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Note on S04 VRS (vehicle restraint systems – crash barrier) and S27 bridge parapet heights.

1. On day 16 of the public inquiry, in relation to S04, during cross examination of Susan Tilbrook the Inspector asked which regulations stipulated the placement of VRS barriers in relation to the railway.

2. Ms Tilbrook responded that the requirements are set out in technical design guidance rather than regulations. This guidance is within the Design Manual for Roads and Bridges (DMRB) Volume 2, Section 2, Part 8, TD 19/06 Requirement for Road Restraint Systems. An extract from TD 19/06 (paragraph 4.37 and figure 3-5), which shows the layout of barriers is shown in Appendix A.

3. On day 21 of the public inquiry, in relation to S27, during cross examination of Susan Tilbrook the Inspector asked what the height of a bridge parapet should be over the railway.

4. Guidance is from TD 19/06 (paragraph 4.23) which is shown in Appendix B.

5. From this paragraph, it can be seen that the required height of a parapet pertaining to a bridge over a railway is 1.5m.

Appendix A

Extracts from TD 19/06 pertaining to VRS issue

VOLUME 2 **HIGHWAY STRUCTURES: DESIGN (SUBSTRUCTURES AND SPECIAL STRUCTURES) MATERIALS**

SECTION 2 **SPECIAL STRUCTURES**

PART 8

TD 19/06

REQUIREMENT FOR ROAD RESTRAINT SYSTEMS

SUMMARY

This Standard describes the procedures to be followed by the various parties involved in the design and provision of various types of Road Restraint Systems. It also introduces a risk based framework to support designers in making optimal design choices at specific sites.

INSTRUCTIONS FOR USE

1. Remove Contents pages from Volume 2 and insert new Contents pages for Volume 2 dated August 2006.

2. Remove the following documents from Volume 2 which are superseded by this Standard and archive as appropriate:

   BA 48/93, Volume 2, Section 2
   BD 52/93, Volume 2, Section 3
   TA 45/85, Volume 2, Section 2
   TD 19/85, Volume 2, Section 2
   TD 32/93, Volume 2, Section 2

3. Insert TD 19/06 into Volume 2, Section 2, Part 8.

4. Please archive this sheet as appropriate.

Note: A quarterly index with a full set of Volume Contents Pages is available separately from The Stationery Office Ltd.

(v) Masonry on the front face of the parapet may have an irregular surface finish subject to the maximum amplitude of the steps and undulations in the surface not exceeding 30 mm when measured with respect to a plane through the peaks. This plane must be flat for straight vehicle parapets and curved to follow the nominal vehicle parapet curvature for vehicle parapets which are curved on plan.

(vi) Uncoursed work, where it is impractical to provide reinforcing mesh, shall only be permitted where there is a low probability of detached masonry presenting a hazard to the public. Uncoursed work shall not be permitted on the front face of the parapet.

Stone or Precast Concrete Copings

4.36 Stone or precast concrete copings to the top of vehicle parapets must only be used with vehicle parapets of concrete construction where the permitted speed is 30 mph or less. Where they are used, the copings must be secured to the concrete backing by fixings capable of resisting at the ultimate limit state a horizontal force of 33 kN per metre of coping.

Additional Requirements for Vehicle Parapets Over or Adjacent to Railways

General

4.37 A safety barrier must be provided on each approach end of the vehicle parapet and on each departure end to prevent a vehicle from reaching the railway below. The length of safety barrier as stated in Chapter 3 Paragraphs 3.30 to 3.33 is the minimum to be provided and must be increased if, based on the RRRAP, it is considered that a significant risk still exists from a vehicle leaving the highway at a greater distance from the bridge and continuing to the railway.

Height of Parapets

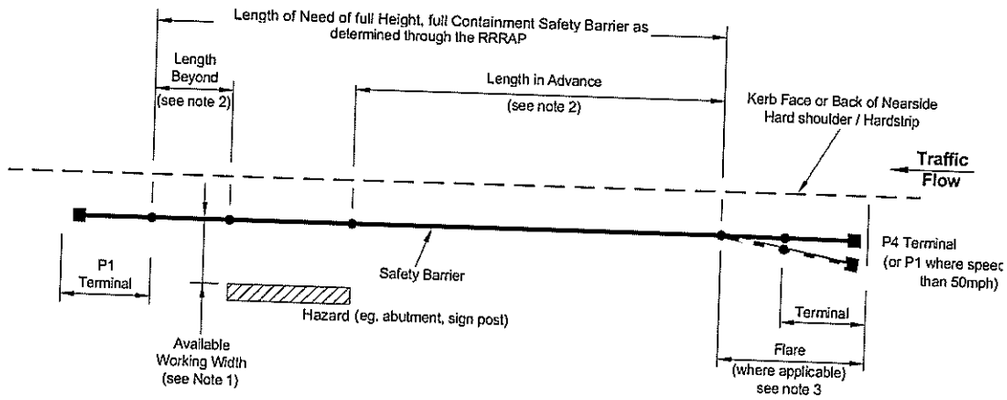
4.38 Where it is necessary to increase the height of a 1500 mm high parapet tested to BS EN 1317 to 1800 mm for an automated railway or where there is a vandalism problem, the additional height may be provided by the use of a suitable additional non-participating structural extension to the parapet (which is not designed to participate in containment and redirection of the vehicle, but is designed not to become detached under impact). This non-participating extension must be designed and constructed such that it is compatible with and not detrimental to the performance of the parapet system to which it is attached. Details of proposals for the non-participating extension and parapet system must be forwarded to the Overseeing Organisation for their consideration as a Departure from Standard.

