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Transport Infrastructure Ireland

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The Design of Concrete Highway Bridges and Structures - Use of BS 5400: Part 4: 1990

AM-STR-06027

June 2014

AM Asset Management & Maintenance

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NRA MCDRW prior to the launch of TII Publications, the NRA document reference used previously is listed above under 'historical reference'. The TII Publication Number also shown above now supersedes this historical reference. All historical references within this document are deemed to be replaced by the TII Publication Number. For the equivalent TII Publication Number for all other historical references contained within this document, please refer to the TII Publications website.

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Volume 3 Section 5
Part 6
NRA BD 24/14

The Design of Concrete Highway Bridges and Structures Use of BS 5400: Part 4: 1990

June 2014

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Summary:

This standard which covers the The Design of Concrete Highway Bridges and Structures Use of BS 5400: Part 4: 1990 has been superseded by the Eurocodes but may be used for Assessment purposes.

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VOLUME 3 **HIGHWAY STRUCTURES: INSPECTION AND MAINTENANCE**

SECTION 5 **STANDARDS AND ADVICE NOTES SUPERSEDED BY THE EUROCODES BUT REQUIRED FOR ASSESSMENT**

PART 6

NRA BD 24/14

THE DESIGN OF CONCRETE HIGHWAY BRIDGES AND STRUCTURES USE OF BS 5400: PART 4: 1990

Contents

1. IMPLEMENTATION

General

1.1 The Design of Concrete Highway Bridges and Structures Use of BS 5400: Part 4: 1990 has been superseded by the Eurocodes (for Design), but may still be required in the Assessment of an existing structure. Refer to '*NRA TB 4 The Structural Eurocodes'* for further information in this regard.

1.2 This NRA BD 24 shall only be used as referenced from an Assessment Standard contained within Section 4 of Volume 3 of the NRA DMRB.

2. USE OF BS 5400: PART 4: 1990

General

2.1 The design of all concrete bridges and other road structures which are funded by the National Roads Authority shall be carried out in accordance with BS 5400: Part 4: 1990 as amended by this Standard. Where reference is made to any Part of BS 5400, this shall be taken as a reference to that Part as implemented by the National Roads Authority.

2.2 The amendments to BS 5400: Part 4 which are necessary to meet the National Roads Authority's requirements are given in Annex A to this Standard. The amendments are listed under the relevant clause numbers of BS 5400: Part 4. Annex A is technically identical to the Interim Advice Note (IAN5) issued by the UK Highways Agency in July 1996.

Additional Requirements

2.3 The clauses in BS 5400: Part 4: 1990 that are expressed in the form of recommendations using the word "should" are to be considered as mandatory.

2.4 Where reference is made in BS 5400: Part 4 to the relevant or appropriate "Bridge Authority", this shall be taken to be both the National Roads Authority and the Local Authority responsible for roads and bridges.

2.5 For the serviceability limit state requirements of prestressed concrete members given in Clause 4.2.2 of BS 5400: Part 4:-

a) The following shall be considered to be lightly trafficked structures:

i. accommodation bridges;

ii. bridleway bridges;

iii. foot/cycle track bridges.

b) All members shall be checked as being in Class 2 for load combinations 2 to 5.

3. ENQUIRIES

3.1 All technical enquiries or comments on this document, or any of the documents listed as forming part of the NRA DMRB, should be sent by e-mail to infoDMRB@nra.ie, addressed to the following:

Head of Network Management, Engineering Standards & Research
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……...
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Head of Network Management,
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ANNEX A: AMENDMENTS TO BS 5400: PART 4: 1990

A.1. The following is a list of amendments to BS 5400: Part 4: 1990 necessary to meet the National Roads Authority's requirements:

Page 3 Contents, Figures 5. Delete "stress".

Page 10 Clause 4.2.2. Delete "Where type HB loading is to be taken into account, only 25 units should be considered", and substitute the following:

"Live loading should generally comprise Type HA only. However, for transverse cantilever slabs, transversely and two-way spanning slabs and central reserves, the loading shall be in accordance with the composite version of BS 5400: Part 2 Clause 6.4.3 (Appendix A of BD 37 (DMRB 1.3)) except that only 30 units of HB loading shall be considered in any notional lane."

