NATIONAL ANNEX

TO

CYS EN 1996-3:2006 Eurocode 6: Design of masonry structures

Part 3: Simplified calculation methods for unreinforced masonry structures

Public Enquiry Draft

Period of Enquiry

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Readers are advised that this is a draft document and subject to change

Prepared by: Eurocodes Committee
Ministry of Interior / Technical Chamber of Cyprus

INTRODUCTION

This National Annex has been prepared by the Eurocodes Committee of the Technical Chamber of Cyprus which was commissioned by the Ministry of Interior of the Republic of Cyprus

NA 1 SCOPE

This National Annex is to be used together with CYS EN 1996-3:2006

This National Annex gives:

(a) Nationally determined parameters for the following clauses of CYS EN 1996-3:2006 where National choice is allowed (see Section NA 2)

- 2.3 (2)P
- 4.1 (P)
- 4.2.1.1 (1)P
- 4.2.2.3 (1)
- D.1(1)
- D.2(1)
- D.3(1)

(b) Decisions on the use of the Informative Annexes A, B and C (see Section NA 3)

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 2.3.(2) P Verification by the partial factor method

The relevant values of the partial factor for materials γ_M , given in clause 2.4.3 of EN 1996-1-1:2005, shall be used for the ultimate limit state for ordinary situations.

NA 2.2 Clause 4.1.(P) Design of unreinforced masonry walls using simplified methods - General

The overall stability of a building, of which the wall forms a part, shall be verified in accordance with 5.4(1) of EN1996-1-1:2005

NA 2.3 Clause 4.2.1.1 P Simplified calculation method for walls subjected to vertical and wind loading – General conditions for application

The numerical value to be ascribed to the symbol h_m shall be taken from the table bellow.

Class	1	2	3
h_m	20 m	16 m	12 m

NA 2.4 Clause 4.2.2.3 (1) Determination of design vertical load resistance of a wall – Capacity reduction factor

The minimum number of wall ties per m^2, $n_{tmin} = 2$

NA 2.5 Clause D.1 (1) Characteristic compressive strength

The characteristic compressive strength of masonry may be calculated using the clause 3.6.1.2 of EN 1996-1-1:2005, or from the tables bellow

Clay Units Group 1

f_b [N/mm²]	General purpose mortar				Thin joint	Light weight mortar		
	M2,5	M5	M10	M20		M2,5	M5	M10
2	1,2	1,4	1,4	1,4	1,2	0,6	0,7	0,7
4	1,9	2,4	2,7	2,7	2,0	1,0	1,3	1,5
6	2,5	3,1	3,8	4,1	2,6	1,4	1,7	2,1
8	3,1	3,8	4,7	5,4	3,2	1,7	2,1	2,6
10	3,6	4,5	5,5	6,8	3,8	2,0	2,4	3,0
12	4,1	5,1	6,2	7,7	4,3	2,2	2,8	3,4
16	5,0	6,2	7,6	9,4	5,2	2,8	3,4	4,2
20	5,9	7,3	8,9	11,0	6,1	3,2	4,0	4,9
25	6,9	8,5	10,4	12,9	7,1	3,8	4,6	5,7
30	7,8	9,6	11,9	14,6	8,1	4,3	5,3	6,5
50	11,2	13,8	17,0	20,9	11,6	6,1	7,5	9,3
75	14,9	18,3	22,5	27,7	11,6	8,1	10,0	12,3

Clay Units Group 2

f_b [N/mm²]	General purpose mortar				Thin joint	Light weight mortar		
	M2,5	M5	M10	M20		M2,5	M5	M10
2	1,0	1,1	1,1	1,1	1,1	0,5	0,6	0,6
4	1,6	1,9	2,2	2,2	1,8	0,9	1,1	1,2
6	2,1	2,6	3,1	3,3	2,5	1,2	1,4	1,7
8	2,5	3,1	3,8	4,4	3,0	1,4	1,7	2,1
10	3,0	3,7	4,5	5,5	3,5	1,6	2,0	2,5
12	3,4	4,2	5,1	6,3	4,0	1,9	2,3	2,8
16	4,1	5,1	6,3	7,7	4,9	2,3	2,8	3,5
20	4,8	5,9	7,3	9,0	5,7	2,7	3,3	4,1
25	5,6	6,9	8,5	10,5	6,7	3,1	3,9	4,7
30	6,4	7,9	9,7	12,0	7,6	3,6	4,4	5,4
50	9,2	11,3	13,9	17,1	10,8	5,1	6,3	7,7
75	12,2	15,0	18,4	22,7	10,8	6,8	8,3	10,2

