DS/EN 1993-2 DK NA:2015

National Annex to

Eurocode 3: Design of steel structures
Part 2: Bridges

Preface

The implementation of Eurocodes has involved the preparation of

- National Annexes to the bridge-specific Eurocodes
- Addenda to National Annexes for bridge-specific sections in Eurocodes for loads.

Together with the basic Eurocodes, including the related national annexes, these constitute the codes of practices to be applied in the design of bridges in Denmark.

Scope

This National Annex sets out the conditions for implementation of EN 1993-2.

Contents

This National Annex contains the national choices that apply in Denmark.

The national choices may be in the form of current national values, a choice between several methods or addition of supplementary guidance.

In connection with the national choices, the national annexes may refer to Banedanmark's Railway Standards (e.g. BN1-59) or Danish Road Directorate's Road Standards.

Reference may also be made to the infrastructure manager (IF). IF is the authority which has ownership and/or holds maintenance responsibility for a road bridge or for a railway bridge. Examples of IFs include the Danish Road Directorate, local authorities, Banedanmark and regional railway providers.

In addition, the National Annex includes an overview of all the items where it has been possible to make a national choice.

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Items for which a national choice has been made

Page	Item	Subject	National choice
12	2.1.3.2 (1)	Design working life.	The recommended value of 100 years is used for footbridges, but for road bridges and railway bridges, it shall be 120 years, see A2.1.1 (1) in DS/EN 1990/A1 DK NA.
16	3.6 (1)	Other bridge components, expansion joints, vehicle parapets, etc.	As vehicle parapet, CE marked vehicle parapets shall be used which comply with the requirements of the Road standards. For special bridges and long bridges ($L \geq 200$ m), the infrastructure manager may decide to use higher and stronger vehicle parapets in accordance with DS/EN 1317.
19	5.4.1 (1)	Analysis method for determining shear forces.	Plastic analysis methods can be used to determine shear forces for accidental design situations if the preconditions for such have been met (including cross section class and rotation capacity).
20	6.1 (1)P	Partial coefficients on the material side.	$\gamma_{M0} = 1.10\ \gamma_3\ \gamma_0$ $\gamma_{M1} = 1.20\ \gamma_3\ \gamma_0$ $\gamma_{M2} = 1.35\ \gamma_3\ \gamma_0$ $\gamma_{M3} = 1.35\ \gamma_3\ \gamma_0$ $\gamma_{M3,ser} = 1.20\ \gamma_3\ \gamma_0$ $\gamma_{M4} = 1.20\ \gamma_3\ \gamma_0$ $\gamma_{M5} = 1.20\ \gamma_3\ \gamma_0$ $\gamma_{M6,ser} = 1.10\ \gamma_3\ \gamma_0$ $\gamma_{M7} = 1.20\ \gamma_3\ \gamma_0$ In respect of γ_3 and γ_0, see DS/EN 1993-1-1 and -1-8 DK NA. For accidental and seismic design situations: $\gamma_{Mi} = 1.00$ (i = 0, 1, 2, 3, 3_{ser}, 4, 5, 6_{ser}, 7). Note: Use of strict control requires independent 3rd party tests of materials and execution, see DS/EN 1990 DK NA.
21	6.2.2.5 (1)	Consideration of the effects of local buckling for class 4 cross sections.	Method 1 is chosen.
32	8.1.3.2.1 (1)	Injection bolts.	Use of injection bolts may be permitted in special cases subject to agreement with the infrastructure manager.
33	8.1.6.3 (1)	Hybrid connections.	Hybrid connections are not permitted in permanent bridge structures
34	8.2.1.5 (1)	Plug welds.	Plug welds are not permitted in bridge structures.
35	8.2.10 (1)	Eccentrically loaded single-sided fillet welds.	Single-sided fillet welds are not permitted in bridge structures. In this connection, partial penetration welds are not considered as fillet welds. Regardless of the design of the connection, the moment impact from the eccentricity shall be included.
37	9.3 (1)P	Partial coefficient of fatigue loads, γ_{Ff}.	For determination of γ_{Ff}, see DS/EN 1990 Annex A1/A2 DK NA.
37	9.3 (2)P	Partial coefficient of fatigue strength, γ_{Mf}.	Determination of γ_{Mf}: Assessment method CC2 CC3 Damage tolerance 1.00 1.15 Safe life I 1.15 1.35 Safe life II 1.54 1.88 The values for safe life I assume that a visual inspection is made for cracks at least every six years and any fatigue cracks in the relevant member will not be able to cause a random failure and generally compromise the overall safety.
38	9.4.1 (6)	Alternative procedures based on fatigue stress ranges.	Reference is made to DS/EN 1991-2 DK NA.
42	9.5.2(5)	Choice of design life t_{Ld}	Reference is made to DS/EN 1990/A1 DK NA.
44	9.5.3 (2)	Damage equivalence factor, λ, for railway bridges.	Table 9.4, column with 25t Mix is used for main tracks and TEN sections. Table 9.3 is used for all other sections. Main tracks and TEN sections are defined in Railway Standard BN1-59.
52	A.3.3 (1)P	Anchorage of bearings, partial coefficients of friction.	The following partial coefficient is used: $\gamma_\mu = 2.00$ for all materials
59	A.4.2.1 (4)	$\Delta T\gamma$ and ΔT_0.	For ΔT_γ, $\pm 5^oC$ is used. For ΔT_0, the values in table A4 are used.
72	C.1.2.2 (1)	Thickness of deck plates and stiffeners.	The recommended values can be applied on the condition that the surfacing is included in a documented composite action with the deck plate.
74	C1.2.4	Welds connecting deck plate and	The connection shown shall not be made as a double fillet weld where the web

