SERIES NG 400
ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

Contents

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VEHICLE RESTRAINT SYSTEMS

General Requirements

NG 401 (05/17) Vehicle Restraint Systems General

1 (03/20) Safety barrier, vehicle parapet (excluding concrete vehicle parapet), terminal, transition and crash cushion systems should conform to CD 377 (DMRB 2.2.8), the various parts of BS EN 1317 and DD ENV 1317-4:2002. The introduction of these Standards ensures a consistent performance based standard is used in the testing and supply of Vehicle Restraint Systems (VRS) throughout the European Economic Area and will thereby avoid 'barriers to trade'.

2 (05/17) BS EN 1317-5 is a harmonised standard covered by the Construction Products Regulation (EU No.305/2011) (CPR). Road restraint systems that fall under the scope of this standard are thus required to be CE marked and the manufacturer is required to draw up a declaration of performance. BS EN 1317-5 uses the other parts of BS EN 1317 to establish the performance characteristics of systems.

3 (05/17) DD ENV 1317-4 remains the reference for transitions, removable barrier sections and terminals in BS EN 1317-5 and so it continues to be used.

4 (03/20) It is necessary for the compiler to specify VRS using performance class requirements and not by stipulating specific types of systems.

Contract specific Appendix 4/1 should be used by the compiler to detail the performance requirements using a schedule and other contract specific requirements. The following should be included as required.

(i) The type of RRS

(ii) The minimum Performance Class Requirements:

- Containment Level,
- Impact Severity Level [ISL],
- Working Width Class [W],
- Vehicle Intrusion Class [VI],
- Performance Level,
- Redirection Zone Class [Z],
- Permanent Lateral Displacement Zone Class [D],
- Performance Class [P],
- Permanent Lateral Displacement Zone [D.x.y],
- Exit Box Class[Z].

(iii) other requirements including:

- the Length of Need (as defined in CD 377),
- the Setback (as defined in CD 127),
- the need for double or single sided VRS
- the minimum height of parapets (as defined in CD 377),
- requirements for pedestrian provision (is a vehicular or pedestrian/vehicular parapet required for example)
- the maximum height of the road restraint that allows the required visibility for road users
- for crash cushions whether they should be redirective or non-redirective.
- for crash cushions and terminals, whether they should be single sided or double sided,
- the required clearance to any highway feature that is vulnerable to residual loading,
- the need for mitigation measures for motorcyclists,

- measures to reduce the risk of injury to pedestrians, equestrians and other vulnerable users (e.g. no sharp edges),
- plinth width for parapets.

Where the Road Restraint Risk Assessment Process (RRRAP) has been used for the design process the compiler will need to incorporate the outputs into contract specific Appendix 4/1 as appropriate. Where amendments to the format of contract specific Appendix 4/1 have been made in comparison to the RRRAP output the compiler will need to make adjustments as necessary. CD 377 also requires the RRRAP outputs to be included with the designer's health and safety documentation required under the CDM regulations.

Where it is proposed to attach a Road Restraint System (RRS) partially or wholly to a structure any particular requirements or restrictions of the RRS with respect to the structure or conversely requirements or restrictions of the structure with respect to the RRS should be described. The RRS may be continuous over a structure or in front of the structure, or the RRS may be supported by an additional element such as an independent slab across a structure or form a connection with the elements of a structure. These requirements may include, but not be limited to, the following:

(i) Loads and their points of origin transmitted from the RRS to be resisted by the structure;

(ii) Limits of loads that may be resisted by the structure from the RRS and the points of application of those loads;

(iii) Maximum loads that may be resisted by any existing anchorage systems;

(iv) Geometric restrictions of either the RRS or the structure;

(v) Testing of any existing anchorage systems'.

5 (05/17) The Contractor is required to submit details of the proposed vehicle restraint systems to the Overseeing Organisation with the supporting information stated in Clause 401 demonstrating compliance with the specification. The nature of the details will depend upon the system(s) being proposed but it will include the declaration(s) of performance required for CE marked products. For all systems, including CE marked systems, sufficient information should be requested and thus provided by the Contractor to ensure that the vehicle restraint system complies with both the relevant standards and the requirements of contract specific Appendix 4/1. Information is required prior to installation for acceptance by the Overseeing Organisation and after installation, i.e. for contractual/construction records.

Where systems with posts are proposed, the drawings and other submitted information should show the type(s) of post foundation which have been selected on the basis of assumed, or wherever possible, tested ground conditions.

6 (05/17) CPR prevents additional acceptance criteria or testing being set for products falling under the scope of a harmonised standard. However, contract compliance testing, checking and inspection are matters for the specific contract and the compiler should consider this and include details as appropriate.

7 (05/17) CPR requires manufacturers to ensure that CE marked products are accompanied by instructions and safety information. BS EN 1317-5 requires the manufacturer to provide an installation manual and this is also required to include details of maintenance and inspection. A system cannot be considered as compliant unless it is installed in accordance with the instructions, the instructions need, therefore, to cover all of the aspects required for the particular use and location concerned.

8 (05/17) In-situ concrete barriers based on proprietary, commercialised designs have in the past been considered to be outside the scope of BS EN 1317, however, the EC has made a decision that this is not the case and in-situ concrete barriers that are commercialised designs and are to be incorporated into permanent works do fall under the scope of BS EN 1317 and are required to be CE marked. In-situ concrete barriers or parapets to be incorporated into permanent works that are bespoke, rather than commercialised products, are not considered as products falling within the scope of BS EN 1317 and do not require CE marking if they are erected by the Contractor providing construction services in-situ in the absence of a manufacturer's system. Where the compiler is considering the inclusion of such barriers or parapets the Overseeing Organisation should be consulted and the Departures from Standard and/or technical approval procedures followed as necessary.

