SLOVENSKI STANDARD
SIST EN 1992-1-2:2005/A1:2019

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Evrokod 2: Projektiranje betonskih konstrukcij - 1-2. del: Splošna pravila - Projektiranje požarnovarnih konstrukcij

Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

Eurocode 2: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

Eurocode 2 : Calcul des structures en béton - Partie 1-2 : Règles générales - Calcul du comportement au feu

Ta slovenski standard je istoveten z: EN 1992-1-2:2004/A1:2019

ICS:

13.220.50	Požarna odpornost gradbenih materialov in elementov	Fire-resistance of building materials and elements
91.010.30	Tehnični vidiki	Technical aspects
91.080.40	Betonske konstrukcije	Concrete structures

SIST EN 1992-1-2:2005/A1:2019 en,fr,de

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1992-1-2:2004/A1

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ICS 91.010.30; 91.080.40

English Version

Eurocode 2: Design of concrete structures - Part 1-2: General rules - Structural fire design

Eurocode 2 : Calcul des structures en béton - Partie 1-2 : Règles générales - Calcul du comportement au feu

Eurocode 2: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1-2: Allgemeine Regeln - Tragwerksbemessung für den Brandfall

This amendment A1 modifies the European Standard EN 1992-1-2:2004; it was approved by CEN on 8 March 2019.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Contents

European foreword

This document (EN 1992-1-2:2004/A1:2019) has been prepared by Technical Committee CEN/TC 250 “Structural Eurocodes”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

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1 Modification of 4.2.1(1)

Replace existing NOTE 2 in paragraph (1) of 4.2.1 with the following new NOTE 2:

"NOTE 2 Tabulated data for the fire design of slender reinforced columns in braced and unbraced systems is given in Annex C.".

2 Modification of 5.3.3(1)

Delete the following sentence in paragraph (1) of 5.3.3:

"Further information is given in Annex C.".

3 New Annex C

Replace the existing Annex C with the following:

"

Annex C
(informative)

Buckling of columns under fire conditions

(1) The tables in this annex provide information for assessing columns with rectangular cross section in braced or unbraced structures giving the maximum permissible slenderness ratio under fire conditions, $\lambda_{fi,max}$. The slenderness ratio in the fire situation is $\lambda_{fi} = l_{0,fi} / i$, where the effective column length, $l_{0,fi}$, is defined by the actual length of the column, l, and the support conditions under fire conditions.

The effective length in fire $l_{0,fi}$ may be taken as the effective length l_0 in ambient conditions in all cases. For braced building structures where the required standard fire exposure is higher than 30 min and the column is continuous through a slab that provides fire separation, the effective length $l_{0,fi}$ may be taken as 0,5 l for intermediate floors and 0,5 $l \leq l_{0,fi} \leq$ 0,7 l for the upper floor. Intermediate values of $l_{0,fi} / l$ may be chosen depending of the actual moment restraints at the supports under fire conditions. For unbraced structures $l_{0,fi}$ should be taken as the lesser of $2l$ or l_0 in ambient conditions.

The radius of gyration i is shown in Figure C.1.

The tables are valid for the range of thermal conductivity between the lower and upper limit given in 3.3.3. The column slenderness λ_{fi} is limited to values ≤ 55.

(2) The following parameters are needed to use the tables in this annex:

h, b dimensions of column cross section, $b \leq h$

A_c cross sectional area of column, $A_c = b \times h$

n_{fi} load ratio:

$$n_{fi} = \frac{N_{Ed,fi}}{\left(\dfrac{A_c \times f_{cd}}{\alpha_{cc}}\right) + 2 \times \text{Min}\left(A_{sc,e} ; A_{st,e}\right) \times f_{yd}} \quad \text{(C.1)}$$

ω modified mechanical reinforcement ratio:

$$\omega = \frac{2 \times \text{Min}\left(A_{sc,e} ; A_{st,e}\right) \times f_{yd}}{\dfrac{A_c \times f_{cd}}{\alpha_{cc}}}$$

$A_{sc,e}$ and $A_{st,e}$ are defined in (3).