Clay Units Group 3 and 4

f_b [N/mm²]	General purpose mortar				Thin joint		Light weight mortar		
	M2,5	M5	M10	M20	Group 3	Group 4	M2,5	M5	M10
2	0,7	0,9	0,9	0,9	0,8	0,6	0,4	0,5	0,5
4	1,2	1,5	1,7	1,7	1,3	1,1	0,7	0,9	1,0
6	1,6	2,0	2,4	2,6	1,8	1,6	0,9	1,1	1,4
8	2,0	2,4	3,0	3,4	2,1	2,0	1,1	1,4	1,7
10	2,3	2,8	3,5	4,0	2,5	2,5	1,3	1,6	2,0
12	2,6	3,2	4,0	4,6	2,8	2,9	1,5	1,8	2,3
16	3,2	4,0	4,9	5,6	3,5	3,7	1,8	2,3	2,8
20	3,8	4,6	5,7	6,5	4,1	4,5	2,1	2,6	3,2
25	4,4	5,4	6,6	7,7	4,8	5,4	2,5	3,1	3,8
30	5,0	6,1	7,6	8,7	5,4	6,3	2,8	3,5	4,3
50	7,1	8,8	10,8	12,4	7,7	9,7	4,1	5,0	6,2
75	9,5	11,6	14,3	16,5	7,7	9,7	5,4	6,7	8,2

Calcium silicate, aggregate concrete and autoclaved aerated concrete units Group 1

f_b [N/mm²]	General purpose mortar				Thin joint	Light weight mortar (not for calcium silicate units)		
	M2,5	M5	M10	M20		M2,5	M5	M10
2	1,2	1,4	1,4	1,4	1,4	1,0	1,1	1,1
4	1,9	2,4	2,7	2,7	2,6	1,6	1,9	2,2
6	2,5	3,1	3,8	4,1	3,7	2,1	2,6	3,1
8	3,1	3,8	4,7	5,4	4,7	2,5	3,1	3,8
10	3,6	4,5	5,5	6,8	5,7	3,0	3,7	4,5
12	4,1	5,1	6,2	7,7	6,6	3,4	4,2	5,1
16	5,0	6,2	7,6	9,4	8,4	4,1	5,1	6,3
20	5,9	7,3	8,9	11,0	10,2	4,8	5,9	7,3
25	6,9	8,5	10,4	12,9	12,3	5,6	6,9	8,5
30	7,8	9,6	11,9	14,6	14,4	6,4	7,9	9,7
50	11,2	13,8	17,0	20,9	22,2	9,2	11,3	13,9

Calcium silicate and aggregate concrete units Group 2

f_b [N/mm²]	General purpose mortar				Thin joint	Light weight mortar (not for calcium silicate units)		
	M2,5	M5	M10	M20		M2,5	M5	M10
2	1,0	1,1	1,1	1,1	1,1	1,0	1,1	1,1
4	1,6	1,9	2,2	2,2	1,7	1,6	1,9	2,2
6	2,1	2,6	3,1	3,3	2,3	2,1	2,6	3,1
8	2,5	3,1	3,8	4,4	2,8	2,5	3,1	3,8
10	3,0	3,7	4,5	5,5	3,3	3,0	3,7	4,5
12	3,4	4,2	5,1	6,3	3,7	3,4	4,2	5,1
16	4,1	5,1	6,3	7,7	4,5	4,1	5,1	6,3
20	4,8	5,9	7,3	9,0	5,3	4,8	5,9	7,3
25	5,6	6,9	8,5	10,5	6,2	5,6	6,9	8,5
30	6,4	7,9	9,7	12,0	7,0	6,4	7,9	9,7
50	9,2	11,3	13,9	17,1	10,1	9,2	11,3	13,8

Aggregate concrete units Group 3

f_b [N/mm²]	General purpose mortar				Thin joint
	M2,5	M5	M10	M20	
2	0,9	1,0	1,0	1,0	0,8
4	1,4	1,7	2,0	2,0	1,3
6	1,8	2,3	2,8	3,0	1,8
8	2,3	2,8	3,4	3,9	2,1
10	2,6	3,2	4,0	4,9	2,5
12	3,0	3,7	4,5	6,3	2,8
16	3,7	4,5	5,6	7,7	3,5
20	4,3	5,3	6,5	9,0	4,1
25	5,0	6,2	7,6	10,5	4,8
30	5,7	7,0	8,6	12,0	5,4
50	8,1	10,0	12,3	17,1	7,7

The use of the above tables is allowed taking into account that:

1) EN 998-2 gives no limit for the thickness of joints made of thin layer mortar; the values in the above tables are based on a thickness of 3 mm or less to ensure that the thin layer mortar has the enhanced properties required to achieve the given values.

