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Notes for Guidance to the Specification for Road Works Series NG 400 - Road Restraint Systems (Vehicle and Pedestrian)

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Standards

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Document Attributes

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NRA DMRB and MCDRW References

For all documents that existed within the NRA DMRB or the NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

Contents

ROAD RESTRAINT SYSTEMS (VEHICLE AND PEDESTRIAN)

NG 401 General

1 The specialist responsible for the design of the road furniture should identify the performance characteristics required to protect each hazard within the scheme. A schedule of these factors should be placed on the Drawings or within Appendices 4/1 or 4/7 as appropriate.

2 In accordance with the requirements of IS EN 1317-5, manufacturers must incorporate CE marking on their products, defining the performance characteristics for which the product has been certified. Reference should be made to IS EN 1317-5 to establish the full requirements of the submission, which include details of the system, its components, constituent materials, performance testing, production controls, product traceability, durability assessment, applicable site conditions, installation and site testing requirements.

3 Certification is granted to a particular manufacturer for a specific product. If a supplier sources the same product from more than one manufacturer, then separate certification is required for each source.

4 The positioning of a road restraint system can be affected by the location of drains, cables etc within the verge or central reserve. This is of particular relevance on the approaches to structures where the approach barrier or transition may be affected by chambers for services in the bridge deck.

5 In many cases there will not be an optimum position for the road restraint system and a wide range of Set-backs could be used. The specialist responsible for the design of the road furniture, however, should always identify one location for the road restraint system and state this in Appendix 4/1. Care should be taken to ensure that the Set-back identified does not unduly restrict the selection of road restraint system. If the Contractor proposes a road restraint system which requires a different Set-back, the Contractor's specialists must undertake any redesign required in order that this system can be installed satisfactorily.

6 The interaction of a particular barrier system with the particular ground conditions at an individual location requires specific assessment. This is addressed by the requirement for an independent Chartered Engineer to certify the appropriateness of the proposed site testing regime for the particular barrier system in the particular ground conditions. In addition, modifications affecting the performance of the road restraint system also require assessment. This is also addressed by the requirement for an independent Chartered Engineer, in this case to certify the compliance of the modification with Annex A of IS EN 1317-5. In order for any independent certification procedure to be of value it is essential that all proposed independent Chartered Engineers are listed as specialists in the contract schedule and required to provide at least €2M Professional Indemnity Insurance cover.

NG 403 Durability

1 One of the requirements for certification under IS EN 1317-5 is that the manufacturer submits a formal assessment of the anticipated durability of the product. A copy of this assessment should be provided with the product and should be reviewed by the Employer's Representative relative to the stated durability requirements.

NG 406 Installation

Installation Description

1 It is a requirement of IS EN 1317-5 that detailed descriptions of the installation requirements are provided by the manufacturer, and it is very important that these are readily available to all relevant parties on site. These must be carefully adhered to, to ensure that the system is installed on site in the same manner as when it was certified.

Handling and Storage

2 Handling and storage arrangements should be appropriate to the materials concerned. Requirements for the most common materials, coated steel and precast concrete are referenced specifically, but the general requirement applies equally to other materials.

Layout

3 The intended location of the road restraint systems should be defined by the specialists responsible for the design of the road furniture in accordance with the requirements and guidance contained in the NRA DMRB and general good design. The specification then permits a maximum deviation from the designed location in order to achieve satisfactory performance and appearance.

Concrete Foundations and Anchor Blocks

4 Concrete foundations and anchor blocks perform a vital component of safety barrier systems and must be constructed appropriately in accordance with the system manufacturer's requirements and general good practice. In particular if concrete foundations are placed within filter material it is essential for the correct function of both the drain and the foundation that concrete grout loss is prevented.

Cutting of components

5 The layout of road restraint systems needs to be considered in the full knowledge of both the hazards to be protected and other obstacles to the correct installation of the system. It is not acceptable simply to select a system and then make site adjustments to fit it the particular circumstances encountered on site. Such an approach will almost certainly compromise the performance of the road restraint system. Where special, non-standard components are required these should be identified prior to ordering of the restraint system, appropriate details agreed with the manufacturer and special components prepared in the factory.

Installation

6 As the requirements for each road restraint system differ, it is vital, to ensure that the system will perform as specified, that those installing the system have been provided with adequate training particular to the specific system. This training shall be provided by the specific system manufacturer.