e_N modified, total first order eccentricity of the normal force, $N_{Ed,fi}$, see Figure C.1. However, $e_N \geq e_0$, see EN 1992-1-1:2004, 6.1(4)

a axis distance of the main bars

$N_{Ed,fi}$ design axial load in the fire condition

$M_{0Ed,fi}$ design first order moment in the fire condition

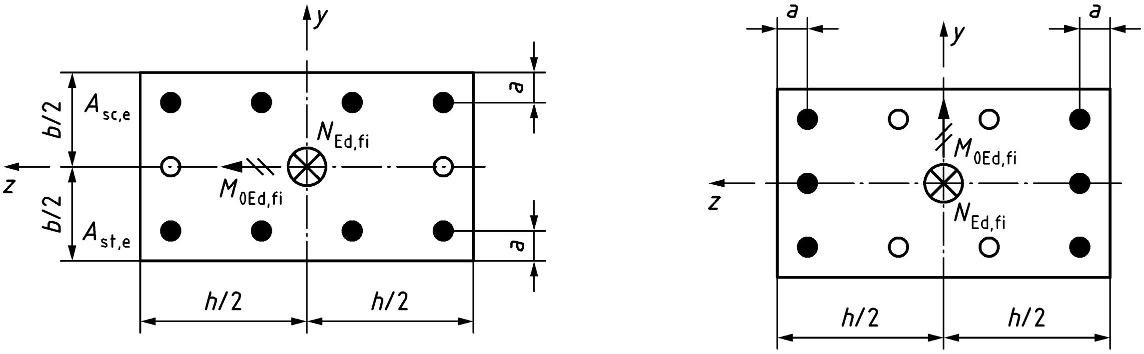
The tables are not applicable for $f_{ck} > 50$ MPa. The reference dimension for the cross section in the tables is always the smaller cross section dimension b.

(3) $A_{sc,e}$ is the cross-sectional area of the reinforcement at the distance a from the most compressed side of the column and $A_{st,e}$ is the cross-sectional area of the reinforcement at the distance a from the least compressed side of the column. Other reinforcing bars in the cross section are disregarded.

Buckling around *y*-axis and *z*-axis should be examined. The tables may be used for buckling around both the *z*-axis and the *y*-axis as defined in Figure C.1. They may also be used for rectangular cross sections with asymmetric reinforcement arrangement. For buckling around both the *z*-axis or the y-axis, the smaller dimension *b* should be used as the parameter in the tables.

For buckling around the *y*-axis, the actual first order eccentricity of the normal force in the fire condition may be reduced by the factor b/h. Using the tables, e_N always is at least 20 mm.

For columns with asymmetric reinforcement arrangements, the minimum values of $A_{sc,e}$ and $A_{st,e}$ shall be used.



a) Buckling around z-axis:

$$e_N = \frac{M_{0Ed,fi}}{N_{NEd,fi}};$$

$$i = \frac{b}{\sqrt{12}}$$

b) Buckling around y-axis:

$$e_N = \frac{b}{h} \times \frac{M_{0Ed,fi}}{N_{NEd,fi}} \geq 0,5 \frac{M_{0Ed,fi}}{N_{NEd,fi}}$$

$$i = \frac{h}{\sqrt{12}}$$

Key

○ reinforcing bars to be disregarded

● reinforcing bars

Figure C.1 — Rectangular cross sections

(4) For rectangular cross sections the minimum number of reinforcing bars in each A_{sc} and A_{st} is given in Table C.1.

Table C.1 — Minimum number of reinforcing bars

ω	Minimum dimension of column section, *b*					
	600 mm	500 mm	400 mm	300 mm	250 mm	200 mm
0,1	3	3	3	2	2	2
0,2	3	3	3	2	2	2
0,5	3	3	3	2	2	2
1,0	5	4	3	2	2	2

(5) In accordance with EN 1992-1-1:2004, 4.4.1.2(3) the axis distance for the reinforcing bars in the cross section shall fulfil $a \geq 1,5\phi_{sl}$, where ϕ_{sl} is the bar diameter.

(6) When using the tables within this annex, linear interpolation is permitted.