(05/17) **Serviceable life**

9 (i) (05/17) It is expected that the serviceable life requirements for steel vehicle parapets and steel components of combined concrete and metal vehicle parapets will be obtained from galvanising alone and no additional corrosion protection system, e.g. paint, will be required. The parapet manufacturer's product specification must reflect this requirement. Where parapets are to be installed in very aggressive environments where galvanising alone will not provide the required serviceable life, or there are overriding aesthetic considerations, additional corrosion protection systems may be required. Where such requirements exist they should be detailed in contract specific Appendix 4/1.

(ii) (05/17) Parapet manufacturers and the Overseeing Organisation must be consulted before additional corrosion protection is specified. The Overseeing Organisation's approval must be obtained before painting for aesthetic reasons is specified or maintenance, other than that required due to accidental damage, is to be allowed within the serviceable life of the parapet.

(iii) (05/17) Where additional protective treatments are required, the minimum periods 'No maintenance up to 12 years,' 'Minor maintenance from 12 years' and 'Major maintenance after 20 years' will normally be appropriate.

(iv) Where access is especially difficult, or access for maintenance would be very disruptive to the highway network, consideration should be given to specifying only major maintenance after 20 or even 25 years with no maintenance before that time.

NG 402 (05/17) Components for Maintenance and Repair of Legacy Vehicle Restraint Systems

1 (05/17) Since all new VRS are required to be in accordance with BS EN 1317 and be CE marked, the traditional forms of barrier such as tensioned corrugated beam and open box beam could only be used for new construction if they were CE marked. Hence the specification requirements given for 'legacy' systems are with respect to the provision and installation of components for repair and maintenance of existing non CE marked VRS only. The maintenance and repair of CE marked systems is not covered by Clause 402.

(05/17) **Welding**

2 (05/17) Prior to the anticipated start of delivery of vehicle restraint components, the Contractor should obtain copies of the most recent certified destructive test reports covering those component types to be supplied under the Contract.

3 (05/17) Sample components and/or joints for destructive testing should be selected by a Welding Inspector certified by the Certification Scheme for Weldment Inspection Personnel (CSWIP) or equivalent. Selection should be made taking into account the manufacturer's inspection reports, previous destructive test reports and observations of current production practice on similar component types. Where practicable, samples should be selected on the basis that they represent the lower end of quality in the production batch. Particular attention should be given to any features which could adversely affect the true throat size or the mechanical properties of the materials.

4 (05/17) Sample components and/or joints selected for destructive testing should be indelibly marked and dispatched to a testing laboratory appropriately accredited in accordance with sub-Clauses 105.3 and 105.4 for such tests.

5 (05/17) The following points should be considered when ascertaining the acceptability of components subject to destructive testing:

(i) When conducting destructive testing, each length of weld between weld ends or changes of direction should be sectioned at intervals not exceeding 100 mm. One side of each section should be ground, filed, linished or machined to an appropriate finish so that the actual throat and leg dimensions can be measured and any discontinuities exposed. One fracture test in accordance with BS EN 1320 on a length of weld of not less than 50 mm should be made for each joint type on each component. Additional

sections and fracture tests may be required in cases of borderline acceptance. Non-compliance with the imperfection acceptance levels of BS EN ISO 15614-1 should be recorded. Non-compliance with the requirements of sub-Clause 406.7 should be cause for rejection, except that in sub-Clause 402.7(iv) (a) the throat and leg dimensions should be the true rather than the apparent dimensions.

(ii) One representative section from each joint type for each type of component should be prepared for macro-examination. A hardness survey should be done where any of the parent material thickness exceeds 20 mm. An additional macro-examination should be made of each non-conforming weld.

6 (05/17) The results of the destructive tests including macrographs should be reported and a certified copy sent to the manufacturer. In the event of non-conformances being found, the Contractor and manufacturer should be notified as soon as possible. The test specimens, uniquely identified by hard stamped marks should be returned to the manufacturer's works.

(05/17) Safety Barriers, Terminals, Transitions, Removable Barrier Sections and Crash Cushions

NG 403 (05/17) Installation of Safety Barriers (except vehicle parapets), Terminals, Transitions, Removable Barrier Sections and Crash Cushions – Overall Requirements

1 (05/17) Installation of safety barriers, terminals, transitions, removable barrier sections (RBS) and crash cushion systems should be in accordance with the details supplied by the Contractor including installation instructions supplied by the manufacturer and also the quality management requirements of Clause 104 and the associated quality management schemes listed in Appendix A.

2 (05/17) Adjustments to line and level of safety barriers, terminals, RBS and transitions at connections to vehicle parapets may be necessary to achieve an even flowing alignment.

(05/17) Anchorages and Attachment Systems for Surface Mounted Posts

3 (05/17) Examples of the evidence required by sub-Clause 403.15 include (a) the results of testing to BS 5080 by a testing laboratory appropriately accredited in accordance with sub-Clauses 105.3 and 105.4 for such test or (b) a Certificate from any UEAtc (Union européenne pour l'agrément technique dans la construction - European union for technical approval in the construction) member together with the results of testing to the European Union of Agrément Directive for Assessment of Anchor Bolts MOAT No. 42 (adapted to include only anchorage types permitted by the Specification). If the 4 week time period required by sub-Clause 403.15 is unrealistic then the appropriate time period should be stated in contract specific Appendix 4/1.