NG 407 Site Testing

Anchorages in Drilled Holes

1 The anchorage test results should be included with the as-built records.

System

2 The manufacturer should provide a schedule of testing for the road restraint system to demonstrate its correct installation. This should be sufficiently detailed to provide a high degree of assurance that the system will perform in a satisfactory manner.

Ground Conditions

3 All safety barrier systems inclusive of transitions ultimately transfer the impact force into the ground and as such rely on ground conditions being compatible with the system design in order to perform to their designed criteria. It is vital that the performance of a safety barrier is not compromised in service through the provision of inadequate ground conditions. IS EN 1317-5 requires that the manufacturer provides a description of the ground conditions required for the system to perform as certified. Consequently, testing shall be undertaken to demonstrate that the ground conditions are compatible with the selected barrier system. The nature of the testing will obviously depend on the type and form of the barrier and it is therefore important that the safety barrier manufacturer specifies the testing.

4 Some barrier systems include knock down posts which are held in post sockets, with the intention that the posts be replaced within the same socket following impact. Experience has shown that the most common ground conditions related failure is for these sockets to become dislodged or mis-aligned during impact, such that they are no longer suitable to receive the replacement post. To overcome this, a requirement has been included to demonstrate that the sockets remain serviceable following collapse of the post.

NG 408 Anchorages and Attachment Systems for Surface Mounted Posts

1 Many road restraint systems rely on anchorage details, be it of tensioned beams, tensioned ropes or attachment systems for surface mounted posts. Where the road restraint system relies on a tensioned beam or rope, which will inevitably lose tension following an impact, it is essential that the length of barrier which is temporarily unserviceable is kept to a reasonable minimum. The specified intermediate anchorage requirements are intended to set a minimum criteria in this regard.

2 In most cases the anchorage details will form part of the certified road restraint system, while in others, particularly in the case of surface mounted posts, alternative anchorage details may be permissible provided they meet certain performance criteria. Anchorages for securing surface mounted posts which utilise drilled holes have been known to fail due to either a lack of cleanliness of the hole or the excess tolerance in the size of the hole. The manufacturer of the anchorages should provide details of the maximum tolerances permitted and the evidence should be submitted to the Employer's Representative. Such evidence should show that the anchorages perform satisfactorily when installed in holes having these tolerances. With the introduction of bonded anchorage details it is especially important that the manufacture provides full details of the system and its correct installation and testing.

NG 410 Temporary Safety Barriers

1 Temporary safety barriers can be provided by:

(i) The Contractor as part of Temporary Works and remaining his property.

(ii) The Contractor but becoming the property of the Road Authority on completion of the Works.

(iii) The Road Authority for the Contractor's use during the Works.

Appendix 4/1 should state which of the above applies, and where appropriate, details of locations from which the barriers can be collected and/or returned.

NG 411 Terminals and Transitions

1 IS ENV 1317-4, which relates to Terminals and Transitions, has not been formally implemented, but a sufficient number of terminal details have now been developed and tested in accordance with this voluntary standard that it is now considered appropriate for terminals to be specified in these terms. In particular full height terminals have been developed and tested in accordance with this standard that offer significant safety benefits over ramped terminal on the upstream ends of safety barriers. The specialist responsible for the design of the road furniture should identify the performance characteristics required for each specific safety barrier terminal location. A schedule of these factors should be placed on the Drawings or within Appendix 4/3.

NG 412 Provision of Information, Training, Materials and Equipment

1 The Employer or other body which will be responsible for the maintenance of the road restraint system may require the provision of user installation/maintenance manuals and a stock of materials and equipment to be retained in store for maintenance purposes. Training of maintenance staff may also be required for road restraint systems which have not previously been installed on the road network. Where this is the case, the compiler should provide a schedule in Appendix 4/4 indicating which materials are required as well as the system types for which manuals and training are not required.

NG 413 Pedestrian Restraint Systems

1 The type and the location of pedestrian restraint systems should be described in Appendix 4/2.

NG 415 Bespoke Vehicle Parapets

1 The need for bespoke vehicle parapets may arise, inter alia, for bridges over the railway, where particular safety criteria apply, for heritage structures where particular aesthetic criteria may apply or in urban areas where traffic speeds are low and aesthetic criteria may apply. Wherever possible road restraint systems tested in accordance with IS EN 1317 should be used in these circumstances and only as the last resort should a bespoke vehicle parapet be provided.

