Min set back**	**Length of need**	**Minimum height above the adjacent paved surface**	**Designation**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the pedestrian guardrail, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the pedestrian guardrail location.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a number in units of m, to identify the minimum setback of the pedestrian guardrail, refer to CD 127 [Ref 3.N].

f) Enter a number in units of m, to identify the length of need of pedestrian guardrail.

g) Enter a number in units of m, to identify the minimum height of the top rail above the adjacent paved surface.

h) Enter a value, from options Class 1, Class 2, Class 3, Class 4, to identify the minimum loading class of the pedestrian guardrail.

Pedestrian guardrails (continued)						
Pedestrian guardrail ID	**Guardrail use**	**Infill type**	**Infill class**	**Surface preparation and protection against corrosion to comply with CC 486 [Ref 19.N]**	**Additional infill requirements**	**Aesthetic requirements**
(a)	(i)	(j)	(k)	(l)	(m)	(n)

i) Enter a value, from options Pedestrian, Cyclist, Equestrian, to identify the use of the guardrail.

j) Enter a value, from options Full height vertical infill, Part height vertical infill, Mesh infill, Solid infill, None, to identify the pedestrian guardrail infill requirements.

k) Enter a value, from options Class A, Class B, Class C, Class D, to identify the minimum loading class of the pedestrian guardrail infill.

l) Enter a value, from options Yes, No, to identify whether the surface preparation and protection against corrosion of all steel pedestrian guardrails and steel components of combined metal and concrete pedestrian guardrails is to comply with CC 486 [Ref 19.N].

m) Enter text, to define any additional requirements for the infill, such as environmental barrier or visibility requirements.

n) Enter text, to specify any aesthetic requirements for the pedestrian guardrail.

Pedestrian guardrails (continued)					
Pedestrian guardrail ID	**Suicide prevention measures required**	**Detailed layout**	**Holding down bolt requirements**	**Loading and anchorage requirements**	**Nominal tensile load for on-site anchorage load tests**
(a)	(o)	(p)	(q)	(r)	(s)

o) Enter text, to detail any suicide prevention measures which are required to be incorporated into, or attached to, the pedestrian guardrail.

p) Enter text, to identify relevant details such as horizontal and vertical dimensions and alignment joints required, giving details of position and movement and any special features such as vertical movements etc.

q) Enter text, to identify the type of holding down bolts (if required), foundations method of fixing, and whether a passively safe support system is required.

r) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

s) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for pedestrian guardrails.

Pedestrian guardrails (continued)			
Pedestrian guardrail ID	**Additional corrosion protection system**	**Environmental requirements**	**Additional requirements**
(a)	(t)	(u)	(v)

t) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

u) Enter text, to define any environmental requirements that can affect the choice, positioning, and type of material, for the pedestrian guardrail.

v) Enter text, to define any additional requirements.

13. Removable barrier sections

Removable barrier section requirements

13.1 Removable barrier sections shall comply with "General requirements for road restraint systems" in Section 1 of this document.

13.2 Removable barrier sections shall comply with "General requirements for non-harmonised/non-designated road restraint products" in Section 2 of this document.

13.3 Removable barrier sections shall comply with "Vehicle restraint systems" in Section 3 of this document.

13.4 Removable barrier sections shall be compliant with DD ENV 1317-4 2002 [Ref 16.N]or PD CEN/TS 1317-9 [Ref 25.N].

Schedule for removable barrier sections

13.5 Removable barrier sections shall be supplied and installed as specified in CC 400/WSR/013.

Removable barrier sections						
Removable barrier section ID	**Removable barrier section location**	**Drawing/ model reference(s)**	**RRRAP/ Risk assessment reference(s)**	**Single or double sided**	**Connected road restraint systems**	**Method of opening**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the removable barrier section, the traffic direction of the carriageway, e.g. Northbound, and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the location of the removable barrier section.

d) Enter text, to define the RRRAP(s)/Risk assessment(s) used as the basis for the design and installation.

e) Enter a value, from options Single sided, Double sided, to identify whether the removable barrier section is to be single or double sided.

f) Enter text, to identify the road restraint systems at each end of the removable barrier section.

g) Enter a value, from options Completely removable, Opens at one end, Opens at both ends, Opens centrally, to identify the method of opening or demounting the removable barrier section.