4 (05/17) Anchorages for securing surface mounted posts which utilise drilled holes have been known to fail due to either the lack of cleanliness of the hole or the excessive tolerance in the size of the hole. The manufacturer of the anchorages should provide details of the maximum tolerances permitted and the evidence submitted in accordance with sub-Clause 403.15 should show that these are satisfactory when installed in holes having these tolerances.

5 (05/17) Where anchorages and attachment systems are used, the bolts or nuts should be tightened adequately, in accordance with the manufacturer's instructions, to ensure that effective shear transfer will occur between the post baseplate and the base. In addition, it is important to ensure an adequate length of thread engagement. The surrounding concrete should be appropriately reinforced to prevent shear cone failure, particularly where an anchorage is close to the edge of the concrete.

6 (05/17) Where safety barriers, terminals, RBS and transition posts are to be installed on bridge decks an anchorage and attachment system should be used. Care should be taken to avoid damaging bridge deck waterproofing systems when installing anchorages in drilled holes. Normally, an anchorage and attachment system, which avoids this problem, should be used. In exceptional circumstances, where damage to the waterproofing is unavoidable a compatible sealing system agreed with the Overseeing Organisation to prevent ingress of water and avoid corrosion should be provided.

7 (05/17) Where safety barriers, terminals, RBS and transition posts are installed in cast in post sockets, an easily removable sealing system should be applied to prevent the ingress of detritus.

8 (05/17) The holding down system should have a serviceable life which is similar to that of the structure on which it is mounted, the compiler should consider this and take account of the exposure levels of the components to the environment whilst recognising that replacement of the posts is likely. The requirements should be stated in contract specific Appendix 4/1. During the lifespan of the structure the post may be replaced numerous times, as such stainless steel is prescribed for the holding down bolts.

NG 404 (05/17) Site Testing for Contract Compliance

(05/17) **Anchorages in Drilled Holes for Safety Barriers, Terminals, Transitions, Removable Barrier Sections and Crash Cushions**

1 (05/17) The anchorage test results should be included with the 'as-built' records and the health and safety file.

2 (05/17) The Contractor is responsible for carrying out the site tests at the frequency of the more onerous of either the values given in the accepted manufacturer's Installation Manual or as given in contract specific Appendix 1/5. Any particular requirements should be included in contract specific Appendix 4/1. The rate of testing will need to be determined for each location where anchorages in drilled holes are to be used. As a guide where the anchorages are to be installed on bridges or other structures, the rate of testing should normally be not less than 1 No. anchorage per post anchorage group for safety barrier, terminal, RBS and transition for each of the first 5 No. anchorage groups installed and 1 No. anchorage per 5 No. anchorage groups installed thereafter. For crash cushions, the rate of testing will need to be determined on an individual basis and in accordance with the design of the crash cushion to be installed. If failures are recorded the rate of testing should be increased until the suitability of the anchorages can be established. Any anchorage which fails the testing should be replaced and retested. The testing programme should consider variations in the locations of the anchorages.

(05/17) **Post Foundations**

3 (05/17) Testing should be carried out at the location where the posts are to be installed, in the direction of anticipated deflection, and at a time when the ground is likely to have least resistance.

4 (05/17) Contract specific Appendix 4/1 should identify whether the Overseeing Organisation or the Contractor will provide the test equipment and carry out the tests and details of the test posts and foundations should be shown on the drawings where appropriate. The Contractor should put forward a testing schedule to check compliance with the safety barrier, terminal, transition, RBS and crash cushion system manufacturer's instructions. The Contractor should arrange to undertake the tests put forward and report the results to the Overseeing Organisation.

Vehicle Parapets

NG 406 (05/17) General

1 (05/17) A schedule of vehicle parapets is to be placed in contract specific Appendix 4/1. The schedule should list the Performance Class Requirements for the proposed vehicle parapets and the other appropriate information given in Clause NG 401.

2 (03/20) Where requirements for verges on bridges and structures differ from those stated in CD 377 they should be identified in contract specific Appendix 4/1.

(05/17) **Aesthetic Requirements**

3 (03/20) The vehicle parapet systems should comply with the aesthetic requirements in contract specific Appendix 4/1.

4 (03/20) The Overseeing Organisation should be consulted on the aesthetic requirements to be included in contract specific Appendix 4/1 and on the systems put forward by the Contractor.

(05/17) **Maintenance and Repair**

5 (03/20) Contract specific Appendix 4/1 should be used by the compiler to detail the requirements for components for maintenance and/or repair including the design, specification and geometry requirements. Where possible this should be stated in performance terms appropriate to the parapet being repaired or maintained including the CE marking requirements. Where the system is not a legacy system CE marking of repair components will apply.

NG 407 (05/17) Anchorages and Attachment Systems for Vehicle Parapets

1 (05/17) Failures of anchorages in drilled holes are known to occur due to either the lack of cleanliness of the hole or excessive tolerance in the size of the hole. Manufacturers of the anchorages should give details of the maximum tolerance permitted and test evidence that they are satisfactory when installed in holes having these tolerances.

2 (05/17) Where attachment systems are used, bolts or nuts should be tightened in accordance with the manufacturer's recommendations to ensure that effective shear transfer will occur between the post baseplate and the base. In addition, it is important to ensure an adequate length of thread engagement.

3 (05/17) The holding down system should have a serviceable life which is similar to that of the structure on which it is mounted, the compiler should consider this and take account of the exposure levels of the components to the environment whilst recognising that replacement of the parapet system is likely. The requirements should be stated in contract specific Appendix 4/1.

NG 408 (05/17) Amendments and Additions to BS 6779

1 (05/17) **BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003)**

(i) Sealing of voids in anchorages, attachment systems and base plates with a non-structural impermeable durable filler is important to prevent water ingress and to avoid corrosion and damage. Fillers may be derived from polymers or elastomers, but shall exclude acrylic or polyester based materials.