NG SAMPLE APPENDIX 4/1: SAFETY BARRIERS

Sheet 1

1. The locations of safety barriers are shown on Drawings Nos …… *[generally the 1:500 or 1:1000 Site Plans].*

2. The performance criteria for the safety barriers are shown on the above drawings/scheduled in the following table. *[Delete as appropriate.]*

3. Schedule of Safety Barriers

Barrier Ref No	Start Chainage of LoN	End Chainage of LoN	Hazard Information				Barrier Type	Single/ Double Sided	Safety Barrier Performance Criteria			
			Hazard Description	Hazard Chainage	Location	Drawing Reference			Containment Level	Impact Severity Level	Working Width	Set-back

[Safety barriers with different performance criteria within a continuous length should be split into sections such that the performance criteria for each section are unique. Alternatively, the safety barriers on a scheme may be assigned categories each of which defines the performance criteria for that type of fence. The table should identify the performance criteria for each section of safety barrier at each barrier location or of each barrier type.
Where a Length of Need comprises many short lengths of barrier with different performance criteria (for example at lighting columns in a central reserve), standard details should be provided on the Drawings and each combination of barriers given a reference. This barrier reference should then be entered in the table once only for each length of combined barrier. There is no need to indicate each length of each type of safety barrier but performance criteria should be stated for all barriers in the combination (e.g. W6/W4/W3, H2/N2 etc.).
Barrier types will normally be indicated where:

1. *the In-situ Concrete Barrier is to be used; or*
2. *there are exceptional and overriding reasons for specifying a particular barrier type.*

In the latter case, the agreement of the National Roads Authority is required before particular barrier types are included in the Schedule of Safety Barriers.
The Compiler should indicate the Working Width required as an absolute value (e.g. W6) and not as a range of acceptable values.
The Start and Finish Chainages shall be derived from the Approach and Departure Lengths which have been determined in accordance with NRA TD 19 and the Designer's risk assessment of the level of protection required.]

4. Temporary Safety Barriers

   [Note to compiler: State here:]

   (i) Who is to provide temporary safety barriers.

   (ii) Location for removal of temporary safety barriers on completion of the Works.

   (iii) Location(s) from which temporary safety barriers are to be collected and returned by the Contractor if provided by the Employer.

   (iv) Who is to own the temporary safety barriers on completion of the Works.

5. Other Details [to be included as required]

   a) Any special details which are shown on the Drawings and have been designed by the specialist with responsibility for the design of the road furniture.

   b) Any special requirements for setting out details.

   c) Details of testing requirements and frequency of testing not covered already within the Specification.

   d) Any special testing requirements for anchorages in drilled holes.

   e) Any other relevant details.

NG SAMPLE APPENDIX 4/2: PEDESTRIAN RESTRAINT SYSTEMS

[Note to compiler: Details should be given here of locations and type of pedestrian restraint systems required. Cross-reference may be made to the drawings where appropriate.]

NG SAMPLE APPENDIX 4/3: Safety Barrier Terminals

[Note to compiler: . Include here:]

1. The locations of safety barrier terminals are shown on Drawings Nos …… *[generally the 1:500 or 1:1000 Site Plans].*

2. The performance criteria for the safety barrier terminals are shown on the above drawings/scheduled in the following table. *[Delete as appropriate.]*

3. Schedule of Safety Barrier Terminals

Barrier Ref No	Upstream Terminal					Downstream Terminal						
	Performance Class P(1,4)	Impact Severity Level	Permanent Lateral Displacement Class		Exit Box Class Z(1,2,3,4)	Performance Class	Impact Severity Level	Permanent Lateral Displacement Class		Exit Box Class Z(1,2,3,4)	Ramp down Y/N	Flared Y/N
			X(1,2,3)	Y(1,2,3,4)								

Each length of permanent safety barrier listed in Appendix 4/1 should be cross referenced here providing details of both the upstream and downstream terminal performance requirements.

NG SAMPLE APPENDIX 4/4: Safety Barrier Maintenance

[Note to compiler: Where required by the Employer, the compiler should include a schedule of:

(i) Installation and/or maintenance manuals for each barrier and terminal type;

(ii) Any materials which are to be provided for maintenance purposes;

(iii) Special items of equipment etc required for the installation, testing, maintenance and demolition of the safety barriers and terminals.