Removable barrier sections (continued)								
Removable barrier section ID	**Max opening time**	**Max closing time**	**Storage requirements**	**Min set back**	**Min length of opening**	**Containment level**	**Impact severity**	**Normalised working width**
(a)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)

h) Enter a number in units of min, to identify the maximum opening time for the removable barrier section.

i) Enter a number in units of min, to identify the maximum closing time for the removable barrier section.

j) Enter text, to identify any storage requirements for the removable barrier section whilst it is open,where applicable.

k) Enter a number in units of m, to identify the minimum set back(s) of the removable barrier section, refer to CD 127 [Ref 3.N].

l) Enter a number in units of m, to identify the minimum length of the opening within the removable barrier section.

m) Enter a value, from options N1, N2, H1, H2, H4a, to identify the minimum containment level class of the removable barrier section.

n) Enter a value, from options A, B, to identify the maximum impact severity level for the removable barrier section.

o) Enter a value, from options <W1, W1, W2, W3, W4, W5, W6, W7, W8, to identify the maximum normalised working width class for the removable barrier section.

Removable barrier sections (continued)								
Removable barrier section ID	**Max value of normalised working width where <W1**	**Normalised dynamic deflection**	**Max normalised vehicle intrusion (higher and very high containment level removable barrier sections only)**	**Max value of normalised vehicle intrusion where <VI1**	**Max height**	**Min height**	**Ground conditions**	**Contractor to provide test equipment for post foundation testing**
(a)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)

p) Enter a number in units of m, to specify the maximum value of normalised working width for the removable barrier section, where it is less than 0.6m.

q) Enter a number in units of m, to identify the maximum normalised dynamic deflection for the removable barrier section.

r) Enter a value, from options <VI1, VI1, VI2, VI3, VI4, VI5, VI6, VI7, VI8, VI9, to identify the maximum normalised vehicle intrusion class for higher and very high containment level removable barrier section.

s) Enter a number in units of m, to specify the maximum value of normalised vehicle intrusion, where it is less than 0.6m.

t) Enter a number in units of m, to identify the maximum height of removable barrier section that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

u) Enter a number in units of m, to identify the minimum height of removable barrier section, if applicable, e.g. enter 1.5 m where the assessment of impact of an overhanging or intruding part of a vehicle with a structure is accepted by the Overseeing Organisation.

v) Enter text, to identify the type of ground conditions at the installation location.

w) Enter a value, from options Yes, No, to identify whether the Contractor will be providing the equipment for post foundation testing.

Removable barrier sections (continued)						
Removable barrier section ID	**Contractor to conduct post foundation testing**	**Frequency of post foundation testing**	**Loading and anchorage requirements**	**Nominal load for on-site anchorage load tests**	**Additional corrosion protection system**	**Vulnerable road user protection**
(a)	(x)	(y)	(z)	(aa)	(ab)	(ac)

x) Enter a value, from options Yes, No, to identify whether the Contractor will be conducting the post foundation testing.

y) Enter text, to define the frequency of post foundation testing as described in the manufacturer's product description and associated installation instructions.

z) Enter text, to define any particular requirements or restrictions of the road restraint system with respect to the structure or foundations, or conversely, requirements or restrictions of the structure or foundations with respect to the road restraint system.

aa) Enter a number in units of kN, to specify the nominal load for conducting on-site tensile load tests for anchorages in drilled or cored holes for removable barrier sections.

bb) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

cc) Enter text, to identify any additional measures required to reduce the risk of injury to pedestrians, equestrians and other vulnerable users.

Removable barrier sections (continued)		
Removable barrier section ID	**Environmental requirements**	**Additional requirements**
(a)	(ad)	(ae)

cc) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the removable barrier section.

dd) Enter text, to define any additional requirements.