(ii) Prior to the anticipated start of manufacture of vehicle parapet components copies of the most recent certified destructive test reports covering those component types to be supplied under the Contract should be examined. Provision for supply of copies of reports should be included in contract specific Appendix 4/1.

(iii) Arrangements should be made for sample components and/or joints for destructive testing to be selected at the works and on site by a Welding Inspector certified by CSWIP or equivalent. Selection should be made taking into account the manufacturer's inspection reports, previous destructive test reports and observations of current production practice on similar component types. Samples should be selected on the basis that they represent the lower end of quality in the production batch. Particular attention should be given to any features which could adversely affect the true throat size or the mechanical properties of the materials.

(iv) For the purposes of defining component types in sub-clause 9.4.3.2.2 of BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003), differences in either member cross-sectional shape, joint configuration or weld type, constitute a change in component type. Variations in cross-section size or member length need not constitute a change in component type. Variations in parent metal thickness or weld throat dimension from the specified sizes on the sample selected for destructive test may be included within the same type up to a limit of ± 40%.

(v) Sample components and/or joints selected for destructive testing in accordance with sub-clause 9.4.3.2.2 of BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003) should be indelibly marked and dispatched to a testing laboratory appropriately accredited in accordance with sub-Clauses 105.3 and 105.4 for weld

testing and in the case of aluminium alloy posts, for static load testing in accordance with Annex E of BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003).

(vi) The following points should be considered when ascertaining the acceptability of components subject to destructive testing

(a) Aluminium alloy posts should be static load tested in accordance with BS 6779-1: 1998 (Amd. No. 14290, 21 March 2003) clause E.1 and E.2 prior to destructive examination.

(b) When conducting destructive examination each length of weld between weld ends or changes of direction should be sectioned at intervals not exceeding 100 mm. One side of each section should be ground, filed, linished or machined to an appropriate finish so that the actual throat and leg dimensions can be measured and any discontinuities exposed. One fracture test in accordance with BS EN 1320 on a length of weld of not less than 50 mm should be made for each joint type on each component. Additional sections and fracture tests may be required in cases of borderline acceptance. Non-compliances with the imperfection acceptance levels of BS EN ISO 15614-1 and BS EN ISO 15614-2, as appropriate, should be recorded.

(c) One representative section from each joint type for each type of component should be prepared for macro-examination. A hardness survey should be done where any of the parent material is 20 mm thick or greater. An additional macro-examination should be made of each non-conforming weld.

(d) For steel posts designed to fail plastically under impact yield/proof stress should be the same or within normal statistical variation of that of the tested prototype.

(e) For aluminium posts designed to fail in a frangible manner the ultimate strength of the alloy should also be as the strength of the prototype.

(f) For both steel and aluminium the extension at break should also be comparable to the prototype.

(g) For rolled or extruded sections the test samples shall be free from laminations or poorly formed fusions.

(vii) The results of the destructive tests including macrographs and load deflection history, where relevant, should be reported and a certified copy sent to the manufacturer. In the event of non-conformances being found the Contractor and the manufacturer should be notified as soon as possible. The test specimens, uniquely identified by hard stamped marks should be returned to the manufacturer's works.

NG 409 (05/17) Inspection and Testing of Vehicle Parapet Posts

1 (05/17) Provided that the test certificate and the time limit relating to a test previously carried out are satisfactory, these may be used in relation to current work.

NG 410 (05/17) Site Tests on Anchorages in Drilled Holes for Vehicle Parapets

1 (05/17) The Contractor is responsible for designing the anchorages and carrying out site tests at the frequency given in contract specific Appendix 1/5. Any particular requirements should be included in contract specific Appendix 4/1. The rate of testing will need to be determined for each location where anchorages in drilled holes are to be used. As a guide the rate of testing should normally be not less than 1 No. anchorage per vehicle parapet post anchorage group for each of the first 5 No. vehicle parapet post anchorage groups installed and 1 No. anchorage per 5 No. vehicle parapet post anchorage groups installed thereafter. If failures are recorded the rate of testing should be increased until the suitability of the anchorages can be established. Any anchorage which fails the testing should be replaced and retested. The testing programme should consider variations in the locations of the anchorages.

2 (05/17) The vehicle parapet post anchorage test results should be included with the 'as-built' records and the health and safety file.

PEDESTRIAN RESTRAINT SYSTEMS

NG 411 (05/17) Pedestrian Parapets and Pedestrian Guardrails

1 (05/17) The type, class and the location of pedestrian parapets and pedestrian guardrails should be described in contract specific Appendix 4/1.

2 (05/17) It is expected that the serviceable life requirements for steel pedestrian parapets and pedestrian guardrails and steel components of combined concrete and metal pedestrian parapets and pedestrian guardrails will be obtained from galvanising alone and no additional corrosion protection system, e.g. paint, will be required. Alternative means of protection other than galvanisation are acceptable so long as the protection provided by this system can be demonstrated to meet the required serviceable life without maintenance other than that required for accidental damage. The parapet or guardrail manufacturer's product specification must reflect this requirement.

Where parapets or guardrails are to be installed in very aggressive environments where galvanising alone will not provide the required serviceable life, or there are overriding aesthetic considerations, alternative corrosion protection systems may be required. Where such requirements exist they should be detailed in contract specific Appendix 4/1.

Parapet or guardrail manufacturers and the Overseeing Organisation must be consulted before additional corrosion protection is specified for a very aggressive environment. The Overseeing Organisation's approval must be obtained before painting for aesthetic reasons is specified or maintenance, other than that required due to accidental damage, is to be allowed within the serviceable life of the parapet or guardrail.