2) The thickness of the masonry is equal to the width or length of the unit, so that there is no mortar joint parallel to the face of the wall through all or any part of the length of the wall.

3) The coefficient of variation of the strength of the masonry units is not more than 25 %.

4) Where action effects are parallel to the direction of the bed joints, the characteristic compressive strength may also be determined from the tables, using the normalised compressive strength of the masonry unit, fb, obtained from tests where the direction of application of the load to the test specimen is the same as the direction of the action effect in the masonry, but with the factor, δ, as given in Annex A of EN 772 not taken to be greater than 1,0. For Group 2 and 3 units, the value of fk obtained from the tables should be multiplied by 0,5.

5) For masonry made of general purpose mortar where Group 2 and Group 3 aggregate concrete units are used with the vertical cavities filled completely with concrete, the value of fb should be obtained by considering the units to be Group 1 with a compressive strength corresponding to the compressive strength of the units or of the concrete infill, whichever is the lesser.

6) When the perpendicular joints are unfilled, the tables may be used, with due consideration being given to any horizontal actions that might be applied to, or be transmitted by, the masonry.

7) For masonry made with general purpose mortar where there is a mortar joint parallel to the face of the wall through all, or any part, of the length of the wall, the values of fk can be obtained by multiplying the values given in the tables by 0,8.

NA 2.6 Clause D.2 (1) Characteristic flexural strength

The characteristic flexural strength of masonry may be calculated using the clause 3.6.3 (2) of EN 1996-1-1:2005, or from the tables bellow

Masonry unit	$f_{xk1,s}$ [N/mnm²]			
	General purpose mortar		Thin layer mortar	Light weight mortar
	< M5	≥ M5		
Clay	0,10	0,10	0,15	0,10
Calcium silicate	0,05	0,10	0,20	not used
Aggregate concrete	0,05	0,10	0,20	not used
Autoclaved aerated concrete	0,05	0,10	0,15	0,10

Masonry unit		$f_{xk2,s}$ [N/mnm²]			
		General purpose mortar		Thin layer mortar	Light weight mortar
		< M5	≥ M5		
Clay		0,20	0,40	0,15	0,10
Calcium silicate		0,20	0,40	0,30	not used
Aggregate concrete		0,20	0,40	0,30	not used
Autoclaved aerated concrete	$\rho < 400$ kg/m³	0,20	0,20	0,20	0,15
	$\rho \geq 400$ kg/m³	0,20	0,40	0,30	0,15

(1) Provided that thin layer mortar and light weight mortars are M5, or stronger;

(2) For masonry made with autoclaved aerated concrete units laid in thin layer mortar, f_{xk1} and f_{xk2} values may be taken from the above tables or from the following equations:

$f_{xk1,s} = 0{,}035\ f_b$, with filled and unfilled perpend joints;

$f_{xk2,s} = 0{,}035\ f_b$, with filled perpend joints or $0{,}025\ f_b$, with unfilled perpend joints.

NA 2.7 Clause D.3 (1) Characteristic initial shear strength

The characteristic initial shear strength of masonry $f_{vko,s}$, provided that general purpose mortars made according to EN1996-1 do not contain admixtures or additives, may be taken from the table bellow.

Masonry unit	$f_{vko,s}$ [N/mnm²]			
	General purpose mortar of Strength Class given		Thin layer mortar	Light weight mortar
Clay	M1 – M2 M2,5 – M9 M10 –M20	0,10 0,20 0,30	0,30	0,15
Calcium silicate	M1 – M2 M2,5 – M9 M10 –M20	0,10 0,15 0,20	0,40	0,15
Aggregate concrete Autoclaved aerated concrete	M1 – M2 M2,5 – M9 M10 –M20	0,10 0,15 0,20	0,30	0,15

NA 3 DECISION ON USE OF ANNEXES A, B, C AND D

NA 3.1 Annex A

Annex A may be used

NA 3.2 Annex B

Annex B should be used

NA 3.3 Annex C

Annex C may be used

NA 3.4 Annex D

Annex D should be used

NA 4 REFERENCES TO NON-CONTRADICTORY COMPLEMENTARY INFORMATION

None.