Documentation requirements for removable barrier sections

NI/13.6 The following Documentation shall be submitted for removable barrier sections prior to the commencement of incorporation into the works: certified results of impact testing.

NI/13.7 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to certified results of impact testing for removable barrier sections.

13.8 The Documentation submitted shall demonstrate that the proposed removable barrier section meets the specification requirements.

13.9 Certified results of impact testing shall comprise of the following.

1. test result certificate from an accredited laboratory; and
2. test report in accordance with DD ENV 1317-4 2002 [Ref 16.N] or PD CEN/TS 1317-9 [Ref 25.N]; and

3. video or high speed film of impact test annotated showing date, test number and performance class; and

4. still photographs of complete installation prior to impact including anchorage points; and

5. still photographs of vehicle before and after impact and full drawings of tested items; and

6. certification from the manufacturer that the item tested complies with the drawings supplied.

14. Vehicle arrester beds

Vehicle arrester bed requirements

14.1 Vehicle arrester beds shall comply with "General requirements for road restraint systems" in Section 1 of this document.

14.2 Vehicle arrester beds shall be Contractor design items, unless otherwise stated in CC 400/WSR/014.

14.3 The design of vehicle arrester beds shall be in accordance with CD 377 [Ref 23.N].

14.4 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 6.N] shall apply to the design of vehicle arrester beds.

Schedule for vehicle arrester beds

14.5 Vehicle arrester beds shall be supplied and installed as specified in CC 400/WSR/014.

Vehicle arrester beds							
Contractor design	**Vehicle arrester bed ID**	**Vehicle arrester bed location**	**Drawing/ model reference(s)**	**Max. length of vehicle arrester bed**	**Max. width of vehicle arrester bed**	**Max. depth of vehicle arrester bed**	**Fill type for vehicle arrester bed**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)

a) Enter a value, from options Yes, No, to identify whether the Contractor will be designing the vehicle arrester bed.
b) Enter a unique reference.

c) Enter text, to identify the start and finish locations of the vehicle arrester bed, the traffic direction of the carriageway (e.g. Northbound), and whether the works are in the verge, median, or other.

d) Enter text, to define the drawing(s)/model(s) that shows the vehicle arrester bed location.

e) Enter a number in units of m, to specify the maximum length of the vehicle arrester bed.

f) Enter a number in units of m, to specify the maximum width of the vehicle arrester bed.

g) Enter a number in units of m, to specify the maximum depth of the vehicle arrester bed.

h) Enter text, to identify the type of fill to be used within the vehicle arrester bed.

Vehicle arrester beds (continued)				
Contractor design	**Type of vehicle arrester bed**	**Ground conditions**	**Environmental requirements**	**Additional requirements**
(a)	(i)	(j)	(k)	(l)

i) Enter a value, from options Remote, Adjacent, to identify whether the vehicle arrester bed will be incorporated into a separate escape lane leading off the main carriageway (remote) or adjacent to the nearside of the carriageway in a widened section of the highway (adjacent).

j) Enter text, to identify the type of ground conditions at the installation location of the vehicle arrester bed.

k) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the vehicle arrester bed.

l) Enter text, to define any additional requirements for the vehicle arrester bed.

15. Anti-glare screens mounted on road restraint systems

Anti-glare screen mounted on road restraint systems requirements

15.1 Anti-glare screens mounted on road restraint systems shall comply with "General requirements for road restraint systems" in Section 1 of this document.

15.2 Anti-glare screens mounted on road restraint systems shall be compliant with BS EN 12676-1 [Ref 1.N].

15.3 The anti-glare screens mounted on road restraint systems shall meet the performance characteristics as stated in table 15.3.

Table 15.3 Minimum performance characteristics for anti-glare screens mounted on road restraint systems

BS EN 12676-1 [Ref 1.N]essential characteristic	Minimum performance class
Resistance to horizontal loads	Pass
Light screening capability	Refer to WSR
Durability (of resistance to horizontal loads)	Pass
Durability (of light screening capability)	Pass
Dangerous substances	None

15.4 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 6.N] shall apply to anti-glare screens mounted on road restraint systems.

