SLOVENSKI STANDARD

SIST EN 40-3-1:2001

01-april-2001

Drogovi za razsvetljavo - Del 3-1: Projektiranje in preverjanje - Specifikacija za značilne obtežbe

Lighting columns - Part 3-1: Design and verification - Specification for characteristic loads

Lichtmaste - Teil 3-1: Bemessung und Nachweis - Charakteristische Werte der Lasten

Candélabres d'éclairage public - Partie 3-1: Conception et vérification - Spécification pour charges caractéristiques

Ta slovenski standard je istoveten z: EN 40-3-1:2000

ICS:

91.160.20	Zunanja razsvetljava stavb	Exterior building lighting
93.080.40	Cestna razsvetljava in pripadajoča oprema	Street lighting and related equipment

SIST EN 40-3-1:2001 en

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 40-3-1

February 2000

ICS 91.160.20

Will supersede EN 40-6:1982

English version

Lighting columns - Part 3-1: Design and verification - Specification for characteristic loads

Candélabres d'éclairage public - Partie 3-1: Conception et vérification - Spécification pour charges caractéristiques

This European Standard was approved by CEN on 11 December 1999.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 40-3-1:2000 E

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 50 "Lighting columns and spigots", the secretariat of which is held by BSI.

This European Standard replaces EN 40-6:1982.

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of an identical text or by endorsement, at the latest by August 2000, and conflicting national standards shall be withdrawn at the latest by August 2000.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

There are six Parts to this standard as follows:

Part 1: Definitions and terms

Part 2: General requirements and dimensions

Part 3-1: Design and verification - Specification for characteristic loads
Part 3-2: Design and verification - Verification by testing
Part 3-3: Design and verification - Verification by calculation

Part 4: Specification for reinforced and prestressed concrete lighting columns

Part 5: Specification for steel lighting columns

Part 6: Specification for aluminium lighting columns

1 Scope

This European Standard specifies design loads for lighting columns. It applies to post top columns not exceeding 20 m height for post top lanterns and to columns with brackets not exceeding 18 m height for side entry lanterns. Special structural designs to permit the attachment of signs, overhead wires, etc. are not covered by this standard.

The requirements for lighting columns made from materials other than concrete, steel or aluminium (for example wood, plastic and cast iron) are not specifically covered in this standard.

This standard includes performance requirements for horizontal loads due to wind. Passive safety and the behaviour of a lighting column under the impact of a vehicle are not included, this group of lighting columns will have additional requirements (see prEN 40-2:1999).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

ENV 1991-2-4 Eurocode 1: Basis of design and actions on structures - Part 2-4: Wind action

3 Basis of loads

3.1 Dead loads

The masses of the brackets and the lanterns shall be taken into consideration.

3.2 Wind pressures

3.2.1 *General*

The characteristic wind pressure q(z), in N/m^2, for any particular height above ground, z, shall be obtained from the following equation:

$$q(z) = \delta \times \beta \times f \times Ce_{(z)} \times q_{(10)}$$

where:

$q_{(10)}$	is the reference wind pressure given in 3.2.2
δ	is a factor depending on the column size, and given in 3.2.3
β	is a factor depending on the dynamic behaviour of the column given in 3.2.4
f	is a topography factor and given in 3.2.5
$Ce_{(z)}$	is a factor depending on the terrain of the site and the height above ground z, and given in 3.2.6

NOTE 1. $q_{(10)}$, f and $Ce_{(z)}$, are based on the principles of ENV 1991-2-4.

NOTE 2. The equivalent dynamic factor Cd described in ENV 1991-2-4 is currently not finalized. It is extremely complex to use for lighting columns and it gives a lower value than the product β x δ.
So, the δ and β factors have been retained for simplicity and security.

3.2.2 Reference wind pressure $q_{(10)}$

The value of $q_{(10)}$ accounts for the geographical location of the lighting column. It is derived from the reference wind velocity V_{ref} (in m/s) using the following equation:

$$q_{(10)} = 0,5\, \rho\, (C_s)^2\, V_{ref}^2 \text{ N/m}^2$$

where

V_{ref} is defined as the 10 minutes mean wind velocity at 10 m above ground of terrain category II (see Table 1) having an annual probability of exceedence of 0,02 (commonly referred to as having a mean return period of 50 years).

V_{ref} is given by:

$$V_{ref} = C_{ALT}\, V_{ref,o}$$

$V_{ref,o}$	is the basic value of the reference wind velocity at 10 m above sea level obtained from the wind maps referred to in annex A;
C_{ALT}	is an altitude factor to be taken as 1,0 unless specified in annex A Where topography is significant (i.e. when a value of f other than unity is used) then the altitude shall be taken at the base of the topographic feature and not at the level of the site of the column.