Table C.2 — Maximum permissible slenderness ratio under fire conditions for braced and unbraced columns: R30

R30	*b* (mm)		600			500			400			300			250			200		
	n_{fi}		0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6
	e_N (mm)	*a* (mm)	$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$		
ω = 0,1	20	25	55	55	52	55	55	50	55	55	47	55	50	40	55	47	35	55	42	28
	20	45	55	55	55	55	55	55	55	55	55	55	55	49	55	55	44	55	49	36
	20	65	55	55	55	55	55	55	55	55	55	55	55	55	55	55	48	55	46	37
	20	85	55	55	55	55	55	55	55	55	55	55	55	55	55	54	47	54	44	
	50	25	55	55	46	55	54	42	55	50	36	54	39	21	49	32		40	18	
	50	45	55	55	55	55	55	52	55	55	45	55	47	27	55	38		47	19	
	50	65	55	55	55	55	55	55	55	55	51	55	51	31	55	38		43		
	50	85	55	55	55	55	55	55	55	55		55	47	28	52	33		37		
	100	25	55	48	32	55	42	22	52	33		35			21					
	100	45	55	55	41	55	51	29	55	40		45			30					
	100	65	55	55	47	55	55	33	55	43					28					
	100	85	55	55		55	55	32	55	39					22					

R30	b (mm)		600			500			400			300			250			200		
	n_{fi}		0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6
	e_N (mm)	a (mm)	$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$		
$\omega = 0,2$	20	25	55	55	54	55	55	52	55	55	48	55	53	40	55	50	36	55	44	28
	20	45	55	55	55	55	55	55	55	55	55	55	55	51	55	55	45	55	51	36
	20	65	55	55	55	55	55	55	55	55	55	55	55	55	55	55	48	55	47	36
	20	85	55	55	55	55	55	55	55	55	55	55	55	54	55	54	45	55	42	34
	50	25	55	55	47	55	55	43	55	54	37	55	43	21	55	36		50	22	
	50	45	55	55	55	55	55	55	55	55	47	55	52	29	55	43		55	24	
	50	65	55	55	55	55	55	55	55	55	54	55	55	32	55	40		48		
	50	85	55	55	55	55	55	55	55	55	51	55	47	26	55	31		38		
	100	25	55	53	33	55	47	24	55	38		48			37					
	100	45	55	55	44	55	55	33	55	47		55	18		48			23		
	100	65	55	55	51	55	55	38	55	51		55			45					
	100	85	55	55		55	55	35	55	43		52			28					

R30	b (mm)		600			500			400			300			250			200		
	n_{fi}		0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6
	e_N (mm)	a (mm)	$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$		
ω = 0,5	20	25	55	55	55	55	55	53	55	55	50	55	55	40	55	54	35	55	47	28
	20	45	55	55	55	55	55	55	55	55	55	55	55	53	55	55	47	55	55	37
	20	65	55	55	55	55	55	55	55	55	55	55	55	55	55	55	48	55	47	33
	20	85	55	55	55	55	55	55	55	55	55	55	55	51	55	51	39	54	36	25
	50	25	55	55	49	55	55	45	55	55	38	55	47	20	55	40		55	27	
	50	45	55	55	55	55	55	55	55	55	52	55	55	33	55	50		55	32	
	50	65	55	55	55	55	55	55	55	55	55	55	55	36	55	46		55		
	50	85	55	55	55	55	55	55	55	55	51	55	47	19	55	26		34		
	100	25	55	55	35	55	54	25	55	46		55	22		55			45		
	100	45	55	55	50	55	55	40	55	55	15	55	33		55			51		
	100	65	55	55	55	55	55	46	55	55	14	55	31		55					
	100	85	55	55	55	55	55	39	55	50		55			30					

R30	b (mm)		600			500			400			300			250			200		
	n_{fi}		0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6	0,2	0,4	0,6
	e_N (mm)	a (mm)	$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$			$\lambda_{fi,max}$		
ω = 1,0	20	25	55	55	55	55	55	55	55	55	49	55	55	39	55	55	34	55	49	25
	20	45	55	55	55	55	55	55	55	55	55	55	55	55	55	55	48	55	55	37
	20	65	55	55	55	55	55	55	55	55	55	55	55	55	55	55	48	55	47	31
	20	85	55	55	55	55	55	55	55	55	55	55	55	47	55	48	33	49	27	
	50	25	55	55	53	55	55	47	55	55	38	55	49	17	55	42		55	29	
	50	45	55	55	55	55	55	55	55	55	55	55	55	35	55	55	16	55	37	
	50	65	55	55	55	55	55	55	55	55	55	55	55	39	55	50		55		
	50	85	55	55	55	55	55	55	55	55	51	55	46		55	16		22		
	100	25	55	55	39	55	55	27	55	50		55	25		55			55		
	100	45	55	55	55	55	55	46	55	55	22	55	42		55			55		
	100	65	55	55	55	55	55		55	55	25	55	41		55			23		
	100	85	55	55	55	55	55		55	53		55			26					