Installation requirements for anti-glare screens mounted on road restraint systems

15.5 The anti-glare screen shall not adversely affect the performance of the road restraint system on which the screens are proposed to be mounted.

Schedule for anti-glare screens mounted on road restraint systems

15.6 Anti-glare screens mounted on road restraint systems shall be supplied and installed as specified in CC 400/WSR/015.

Anti-glare screens mounted on road restraint systems						
Anti-glare screen ID	**Anti-glare screen location**	**Drawing/ model reference(s)**	**Light screening capability**	**Light transmission factor (C_{ti})**	**Accessibility category**	**Lateral visibility**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

a) Enter a unique reference.
b) Enter text, to identify the start and finish locations of the anti-glare screen, the traffic direction of the carriageway (e.g. Northbound), and whether the works are in the verge, median, or other.

c) Enter text, to define the drawing(s)/model(s) that shows the anti-glare screen location.

d) Enter a value, from options Block out all the incident rays, Block out partially the incident rays, to identify the light screening capability of the anti-glare screen.

e) Enter a number, to define the proportion of incident light which passes through the anti-glare screen.

f) Enter a value, from options Category 1, Category 2, to identify the category of access required through the anti-glare screen, refer BS EN 12676-1 [Ref 1.N].

g) Enter a value, from options Group 1, Group 2, to identify the lateral visibility group for the anti-glare screen, refer to BS EN 12676-1 [Ref 1.N].

Anti-glare screens mounted on road restraint systems (continued)				
Anti-glare screen ID	**Supporting safety barrier**	**Max height**	**Environmental requirements**	**Additional requirements**
(a)	(h)	(i)	(j)	(k)

h) Enter text, to identify the type of safety barrier which the anti-glare screen will be mounted upon.

i) Enter a number in units of m, to identify the maximum height of the combined anti-glare screen and permanent safety barrier that allows the required visibility, refer to CD 127 [Ref 3.N]and CD 109 [Ref 7.N].

j) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the anti-glare screens.

k) Enter text, to define any additional requirements.

Documentation requirements for anti-glare screens mounted on road restraint systems

15.7 The following Documentation shall be submitted for anti-glare screens mounted on road restraint systems prior to the commencement of incorporation into the works: confirmation from both the anti-glare screen and road restraint system manufacturer(s) that the attachment of the anti-glare screens will not adversely affect the performance of the road restraint system on which the screens are proposed to be mounted.

15.8 The requirements for "Documentation" in Section 2 of GC 101 [Ref 6.N] shall apply to confirmation from both the anti-glare screen and road restraint system manufacturer(s) that the attachment of the anti-glare screens will not adversely affect the performance of the road restraint system on which the screens are proposed to be mounted.

16. Cattle grids

Cattle grid requirements

16.1 Cattle grids shall comply with "General requirements for road restraint systems" in Section 1 of this document.

16.2 Cattle grids shall be Contractor design items, unless otherwise stated in CC 400/WSR/016.

16.3 The design of cattle grids shall be in accordance with CD 377 [Ref 23.N].

16.4 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 6.N] shall apply to the design of cattle grids.

16.5 Cattle grids shall comply with "Technical approval of highway structures" in Section 18 of GC 101 [Ref 6.N].

Schedule for cattle grids

16.6 Cattle grids shall be supplied and installed as specified in CC 400/WSR/016.

Cattle grids						
Cattle grid ID	**Contractor design**	**Cattle grid location**	**Drawing/ model reference(s)**	**Are deer to be contained?**	**Pit length between end walls**	**Pit width between side walls**
(a)	(b)	(c)	(d)	(e)	(f)	(g)

1. Enter a unique reference.

a) Enter a value, from options Yes, No, to identify whether the Contractor will be designing the cattle grid.

b) Enter text, to identify the location of the cattle grid, and the traffic direction of the carriageway, e.g. Northbound.

c) Enter text, to define the drawing(s)/model(s) that shows the cattle grid location.

d) Enter one or more values, from options Yes, No, to identify if deer are to be contained as, in accordance with CD 377 [Ref 23.N], cattle grids for the containment of deer need to be longer in length (at least 4.0m).

e) Enter a number in units of m, to specify the length of the cattle grid pit, enter value which is at least 2.6m, or at least 4.0m for deer.

f) Enter a number in units of m, to specify the width of the cattle grid pit, enter value not less than 2.75m.