Page	Item	Subject	National choice
		web plate.	plate butt up to the deck plate and where traffic loads come directly from above. The connection shall be made as a fully or partially penetrated weld without throat thickness.
86	C3.3 Table C4 7)	Trough-fitted piece is placed against trough with steel backing.	The weld may not be carried out as shown. A double V-weld with root gap 2-5 mm and less than 1 mm gap between fitted piece and backing.
87	C3.3 Table C4 8) and 9)	Piece between trough and cross beam.	Gap shall be made as $s \leq 1.0$ mm. A fully or partially penetrated weld with root defect < 2mm shall be made if $s > 1$ mm.

Overview of possible national choices

The following overview shows the places where a national choice is possible and which informative annexes that apply/do not apply. Moreover, it is specified where a national choice has been made.

Page	Item	Subject	Comment
12	2.1.3.2 (1)	Design working life.	National choice specified.
12	2.1.3.3 (5)	Additional recommendations for durable joints.	No national choice.
12	2.1.3.4 (1)	Robustness and structural integrity.	No national choice.
12	2.1.3.4 (2)	Choice of design method for the assessment of fatigue.	No national choice.
13	2.3.1 (1)	Actions and impacts not included in EN 1991.	No national choice.
14	3.2.3 (2)	Fracture toughness, toughness of base material.	No national choice.
14	3.2.3 (3)	Fracture toughness for bridge components under compression.	No national choice.
14	3.2.4 (1)	Thickness properties.	No national choice.
16	3.4 (1)	Cables and other tension elements, cable types.	No national choice.
16	3.5 (1)	Bearing type.	No national choice.
16	3.6 (1)	Other bridge components, expansion joints, vehicle parapets, etc.	National choice specified.
16	3.6 (2)	Other bridge components, surfacing system.	No national choice.
17	4 (1)	Durability, requirements for supervision and maintenance access.	No national choice.
17	4 (4)	Durability, guidelines regarding elements which may not be inspected.	No national choice.
18	5.2.1 (4)	Guidelines regarding criterion for first order analyses.	No national choice.
19	5.4.1 (1)	Analysis method for determining shear forces.	National choice specified.
20	6.1 (1)P	Partial coefficients on the material side.	National choice specified.
21	6.2.2.3 (1)	'Shear lag effect' in ULS	No national choice.
21	6.2.2.5 (1)	Consideration of the effects of local buckling for class 4 cross sections.	National choice specified.
24	6.3.2.3 (1)	Lateral buckling curves.	No national choice.
25	6.3.4.2 (1)	Simplified method for buckling and lateral buckling.	No national choice.
26	6.3.4.2 (7)	Simplified method for buckling and lateral buckling.	No national choice.
28	7.1 (5)	Functional requirements in the serviceability situation.	No national choice.
29	7.3 (1)	Limitations for stress	No national choice.
29	7.4 (1)	Limit where check for 'web breathing' is not required.	No national choice.
32	8.1.3.2.1 (1)	Injection bolts.	National choice specified.
33	8.1.6.3 (1)	Hybrid connections.	National choice specified.
34	8.2.1.4 (1)	Butt welds.	No national choice
34	8.2.1.5 (1)	Plug welds.	National choice specified.
34	8.2.1.6 (1)	Flare groove welds (fillet welds along round steel bars).	No national choice.
35	8.2.10 (1)	Eccentrically loaded single-sided fillet welds.	National choice specified.
35	8.2.13 (1)	Analysis of structural joints	No national choice.