ρ is the air density. The air density is affected by altitude and depends on the temperature and pressure to be expected in the region during wind storms. Unless otherwise specified in annex A, the value of ρ shall be taken as 1,25 kg/m³.

C_s is a factor to convert V_{ref} from an annual probability of exceedence of 0,02 to other probabilities, and can be derived from the equation given in annex A. For lighting columns the normal requirement is for a mean return period of 25 years for which the factor C_s should be taken as $\sqrt{0,92}$.

3.2.3 Factor for column size δ

The greater the size of a surface subject to wind, the more unlikely it is that the maximum pressure, on which the calculation is based, acts over its full area.

The resultant smaller wind load on a component is taken into account by the factor δ dependent on the size of the area.

The ruling dimension for the size of the area subject to the wind is the greatest dimension in one direction.

For a lighting column, this is the nominal height in metres.

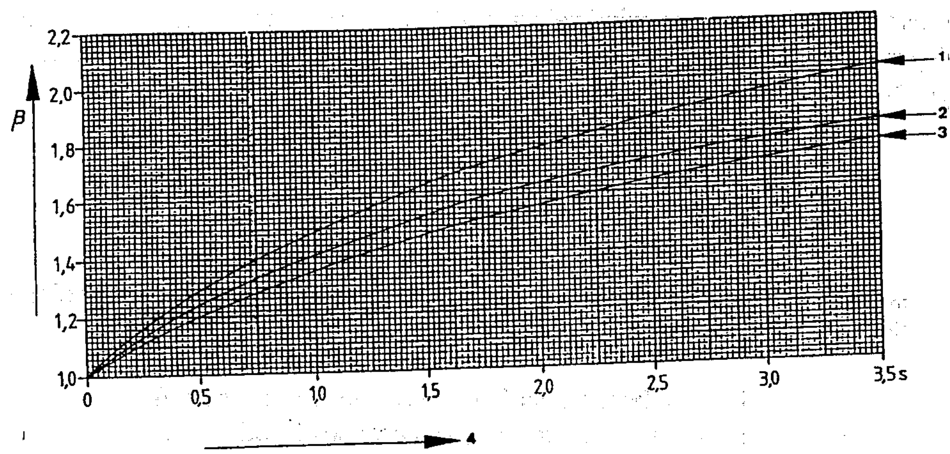
The value of the factor δ shall be obtained from the equation:

$$\delta = 1 - 0,01\,h$$

3.2.4 Factor for dynamic behaviours of lighting column β

The factor β is dependent upon the basic period of vibration T and the damping of the "column/lantern" system and takes into account the increase in the load resulting from the dynamic behaviour of the lighting column cause by wind gusts.

The period of vibration T in seconds for the determination of β in accordance with Figure 1 shall be obtained either by calculation or by testing.



Key

1 Metal
2 Prestressed concrete
3 Reinforced concrete
4 Period of vibration (T)

Figure 1 - Coefficient β for the dynamic behaviour of columns

3.2.5 Topography factor f

The topography factor f shall be taken as 1 unless otherwise specified. Where a slope height is specified f shall be taken as 1 where the height does not exceed 5 m.

Where the height exceeds 5 m f shall be calculated in accordance with annex B.

3.2.6 *Exposure coefficient* $Ce_{(z)}$

The exposure coefficient accounts for variation of wind pressure with respect to height above ground and depends on terrain category.

The appropriate terrain category for the location of the lighting column shall be decided on the basis of Table 1.

Table 1 - Description of terrain category

Category	Description
I	Rough open sea. Lakeshore with at least 5 km fetch upwind. Smooth flat country without obstacles.
II	Farmland with boundary hedges, occasional small farm structures, houses or trees.
III	Suburban or industrial areas and permanent forests
IV	Urban areas in which at least 15 % of the surface is covered with buildings and their average height exceeds 15 m.

For any particular height of consideration and terrain category, the value of exposure coefficient $Ce_{(z)}$ shall be taken either from Table 2 or Figure 2 whichever is considered more convenient.

NOTE 1. For installation on bridges, the height z is measured from the water or ground level over which the bridge is crossing.

NOTE 2. If the terrain category is not provided by the purchaser, the calculation should be carried out considering category II.