Cattle grid ID	**Pit depth from top surface of transverse members to the pit base**	**Clear space between transverse members**	**Shape of transverse members**	**Distance between supports/stiffeners**	**Material of supports**	**Material of stiffeners**
(a)	(h)	(i)	(j)	(k)	(l)	(m)

Cattle grids (continued)

h) Enter a number range (e.g. "40-60") in units of mm, to specify the depth of the cattle grid pit, enter value between 251mm to 450mm.

i) Enter a number range (e.g. "40-60") in units of mm, to specify the clear space between the transverse members, enter value between 130mm and 150mm.

j) Enter a value, from options circular, elliptical, rectangular, composite section, to specify the shape of the transverse members.

k) Enter a number in units of mm, to specify the distance between the supports/stiffeners.

l) Enter a value, from options concrete, rectangular section, composite section, to specify the material of the supports.

m) Enter a value, from options same as transverse members, flat plate, to specify the material of the stiffeners.

Cattle grids (continued)					
Cattle grid ID	**Location of small animal exit ramps/tunnels**	**Ground conditions**	**Serviceable life of the cattle grid, where not 50 years**	**Additional corrosion protection system**	**Environmental requirements**
(a)	(n)	(o)	(p)	(q)	(r)

n) Enter text, to identify the location of small animal exit ramps/tunnels within the cattle grid pit.

o) Enter text, to identify the type of ground conditions at the installation location.

p) Enter a number, to specify the serviceable life of the cattle grid.

q) Enter text, to specify any additional corrosion protection system required, including surface preparation, and any special maintenance requirements for the corrosion protection system.

r) Enter text, to define any environmental requirements that can affect the choice, positioning, and type or material, for the cattle grid and its associated pit.

Cattle grids (continued)	
Cattle grid ID	**Additional requirements**
(a)	(s)

s) Enter text, to define any additional requirements.

17. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref.	**Document**
Ref 1.N	BSI. BS EN 12676-1, 'Anti-glare systems for roads. Performance and characteristics (Designated Standard - CPR)'
Ref 2.N	BSI. BS 8539, 'Code of practice for the selection and installation of post-installed anchors in concrete and masonry'
Ref 3.N	National Highways. CD 127, 'Cross-sections and headrooms'
Ref 4.N	BSI. BS EN ISO 9017, 'Destructive tests on welds in metallic materials. Fracture test'
Ref 5.N	National Highways. CC 601 'Earthworks'
Ref 6.N	National Highways. GC 101, 'General requirements for the Specification for Highway Works'
Ref 7.N	National Highways. CD 109, 'Highway link design'
Ref 8.N	BSI. BS EN ISO 1461, 'Hot dip galvanized coatings on fabricated iron and steel articles. Specifications and test methods'
Ref 9.N	BSI. BS EN ISO 898-1, 'Mechanical properties of fasteners made of carbon steel and alloy steel. Bolts, screws and studs with specified property classes. Coarse thread and fine pitch thread '
Ref 10.N	National Highways. CC 495 'Miscellaneous'
Ref 11.N	BSI. BS EN ISO 17640, 'Non-destructive testing of welds. Ultrasonic testing. Techniques, testing levels, and assessment'
Ref 12.N	BSI. BS EN ISO 17637, 'Non-destructive testing of welds. Visual testing of fusion-welded joints'
Ref 13.N	BSI. BS EN ISO 9934-1, 'Non-destructive testing. Magnetic particle testing. General principles'
Ref 14.N	BSI. BS EN ISO 3452-1, 'Non-destructive testing. Penetrant testing. General principles'
Ref 15.N	BSI. BS EN ISO 9712, 'Non-destructive testing. Qualification