Where additional protective treatments are required, the minimum periods 'No maintenance up to 12 years,' 'Minor maintenance from 12 years' and 'Major maintenance after 20 years' will normally be appropriate.

Where access is especially difficult, or access for maintenance would be very disruptive to the highway network, consideration should be given to specifying only major maintenance after 20 or even 25 years with no maintenance before that time.

(05/17) **Aesthetic Requirements**

3 (05/17) Pedestrian parapets can often be required to be sympathetic to an overall landscape design, as such any special requirements in terms of the nature of their form, construction or colour should be included as an aesthetic requirement in contract specific Appendix 4/1. However, the aesthetic requirements should not override the performance requirements as required by BS 7818.

4 (05/17) The Overseeing Organisation should be consulted on the aesthetic requirements to be included in contract specific Appendix 4/1 and on the systems put forward by the Contractor.

ANTI-GLARE SCREENS

NG 412 (05/17) Anti-glare Screens

1 (03/20) The requirements of anti-glare screen systems should be described in contract specific Appendix 4/1. BS EN 12676-1 is a harmonised standard and thus anti-glare screens are to be CE marked. The compiler should include performance requirements including for light screening capability and durability in contract specific Appendix 4/1.

Further recommendations and advice for the design and maintenance of anti-glare screens are given in Chapter 11 of CD 377 (DMRB 2.2.8). It should be noted that BS EN 12676-1 does not apply to:

(i) Types of anti-glare screens other than those attached to safety barriers and transitions;

(ii) Regulatory characteristics which might be required to ensure that anti-glare systems are compatible with road signs; and

(iii) Specific requirements resulting from extreme environmental conditions.

(05/17) NG SAMPLE CONTRACT SPECIFIC APPENDIX 4/1: ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

[Note to compiler: Include here:]

1 (03/20) **Location:**

1.1 Vehicle Restraint Systems

(i) The location, Containment Level, Impact Severity Level (ISL), setback, Working Width Class (W), Vehicle Intrusion (VI) maximum height that allows the required visibility, and the Length of Need requirements for safety barriers, RBS and transitions are shown on Drawing Nos. ..... *[Generally the 1:500 or 1:1000 Site Plans].*

(ii) The location, Containment Level, Impact Severity Level (ISL), setback, Working Width Class (W) and Vehicle Intrusion (VI), maximum height that allows the required visibility, and the Length of Need requirements for vehicle parapets are shown on Drawing Nos..... *[Generally the 1:500 or 1:1000 Site Plans].*

(iii) The location, Containment Level, Impact Severity Level (ISL), setback, Working Width Class (W) and Vehicle Intrusion (VI) requirements for vehicle/pedestrian parapets are shown on Drawing Nos..... *[Generally the 1:500 or 1:1000 Site Plans].*

(iv) The location, Performance Class, Impact Severity Level (ISL), setback, Permanent Lateral Displacement Zone D.x.y), Vehicle Exit Box Class (Z), and maximum height that allows the required visibility requirements for terminals are shown on Drawing Nos. ..... *[Generally the 1:500 or 1:1000 Site Plans].*

(v) The location, Performance Level, redirective (R) or non-redirective (NR) type of crash cushion, directional or bi-directional type of crash cushion, Impact Severity Level (ISL), setback, Vehicle Redirection Zone Class (Z), Permanent Lateral Displacement Zone Class (D), and maximum height that allows the required visibility requirements for crash cushions are shown on Drawing Nos..... *[Generally the 1:500 or 1:1000 Site Plans].*

1.2 Pedestrian Restraint Systems

(i) The location for pedestrian parapets and pedestrian guardrails are shown on Drawing Nos..... *[Generally the 1:500 or 1:1000 Site Plans].*

1.3 Anti-glare Screens

(i) The location for anti-glare screens are shown on Drawing Nos..... *[Generally the 1:500 or 1:1000 Site Plans].*

2 (03/20) **Other Details:**

Safety Barriers, Terminals, Transitions and Crash Cushions

2.1 Requirements for safety barriers, terminals and transitions if different from the requirements of Clauses 401, 402 and 403.

2.2 Requirements for crash cushions if different from the requirements of Clauses 401 and 403. *[Compiler to specify whether redirective(R) or non-redirective (NR) and whether directional or bi-directional]*

2.3 Any other details *[to be included as required]:*

(i) Any special requirements *[e.g. environmental considerations, motorcyclist protection, lengths of removable safety barrier, ground conditions, proximity to embankment slopes, requirements to accommodate pedestrians on verges, clearance to hazards that are vulnerable to residual loading, loading requirements for structures and measures to reduce the risk of injury to pedestrians, equestrians and other vulnerable users (e.g. no sharp edges)];*

(ii) Specific connection requirements to existing safety barriers, vehicle parapets or other structures.

Vehicle Parapets Including Anchorages and Attachment Systems

2.4 Requirements for vehicle parapets if different from the requirements of Clauses 401 and 406. Requirements for verges on bridges and structures if different from the requirements stated in CD 377.

2.5 Any special requirements for maintenance to the corrosion protection system, other than that required due to accidental damage, permissible within the serviceable life of a metal vehicle parapet or the metal components of a combined metal and concrete vehicle parapet *[Clause 401]*.

2.6 Any additional corrosion protection system required *[Clause 402]*.

2.7 Aesthetic requirements for vehicle parapets *[Clause 406]*.

2.8 Requirements for anchorages and attachment systems if different from the requirements of Clause 407 and the loading limitations of the structure.