Table 2 - Exposure coefficient $Ce_{(z)}$

Height above ground (z) m	Terrain category			
	I	II	III	IV
20	3,21	2,81	2,28	1,72
19	3,17	2,77	2,24	1,69
18	3,14	2,74	2,20	1,65
17	3,10	2,70	2,16	1,60
16	3,07	2,66	2,11	1,56
15	3,03	2,62	2,07	1,56
14	2,98	2,57	2,02	1,56
13	2,94	2,52	1,96	1,56
12	2,89	2,47	1,91	1,56
11	2,83	2,41	1,85	1,56
10	2,78	2,35	1,78	1,56
9	2,71	2,29	1,71	1,56
8	2,64	2,21	1,63	1,56
7	2,57	2,13	1,63	1,56
6	2,48	2,04	1,63	1,56
5	2,37	1,93	1,63	1,56
4	2,35	1,80	1,63	1,56
3	2,09	1,80	1,63	1,56
2	1,88	1,80	1,63	1,56
1	1,88	1,80	1,63	1,56

$Ce_{(z)}$ is determined from the equation: $Ce_{(z)} = C_r^2(z) + 7\,k_r C_{r(z)}$

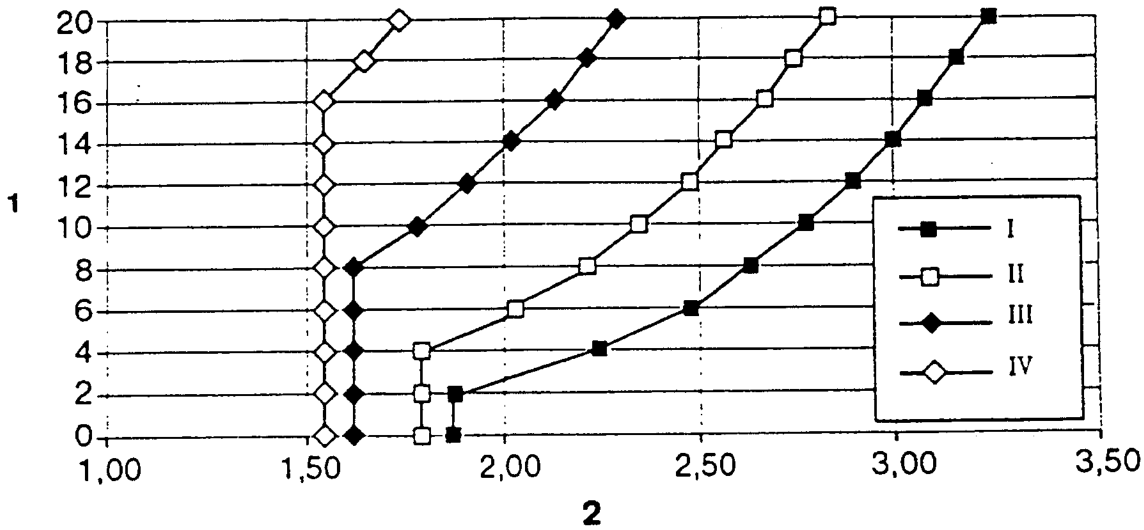
where $C_{r(z)} = k_r \ln (z/z_o)$ for $z_{min} \leq z \leq 200$ m

$= k_r\, l_n (z_{min}/z_o)$ for $z < z_{min}$

k_r, z_o, z_{min}, are given in Table 3, appropriate to each terrain category.

Table 3 - Values of k_r, z_o and z_{min}

Terrain category	I	II	III	IV
k_r	0,17	0,19	0,22	0,24
z_o (m)	0,01	0,05	0,3	1,0
z_{min} (m)	2	4	8	16



Key

1 Height, Z
2 Exposure Coefficient $Ce_{(z)}$

Figure 2 - Exposure coefficient $Ce_{(z)}$

3.3 Shape coefficient

3.3.1 Shape coefficient for columns and brackets with circular cross-sections

For circular cross-sections, the shape coefficient *c* shall be taken from curve a) in Figure 3.

3.3.2 Shape coefficient for columns and brackets with regular octagonal cross-sections

For regular octagonal cross-sections with an *r/D* ratio < 0,075, where *r* is the radius of corner and *D* is the distance across flats, the shape coefficient *c* shall be taken from curve b) in Figure 3.

For regular octagonal cross-sections with an *r/D* ratio > 0,075, the shape coefficient *c* shall be taken from curve c) in Figure 3.

Where moments are calculated by dividing the assembly into sections not exceeding 2 m in height, the *r/D* ratio used to calculate the values of *c* shall be those at midpoint of each section.