Page 12 Clause 4.7. Delete paragraph beginning "For unwelded reinforcement …", and substitute:

"For unwelded reinforcing bars, the effective stress range under load combination 1 for the serviceability limit state under HA loading only, shall be limited to the following values:

SPANS	**bars ≤ 16mm dia**	**bars > 16mm dia**
less than 3.5m	280 N/mm^2	220 N/mm^2
3.5 – 5m	250 N/mm^2	190 N/mm^2
5m – 10m	195 N/mm^2	150 N/mm^2
10m – 200m	155 N/mm^2	120 N/mm^2
200m and greater	250 N/mm^2	190 N/mm^2

Alternatively, the fatigue life may be determined in accordance with BS 5400: Part 10 using the following parameters for the σ_r-N relationship:

bars ≤16mm dia; m = 9, $K_2 = 0.75 \times 10^{27}$
bars >16mm dia; m = 9, $K_2 = 0.07 \times 10^{27}$

A fatigue check is not required for the local effects of wheel loads applied directly to a slab spanning between beams or webs provided that the following conditions are met:

(i) the clear span to overall depth ratio of the slab does not exceed 18;
(ii) the slab acts compositely with its supporting beams or webs;
(iii) either (a) the slab acts compositely with transverse diaphragms or (b) the width of the slab perpendicular to its span exceeds three times its clear span.

The effective stress range to be used in fatigue assessment should be obtained by adding 60% of the range from zero stress to maximum compressive stress to that part of the range from zero stress to maximum tensile stress."

Page 16 Table 6. Cold reduced steel wire, characteristic strength: delete "485" and substitute "460".

Page 17 Clause 5.3.2.2. Delete clause.

Page 18 Clause 5.3.3.2. Last paragraph: delete "bonding" and substitute "bending".

Page 24 Clause 5.5.3.3. Delete clause.

Page 26 Clause 5.5.6. Add at end of clause:
"In calculating the ultimate shear capacity of a circular column, the area of longitudinal reinforcement A_s to be used to calculate v_c shall be taken as the area of reinforcement which is in the half of the column opposite the extreme compression fibre. The effective depth shall be taken as the distance from the extreme fibre with maximum compression to the centroid of this reinforcement. The web width shall be taken as the column diameter."

Page 28 Clause 5.8.2. Third paragraph: after "given in Table 13" add "for precast concrete and the values given in Table 13 increased by 10mm for cast in-situ concrete,".

Page 31 Clause 5.8.6.6. First paragraph, (e): add "(See 7.3.2.3)". Third paragraph: delete "in (c) and (d)" and substitute, "in (c), (d) and (e)".

Clause 5.8.6.7. First paragraph: reposition last sentence "The length of the lap … compression reinforcement." in new paragraph at end of Clause.

Page 38 Clause 6.3.3.2. Delete clause.

Page 48 Clause 7.3.2.1 (d). Delete "threading of bars" and substitute "parallel threading of bars and tapered threads".

Clause 7.3.2.3 (a). Delete "The" and substitute "Parallel".

Before paragraph beginning "Where there is a risk …" add "d) Taper threaded bars may be joined by the use of internally taper threaded couplers".

Delete last paragraph beginning "The structural design of special threaded connections …", and substitute:

"The structural design of threaded connections should be based on tests in accordance with 5.8.6.6, including behaviour under fatigue conditions where relevant. Where tests have shown the strength of the threaded connection to be greater than or equal to the characteristic strength of the parent bars, the strength of the joint may be based on the specified characteristic strength of the joined bars divided by the appropriate γ_m factor."

Page 49 Clause 7.3.3. Last paragraph, beginning "For cement mortar joints…", delete "1.5N/mm^2" and substitute "2.5N/mm^2".

Page 52 Clause 7.5.5. In the definition of n_w delete "load per unit load" and substitute "load per unit length".

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