2.9 Maintenance and/or repair requirements, *[include design, detail, performance and geometry requirements for replacement components, state if the existing system is compliant with BS EN 1317-5 or a legacy system and state the CE marking requirements for replacement components, where known state the performance characteristics of the existing parapet system and the requirements for this performance to be maintained.]*

2.10 Any special requirements *[e.g. environmental considerations, clearance to hazards that are vulnerable to residual loading and loading requirements for structures].*

Pedestrian Restraint Systems

2.11 Requirements for pedestrian parapets and pedestrian guardrails - see also Table C.1 of BS 7818 *[Clause 411. Include requirements for designation (the loading class), when required infill material and protection, infill class and height, when required type of holding down bolts, foundations method of fixing, whether a passively safe support system is required, minimum height above paved surface, if a continuous plinth is not required, the width of the plinth required (for pedestrian parapets) and any other requirements.]*

2.12 Any special requirements for maintenance to the corrosion protection system, other than that required due to accidental damage, permissible within the serviceable life of a metal pedestrian parapet or guardrail or the metal components of a combined metal and concrete pedestrian parapet or guardrail *[Clause 411]*.

2.13 Any additional corrosion protection system required *[Clause 411]*.

Anti-glare Screens

2.14 Requirements for anti-glare screens giving performance requirements which are to be demonstrated by the Declaration of Performance including light screening capability and durability. *[Clause 412].*

3 (03/20) **Testing** *[Cross-reference with Appendix 1/5 as appropriate]*

Destructive Testing for Maintenance of Legacy Systems

3.1 Requirements for provision of copies of certified reports of destructive tests and for supply of test components *[Clauses 402.7(v) and 408].*

Site Testing on Post Foundations for Contact Compliance

3.2 Requirements for site load tests on safety barrier, terminal, transition and crash cushion post foundations *[Clause 404]*.

Inspection and Testing of Vehicle Parapet Posts

3.3 Requirements for inspection if different from the requirements of Clause 409.

3.4 Requirements for static testing of posts if different from the requirements of Clause 409.

Site Testing on Anchorages in Drilled Holes

3.5 Details of testing requirements for anchorage and attachment systems *[Clauses 404 and 410]*.

4 (03/20) **Temporary Safety Barriers**

[Note to compiler: State here:]

(i) Who is to provide temporary safety barriers *[Clause 405]*.

(ii) Containment Level *[Clause 401]*.

(iii) Impact Severity Level *[Clause 401]*

(iv) Working Width Class *[Clause 401]*.

(v) Vehicle Intrusion Class *[Clause 401]*.

(vi) Locations to be provided *[Clause 405]*, where appropriate length of need and set back.

(vii) Where appropriate the method of termination.

(viii) Other requirements and details such as pavement details for the installation location, the presence of structures, any minimum clearances for accesses, details of any hazards that would be vulnerable to residual loading.

(ix) Location(s) for removal of temporary safety barrier on completion of the works *[Clause 405]*.

(x) Location(s) from which temporary safety barrier is to be collected and returned by the Contractor if provided by the Overseeing Organisation *[Clause 405]*.

5 (05/17) Schedule of Road Restraint Systems (Vehicle and Pedestrian)

[Note to Compiler: Complete the schedule below and include in Appendix 4/1. Incorporate in the schedule all the Road Restraint Systems (i.e. safety barriers, terminals, transitions, vehicle parapets, crash cushions, pedestrian parapets and pedestrian guardrails) and any associated anti-glare screens required. Cross-reference should be made to the drawings where appropriate. The Road Restraint Systems should be listed in order of occurrence, irrespective of type, and the respective start and end chainages of the proposed systems listed.

All the Performance Class Requirements appropriate for the Road Restraint System and other details such as parapet height should be included. The difference between the Finish and Start Chainages should be at least the Length of Need of the Road Restraint System as defined in CD 377.]

[Col 0	*Col 1*	*Col 2*	*Col 3*	*Col 4*	*Col 5*	*Col 6*	*Col 7*	*Col 8*	*Col 9*	*Col 10*	*Col 11*	*Col 12*	*Col 13]*
RRS Ref	**Location & Start Chainage (m)**	**Finish Chainage (m)**	**Position on Highway Cross-Section**	**Type of Road Restraint System**	**Set-back (m)**	**Barrier Containment Level/ Terminal Performance Class (P)**	**Impact Severity Level (ISL)**	**Working Width Class** (W)	**Vehicle Intrusion (VI)**	**Performance Level and whether Redirective (R) or Non-redirective (NR) whether Directional or Bi-directional**	**Permanent Lateral Displacement Zone (D.x.y) or Characteristic Permanent Lateral Displacement Zone Class (D)**	**Vehicle Exit Box Class or Vehicle Redirection Zone Class (Z)**	**Other Requirements/ Comments**

Notes to compiler:

Col 0 Give unique alpha or numeric reference for use in cross-referencing.

Col 1 Give chainage and location, for example, road name, verge, central reserve, slip road etc.

Col 3 For example, south verge, central reserve, north verge etc.

Col 4 Give barrier type: Safety barriers, vehicle parapets, vehicle/pedestrian parapets, transitions, RBS, terminals, crash cushions, pedestrian parapets, pedestrian guardrails). Enter temporary safety barrier where required.

Col 6 Give containment level for safety barriers, vehicle and vehicle/pedestrian parapets, transitions, RBS and terminal performance class for terminals. Enter temporary safety barrier where required.

Col 7 Give the Impact Severity Level for safety barriers, vehicle and vehicle/pedestrian parapets, transitions, RBS, terminals, crash cushions. Enter temporary safety barrier where required.