Infilling of Parapets

4.39 The requirements for infilling vehicle parapets on bridges or structures over or adjacent to railways are given in BS 6779-1 and this Chapter. Where reference is made in these documents to "where electrification is likely" this must denote electrification included within the Railway Authority's Investment Programme current at the time when the vehicle parapet provision is being considered.

4.40 Where metal vehicle parapets of open construction are provided they must have infill for railway applications in accordance with Chapter 8 of BS 6779-1.

4.41 Toeholds on the traffic face are not prohibited where pedestrians are excluded by Statutory Order. Panelling may therefore be attached behind the horizontal members in this situation.



Notes:
1. At hazards (e.g. structures, sign post, etc) the Working Width Class shall not be greater than that which can be wholly contained within the available Working Width.
2. Refer to Paragraphs 3.26 to 3.29 and Table 3-1.
3. Flare only provided where required by Manufacturer's system, e.g. to maintain set-back to terminal.
4. See Figure 3-4 and Paragraphs 3.21 to 3.23 for details of Set-back requirements.

Figure 3-5 Verge Safety Barrier Layout Adjacent to Hazards

Appendix B

Extracts from TD 19/06 pertaining to parapet heights

required. Their form and design must be agreed with the Overseeing Organisation, Technical Approval Authority and the appropriate planning authority and will be subject to a Departure from Standards.

4.22 Guidance on the appearance of parapets is given in the Overseeing Organisation's documents 'The Appearance of Bridges and Other Highway Structures', 'The Design and Appearance of Bridges', (**BA 41**) and TRL's Highways Report HR5 'Improved Appearance of Bridge Parapets'.

Height of Parapets

4.23 The height of vehicle parapets must be measured above the adjoining paved surface and must not be less than the following:

1000 mm	–	For vehicle parapets except as below
1250 mm	–	For all bridges and structures over railways carrying motorways, or roads to motorway standards, from which pedestrians, animals, cycles and vehicles drawn by animals are excluded by order
1500 mm	–	For all other bridges and structures over railways, except as below
1400 mm	–	For cycleways immediately adjacent to the vehicle parapet
1500 mm	–	For accommodation bridges
1500 mm	–	For very high containment level applications
1800 mm	–	For bridleways or equestrian usage immediately adjacent to the vehicle parapet
1800 mm	–	For automated railways and where there is a known vandalism problem over railways

4.24 Special conditions at particular sites may require higher vehicle parapets; these cases should be identified in the RRRAP and the required provision agreed with the Overseeing Organisation. See also Paragraph 4.38 relating to height of parapets over railways.

4.25 In order to discourage the stationing of vehicles with their wheels close to the vehicle parapet, a raised verge with a kerb must be provided behind the edge of the hardshoulder, hardstrip or carriageway. The dimensions of kerbs and raised verges at parapets are given in **HA 83 [DMRB 4.2.4]** and **TD 27 [DMRB 6.1.2]** respectively. The adjoining paved surface and verge must fall away from the parapet and towards the top of the kerb to prevent water and salt build up at the base of the parapet which may have a detrimental effect on the parapet or its foundation or fixings.

4.26 It is recommended that the gradient should be in the region of 1 in 20 (5%), but not more than 1 in 10 (10%) or less than 1 in 40 (2.5%) except where pedestrians are excluded from the verge when the maximum gradient may be increased to 1 in 5 (20%). At the ends of the bridge, where the road does not have a continuous kerb, the kerb and verge must slope down gradually to the level of the paved surface on the bridge approaches.

4.27 Where metal parapets are proposed, the Design Organisation should consider the need for a 50 – 100 mm plinth upstand. This upstand defines the deck edge from a drainage point of view and has benefits where pedestrians have access.