Page	Item	Subject	Comment
		connecting H- and I-sections.	
35	8.2.14 (1)	Analysis of structural joints connecting hollow sections.	No national choice.
36	9.1.2 (1)	Fatigue assessment, road bridges.	No national choice.
36	9.1.3 (1)	Fatigue assessment, railway bridges.	No national choice.
37	9.3 (1)P	Partial coefficient of fatigue loads, γ_{Ff}.	National choice specified.
37	9.3 (2)P	Partial coefficient of fatigue strength, γ_{Mf}.	National choice specified.
38	9.4.1 (6)	Alternative procedures based on fatigue stress ranges.	National choice specified.
41	9.5.2 (2	Damage equivalence factor, λ, for road bridges, determination of sub-factor λ_1.	No national choice.
42	9.5.2 (3)	Damage equivalence factor, λ, for road bridges, determination of sub-factor λ_2.	No national choice.
42	9.5.2 (5)	Determination of design life t_{Ld}.	National choice specified.
42	9.5.2 (6)	Damage equivalence factor, λ, for road bridges, determination of sub-factor λ_4.	No national choice.
43	9.5.2 (7)	Damage equivalence factor, λ, for road bridges, determination of λ_{max}	No national choice.
44	9.5.3 (2)	Damage equivalence factor, λ, for railway bridges.	National choice specified.
44	9.5.3 (2)	Damage equivalence factor, λ, for railway bridges on special sections.	No national choice.
47	9.6 (1)	Exclusion of particular details for bridges included in EN 1993-1-9.	No national choice.
47	9.6 (1)	Supplementary guidance for fatigue of deck plates.	No national choice.
48	9.7 (1)	Post-weld treatment.	No national choice
50	Annex A (informative)	Technical specifications for bearings.	Annex A applies as an informative annex with the following amendments.
52	A.3.3 (1)P	Anchorage of bearings, partial coefficients of friction.	National choice specified.
53	A.3.6 (2)	Resistance to movement.	No national choice.
57	A.4.2.1 (2)	Guidance on temperature measurements.	No national choice.
59	A.4.2.1 (3)	ΔT_0 for steel bridges.	No national choice.
59	A.4.2.1 (4)	$\Delta T\gamma$ and ΔT_0.	National choice specified.
62	A.4.2.4 (2)	Accidental design situations related to bearings.	No national choice.
66	Annex B (informative)	Technical specifications for expansion joints for road bridges.	Annex B applies as an informative annex
70	Annex C (informative)	Recommendations for the structural detailing of steel bridge decks.	Annex C applies as an informative annex with the following amendments.
70	C.1.1 (2)	General technical information.	No national choice.
72	C.1.2.2 (1)	Thickness of deck plates and stiffeners.	National choice specified.
73	C.1.2.2 (2)	Requirements for minimum stiffness of longitudinal stiffeners.	No national choice.
74	C1.2.4	Welds connecting deck plate and web plate.	National choice
86	C3.3 Table C4 (7)	Trough-fitted piece is placed against trough with steel backing.	National choice
87	C3.3 Table C4, 8) and 9)	Piece between trough and cross beam.	National choice
91	Annex D (informative)	Buckling lengths and geometrical	Annex D applies as an informative annex

Page	Item	Subject	Comment
		imperfections.	
101	Annex E (informative)	Recommendations for the structural detailing of steel bridge decks.	Annex E applies as an informative annex with the following amendments.
102	E.2 (1)	Combination factor.	No national choice.

Note: No national choice implies that a recommendation in the code of practice is observed.