Col 8 Give the Working Width Class for safety barriers, vehicle and vehicle/pedestrian parapets, transitions, RBS. Enter temporary safety barrier where required.

Col 9 Give the Vehicle Intrusion Class for safety barriers, vehicle and vehicle/pedestrian parapets, transitions, RBS with a containment level of H1 or greater.

Col 10 For crash cushions give the Performance Level and whether the cushion should be Redirective (R) or Non- redirective (NR) and whether the cushion should be directional or bi-directional.

Col 11 For terminals give Permanent Lateral Displacement Zone (D.x.y) and for crash cushions give Permanent Lateral Displacement Zone Class (D). Enter temporary safety barrier where required.

Col 12 For Terminals give Vehicle Exit Box Class and for crash cushions give Vehicle Redirection Zone Class (Z). Enter temporary safety barrier where required.

Col 13 Give all other requirements including required RRS heights, need for anti-glare screens, dynamic deflection, need to consider proximity of embankment slope, requirements to accommodate pedestrians on verges, mitigation measures for risks to motorcyclists, measures to reduce the risk of injury to pedestrians, equestrians and other vulnerable users (e.g. no sharp edges), minimum height above the paved surface for the purpose intended for parapets, plinth width for parapets, clearance to hazards that are vulnerable to residual loading and loading requirements for structures, maximum opening and closing times for RBS. Enter temporary safety barrier where required.

(05/17) NG SAMPLE CONTRACT SPECIFIC APPENDIX 4/2: INFORMATION REQUIRED TO DEMONSTRATE COMPLIANCE OF TRANSITIONS AND TERMINALS TO CLAUSE 401

[Note to Compiler: Include the following proformas which the Contractor is to complete and submit to the Overseeing Organisation with supporting information to demonstrate compliance of the proposed road restraint system transition and/or terminal with BS EN 1317-1:2010 ,BS EN 1317-2:2010 and DD ENV 1317-4:2002 as required by clause 401].

The Contractor shall complete and submit the following supporting information for each type of transition or terminal as required by Clause 401 demonstrating compliance with BS EN 1317-1:2010 , BS EN 1317-2: 2010, DD ENV 1317-4:2002 to the Overseeing Organisation for acceptance:

SUBMISSION FOR COMPLIANCE WITH CLAUSE 401

TYPE OF TRANSITION:

Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:

CONTAINMENT PERFORMANCE CLASS/PERFORMANCE LEVEL/PERFORMANCE CLASS (*):
TEST REPORT NUMBER: **(Test of)**
Test Type: (Primary/Complementary Test) (*)
TEST NUMBER: **TEST DATE:** (*) delete as appropriate

COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax:/ E-mail: PRODUCT NAME:	

Initial submission documents to be supplied for consideration of Initial Type Test (ITT).

Item		Comment	Item Received (Y or N)	Date requested
1	Test report	In accordance with either BS EN 1317-2:2010, Annex A or DD ENV 1317-4:2002, clause 7.8.		
2	Video/high speed film	Of test coverage as specified in relevant part of DD ENV 1317-4:2002. Annotated showing date, test number and performance class		
3	Still photographs	Of complete installation.		
4	Still photographs	Of vehicle before and after impact.		
5	Drawings	Fully detailed drawings of tested item.		
6	Certification from the manufacturer	Confirming that the item tested complies with drawings supplied.		
7	Confirmation from test house	That the test conforms to the relevant requirements of BS EN 1317-1:2010 and BS EN 1317-2:2010 and DD ENV 1317-4:2002 for transitions.		
Additional information, which will be required on acceptance of initial type test prior to installation.				
8	System specification	Manufacturer's specification.		
9	Installation details	Manufacturer's drawings.		
10	Installation procedures	Manufacturer's installation instructions or installation manual.		
11	Maintenance Manual	Manufacturer's inspection, repair and maintenance instructions.		
12	Certificate of registration	National Highways Sector Scheme 2B for the Supply and Installation of Vehicle Restraint Systems for each organisation installing the transition.		
13	Additional information	Any additional information required in contract specific Appendix 4/1.		

Notes:

1. All documents are to be in English.

Signature:	Name:
Date:	

SUBMISSION FOR COMPLIANCE WITH CLAUSE 401 (cond.)

TYPE OF TRANSITION:

Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:

CONTAINMENT PERFORMANCE CLASS/LEVEL(*)

TEST REPORT NUMBER: **(Test of)**

Test Type: (Primary/Complementary Test) (*)

TEST NUMBER: **TEST DATE:** (*) delete as appropriate

COMPANY NAME:	
CONTACT:	
ADDRESS:	
Tel: / Fax:/ E-mail:	
PRODUCT NAME:	