The schedule should take account of the barrier and terminal types specified (if any) and the overall length of each barrier type. The schedule should generally include sufficient length of safety barrier (and components) to allow for the replacement of at least 50m of each safety barrier type or 5% of the overall length of each barrier type installed on that contract. At least one terminal and transition of each type should also be provided. However, reference should be made to the National Roads Authority and the body responsible for maintaining the barriers for replacement materials requirements. Manuals and training should normally be provided for all safety barriers.

Where a scheme is anticipated to be maintained by more than one maintenance body, the schedule should identify which barriers and terminals are provided to the individual maintenance depots. The schedule should also state where the barriers, terminals and components should be delivered to. An entry in the schedule for the safety barrier to be provided to a particular maintenance depot may be as follows.]

Barrier Materials for Maintenance

Barrier Information				**Barrier Quantity to be Supplied for Maintenance**			**Provision of Information, Training etc.**		**Address for Delivery**
Barrier Type	Containment Rating	Impact Severity	**Working Width**	**Barrier Length**	**Transitions**	**Other Items**	**Manuals**	**Training**	
N/A	N2	A	**W6**	**55m**	**1 No. (N2-H2)**	**1 No. set of tools for installation**	**2 No.**	**1 No. course for 5 operatives**	**XXX Depot XXX**

Terminal Materials for Maintenance

Terminal Information						**Terminals Quantity to be Supplied for Maintenance**		**Provision of Information, Training etc**		**Address for Delivery**
Terminal Type	**Performance Class P(1,4)**	**Impact Severity Level**	**Permanent Lateral Displacement Class**		**Exit Box Class**	**Number**	**Other Items**	**Manuals**	**Training**	
			X(1,2,3)	**Y(1,2,3,4)**	**Z(1,2,3,4)**					
N/A	**P4**	**A**	**X2**	**Y2**	**Z1**	**5**	**1 No. set of tools for installation**	**2 No.**	**1 No. course for 5 operatives**	**XXX Depot XXX**

NG SAMPLE APPENDIX 4/5: Anti-Glare Screens

[Note to compiler: Include here:]

The locations of anti-glare screens are shown on Drawings Nos …… *[generally the 1:500 or 1:1000 Site Plans].*

[Include location details, preferably by chainage reference together with any specific performance requirements here.]

NG SAMPLE APPENDIX 4/6: SAFETY BARRIERS : NRA ROAD CONSTRUCTION DETAILS

[Note to Compiler: List the relevant 400 Series RCD's, ensuring to include those listed below where the scope of works includes concrete barriers]

Clause No.	**Road Construction Detail Drg. No.**
409.1	RCD/400/2, 3-5, and 7.
411.3	RCD/400/3.

NG SAMPLE APPENDIX 4/7: VEHICLE PARAPET SYSTEMS

[Note to compiler: This should list the following and cross-refer to Appendix 1/5 and Appendix 1/11 as necessary:]

1 The locations of Vehicle Parapet Systems are shown on Drawings Nos …… *[generally the 1:500 or 1:1000 Site Plans].*

2 The performance classes for the Vehicle Parapet Systems are shown on the above drawings/ scheduled in the following table. *[Delete as appropriate]*

3 Schedule of Vehicle Parapet Systems

Structure Ref No	Length of Vehicle Parapet	Height of Vehicle Parapet	Vehicle Parapet Type	Vehicle Parapet Performance Criteria		
				Containment Level	Impact Severity Level	Working Width

[Vehicle Parapet type will normally be indicated where:

1. A bespoke vehicle parapet system is to be used; or

2. there are exceptional and overriding reasons for specifying a particular vehicle parapet type.

In the latter case, the agreement of the National Roads Authority is required before particular vehicle parapet types are included in the Schedule of Vehicle Parapet Systems.

The Compiler should indicate the Working Width required as an absolute value (e.g. W6) and not as a range of acceptable values.]

4 Other Details *[to be included as required]*

a) Any special details which are shown on the Drawings and have been designed by the specialist with responsibility for the design of the road furniture.

b) Any special requirements for setting out details.

c) Details of testing requirements and frequency of testing not covered already within the Specification.

d) Any special testing requirements for anchorages in drilled holes.

e) Any other relevant details.

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