	and certification of NDT personnel'
Ref 16.N	BSI. DD ENV 1317-4, 'Performance classes, impact test acceptance criteria and test methods for terminals and transitions of safety barriers' , 2002
Ref 17.N	National Highways. CC 401, 'Permanent legacy road restraint systems'
Ref 18.N	BSI. BS EN 1317-5, 'Product requirements and evaluation of conformity for vehicle restraint systems (Designated Standard - CPR)'
Ref 19.N	National Highways. CC 486, 'Protection of steelwork against corrosion'
Ref 20.N	BSI. BS EN ISO 9606-2, 'Qualification test of welders. Fusion welding. Aluminium and aluminium alloys '
Ref 21.N	BSI. BS EN ISO 9606-1, 'Qualification testing of welders. Fusion welding. Steels'
Ref 22.N	BSI. BS EN ISO 9001, 'Quality management systems. Requirements [Designated Standard - NLF]'
Ref 23.N	National Highways. CD 377, 'Requirements for road restraint systems'
Ref 24.N	BSI. PD CEN/TR 1317-10, 'Road restraint system. Assessment methods and design guidelines for transitions and terminal and crash cushion connection. Transitions'
Ref 25.N	BSI. PD CEN/TS 1317-9, 'Road restraint systems. Impact tests and test methods for removable barrier sections'
Ref 26.N	BSI. PD CEN/TS 17342, 'Road restraint systems. Motorcycle road restraint systems which reduce the impact severity of motorcyclist collisions with safety barriers'
Ref 27.N	BSI. PD CEN/TS 1317-7, 'Road restraint systems. Performance characterisation and test methods for terminals of safety barriers'
Ref 28.N	BSI. BS EN 1317-1, 'Road restraint systems. Terminology and general criteria for test methods.'
Ref 29.N	BSI. BS EN ISO 15607, 'Specification and qualification of welding procedures for metallic materials. General rules'
Ref 30.N	BSI. BS EN ISO 15613, 'Specification and qualification of welding procedures for metallic materials. Qualification based on pre-production welding test'
Ref 31.N	BSI. BS EN ISO 15609-1, 'Specification and qualification of

	welding procedures for metallic materials. Welding procedure specification. Arc welding'
Ref 32.N	BSI. BS EN ISO 15609-2, 'Specification and qualification of welding procedures for metallic materials. Welding procedure specification. Gas welding'
Ref 33.N	BSI. BS EN ISO 15614-1, 'Specification and qualification of welding procedures for metallic materials. Welding procedure test. Arc and gas welding of steels and arc welding of nickel and nickel alloys'
Ref 34.N	BSI. BS EN ISO 15614-2, 'Specification and qualification of welding procedures for metallic materials. Welding procedure test. Arc welding of aluminium and its alloys'
Ref 35.N	BSI. BS 7818, 'Specification for pedestrian restraint systems in metal '
Ref 36.N	BSI. BS 5400-4, 'Steel, concrete and composite bridges. Code of practice for design of concrete bridges' , 1990
Ref 37.N	National Highways. CC 482, 'Structural concrete'
Ref 38.N	BSI. BS EN ISO 14732, 'Welding personnel. Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials'
Ref 39.N	BSI. BS EN 1011-1, 'Welding. Recommendations for welding metallic materials. Guidance for arc welding'
Ref 40.N	BSI. BS EN 1011-4, 'Welding. Recommendations for welding of metallic materials. Arc welding of aluminium and aluminium alloys'
Ref 41.N	BSI. BS EN 1011-2, 'Welding. Recommendations for welding of metallic materials. Arc welding of ferritic steels'
Ref 42.N	BSI. BS EN 1011-3, 'Welding. Recommendations for welding of metallic materials. Arc welding of stainless steels'