			Specified	**Actual**	**Satisfactory (Yes or No)**	**Compliance**
BS EN 1317-1: 2010, Table 1	Vehicle Details	**Impact Conditions** Total vehicle mass (kg) Speed (km/h) Angle (degrees) Combination of tolerances meets Figure 6 of ENV1317-4:2002	……. (± …) …… (0, +7%) …… (-1, + 1.5) Refer to Figure 6 of ENV1317-4:2002			
		Centre of Gravity Vertical height (m) Longitudinal (m) Lateral (m)	……. (± 10%) …… (± 10%) ± ……			
		Model				N/A
BS EN 1317-2: 2010, clause 4.2	Vehicle Restraint System (VRS) transition Behaviour	1) The transition shall contain the vehicle without breakage of any of the principal longitudinal elements of the system. 2) All totally detached parts of the transition with a mass greater than 2,0 kg shall be identified, located and recorded in the test report with their size. 3) Elements of the transition shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into the passenger compartment that can cause serious injuries shall not be permitted. 4) Foundations, ground anchorages and fixings shall perform according to the design of the VRS transition.				
BS EN 1317-2: 2010, clause 4.3	Vehicle Behaviour	1) During and after the impact, no more than one of the wheels of the vehicle shall completely pass over or under the transition. 2) The vehicle shall not roll over (including rollover of the vehicle onto its side), during or after impact. 3) For tests with Heavy Goods Vehicles and buses, not more than 5 % of the mass of the ballast shall become detached or be spilt during the test up to the time when the wheel tracks of the vehicle leaves the exit box 4) The vehicle shall leave the transition after impact so that the wheel track does not cross a line parallel to the initial traffic face of the system, at a distance A (2.2m for cars, 4.4m for other vehicles) plus the width of the vehicle plus 16 % of the length of the vehicle within a distance B (10m for cars, 20m for other vehicles) from the last (namely closest to the downstream end of the barrier) point P, where the last of the vehicle wheel tracks re-crosses the original line of the traffic face of the barrier after initial impact.				
BS EN 1317-2: 2010, clause 5.3.2	Installation	1) The length of the transition shall be sufficient to demonstrate the full performance characteristics of the system. 2) Post foundation shall meet the design specification. 3) Description of impact point location (with explanation of the choice of impact point if not at 3/4L for the light vehicle test and L/2 for the heavy vehicle test)				
BS EN 1317-2: 2010, clause 4.4	Impact Severity Level	**SPECIFIED** THIV Limit 33 km/h ASI Limit 1.4	**ACTUAL** THIV …. … km/h ASI …….			
BS EN 1317-2: 2010, clause 4.4	Transition Deformation	**DEFORMATION CHARACTERISTIC** Dynamic Deflection Working Width Vehicle Intrusion	**MEASURED (m) [Class]**	**NORMALISED (m) [Class]**		
BS EN 1317-2: 2010, clause 5.6, Figure 4	Photographic coverage	1) Photographic coverage shall be sufficient to clearly describe behaviour and vehicle motion during and after impact. 2) High speed cameras shall be operated at a minimum of 200 frames per second and stills. 3) As recommended in clause 5.6 and Figure 4. 4) Still Photography shall also be provided.				
	Drawings	Drawings included				
					N/A = Not Applicable	

FULLY COMPLIES WITH STANDARD: BS EN 1317-1:2010 , BS EN 1317-2:2010 , DD ENV 1317-4:2002

Signature:	Name:
Date:	

SUBMISSION FOR COMPLIANCE WITH CLAUSE 401

TYPE OF TERMINAL:

Ref(s) used in contract specific Appendix 4/1 Schedule of RRS:

PERFORMANCE CLASS: **(Test of)**
Test Type: (Primary/Complementary Test) (*) **TEST TYPE NUMBER:**
TEST NUMBER: **TEST DATE:** (*) delete as appropriate

COMPANY NAME: CONTACT: ADDRESS: Tel: / Fax:/ E-mail: PRODUCT NAME:	

			Specified	Actual	Satisfactory (Yes or No)	Compliance
BS EN 1317-1: 2010, Table 1 and DD ENV 1317-4: 2002, clauses 7.4 and 7.5	Vehicle Details	**Impact Conditions** Total vehicle mass (kg) Speed (km/h) Angle (degrees) Combination of tolerances meets Figure 6 of ENV1317-4:2002	……. (± …) ……. (0, +7%) ……. (-1, + 1.5) Refer to Figure 6 of ENV1317-4:2002			
		Centre of Gravity Vertical height (m) Longitudinal (m) Lateral (m)	……. (± 10%) ……. (± 10%) ± …….			
		Model				N/A
DD ENV 1317-4: 2002, clauses 5.4 and 5.5.2	Terminal Behaviour	1) Elements of the terminal shall not penetrate the passenger compartment of the vehicle. Deformations of, or intrusions into, the passenger compartment that could cause serious injuries are not permitted. 2) No major part of the terminal shall become totally detached and come to rest outside the permanent lateral displacement zones defined in clause 5.4 of DD ENV 1317-4:2002. 3) Anchorages and fixings shall perform to the terminal design specifications and other specified requirements as listed in the test report. 4) The permanent lateral displacement zone for the terminal shall be reported after the test.				
DD ENV 1317-4: 2002, clause 5.5.3	Vehicle Behaviour	1) The vehicle shall not overturn, although rolling, yawing and moderate pitching may be accepted. For the terminal Performance Class P1 rolling onto a side may be accepted. 2) The exit box values for the specified test are as defined in Figures 5 and Tables 7 and 8. (as appropriate).				
DD ENV 1317-4: 2002, clause 7.3.2	Installation	1) The terminal shall conform to the structural design details and with the system installation details as given in the design specification of the manufacturer.				
DD ENV 1317-4:2002, clause 5.5.4 and Table 5	Impact Severity Level	**SPECIFIED** Level A: THIV ≤ 44km/h (Tests 1-and 2) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.0 Level B: THIV ≤ 44km/h (Tests 1 and 2) THIV ≤ 33km/h (Tests 4 and 5) ASI ≤ 1.4	**ACTUAL**			
DD ENV 1317-4:2002, clause 7.7, Figure 7	Photographic coverage	1) Photographic coverage shall be sufficient to describe clearly terminal and vehicle motion during and after impact. 2) High speed cameras and/or high speed video cameras at a minimum of 200 frames per second. 3) Still photography shall also be provided.				
	Drawings	Drawings included				
					N/A = Not Applicable	

FULLY COMPLIES WITH STANDARD: BS EN 1317-1 and DD ENV 1317-4:2002

Signature:	Name:
Date:	