NATIONAL ANNEX TO CYS EN 1998-3:2005 (Including AC:2013)

Eurocode 8: Design of structures for earthquake resistance

Part 3: Assessment and retrofitting of buildings

CYPRUS ORGANISATION FOR STANDARDISATION

NATIONAL ANNEX

TO

CYS EN 1998-3:2005 (Including AC:2013)

Eurocode 8: Design of structures for earthquake resistance Part3: Assessment and retrofitting of buildings

This National Annex has been approved by the Board of Directors of the Cyprus Organisation for Standardisation (CYS) on 13.11.2020.

Note: EUROCODE APPLICATION FRAMEWORK FOR INTERVENTIONS IN EXISTING STRUCTURES (October 2020) is part of the National Annex.

INTRODUCTION

This National Annex has been prepared by the CYS TC 18 National Standardisation Technical Committee of Cyprus Organisation for Standardisation. (CYS)

NA 1 SCOPE

This National Annex is to be used together with CYS EN 1998-3:2005 including AC:2013. Any reference in the rest of this text to CYS EN 1998-3:2005 means the above document

This National Annex gives:

(a) Nationally determined parameters for the following clauses of CYS EN 1998-3:2005 where National choice is allowed (see Section NA 2)

- 1.1 (4)
- 2.1 (2)P
- 2.1 (3)P
- 2.2.1 (7)P
- 3.3.1 (4)
- 3.4.4 (1)
- 4.4.2 (1)P
- 4.4.4.5 (2)P
- A.4.4.2 (5)
- A.4.4.2 (9)

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

(c) References to non-contradictory complementary information to assist the user to apply CYS EN 1998-3:2005 (see Section NA 4). Eurocode Application Framework for interventions in Existing Structures. (attached)

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 1.1 (4) Scope of CYS EN 1998-3:2005

Informative Annex A, Informative Annex B and Informative Annex C of CYS EN 1998-3:2005 may be used as Informative Annexes.

NA 2.2 Clause 2.1 Fundamental requirements

(2)P Buildings of importance class IV (as defined in Table 4.3 of CYS EN 1998-1:2004) should be checked for all three Limit States defined in 2.1(1)P of CYS EN 1998-3:2005. For the other importance classes the number of limit states to be checked shall be agreed between the owner/owners and the designer.

(3)P The return periods specified for the various Limit States shall be agreed between the owner/owners and the designer. The protection normally considered appropriate for ordinary new buildings is considered to be achieved by selecting the following values for the return periods: 2.475 years, corresponding to a probability of exceedance of 2% in 50 years for the LS of Near Collapse (NC), 475 years, corresponding to a probability of exceedance of 10% in 50 years for the LS of significant Damage (SD), and 225 years, corresponding to a probability of exceedance of 20% in 50 years for the LS of Damage Limitation (DL).

NA 2.3 Clause 2.2.1 (7)P General

The values of the partial factors specified in clauses 5.2.4(3), 6.1.3(1), 7.1.3(1) and 9.6(3) of CYS EN1998-1:2004 and its national annex should be used in the calculation of strength capacities of brittle "primary seismic" elements.

NA 2.4 Clause 3.3.1 (4) Knowledge levels – Definition of knowledge levels

Table 3.1 (CYS) defines values for the symbols of Table 3.1 of CYS EN 1998-3:2005.

Table 3.1 (CYS): Recommended minimum requirements for different levels of inspection and testing

Knowledge Level	Geometry	Details	Materials	Analysis	CF
KL1	From original outline construction drawings with sample **visual** survey **or** from **full** survey	Simulated design in accordance with relevant practice **and** from **limited** in-situ inspection	Default values in accordance with standards of the time of construction **and** from **limited** in-situ testing	LF-MRS	1,35
KL2		From incomplete original detailed construction drawings with **limited** in-situ inspection **or** From **extended** in-situ inspection	From original design specifications with **limited** in-situ testing **or** from **extended** in-situ testing	ALL	1,20
KL3		From original detailed construction drawings with **limited** in-situ inspection **or** from **comprehensive** in-situ inspection	From original test reports with **limited** in-situ testing **or** from **comprehensive** in-situ testing	ALL	1,00

NA 2.5 Clause 3.4.4 (1) Definition of the levels of inspection and testing

Table 3.2 (CYS) provides the minimum values for the amount of inspection and testing to be used.

Table 3.2 (CYS): Recommended minimum requirements for different levels of inspection and testing

	Inspection (of details)	Testing (of materials)
	For each type of primary element (beam, column, wall):	
Level of inspection and testing	Percentage of elements that are checked for details	Material samples per floor
Limited	20	1
Extended	50	2
Comprehensive	80	3

NA 2.6 Clause 4.4.2 (1)P Lateral force analysis

The value of the ratio ρ_{max}/ρ_{min} is specified as 2,5.

NA 2.7 Clause 4.4.4.5 (2)P Procedure for estimation of torsional and higher mode effects

No reference to complementary non-contradictory information is made

NA 2.8 Clause A.4.4.2 Shear Strength

(5) The value defined for the partial factor for FRP debonding, γ_{fd}, is 1,5

(9) The value defined for the partial factor for FRP, γ_{fd}, is 1,5

NA 3 DECISION ON USE OF THE INFORMATIVE ANNEXES A AND B

NA 3.1 Annex A

Annex A may be used

NA 3.2 Annex B

Annex B may be used

NA 3.3 Annex C

Annex C may be used

NA 4 REFERENCES TO NON-CONTRADICTORY COMPLEMENTARY INFORMATION

Eurocode Application Framework for interventions in Existing Structures. Publication October 2020 (attached)

PART OF THE NATIONAL ANNEX
CYS EN 1998-3:2005(+AC:2013)

EUROCODE APPLICATION FRAMEWORK

FOR INTERVENTIONS IN EXISTING STRUCTURES

October 2020

CONTENTS

TABLES

1. SCOPE AND FIELD OF APPLICATION

1.1. Following the mandatory implementation of Eurocodes in Cyprus, since January 1st 2012, it became necessary to define the policy and framework to be followed for the assessment of seismic capacity of existing structures, the design of interventions and the introduction of new elements in existing structures to which horizontal or vertical additions are intended to be made.

1.2. This document, which was prepared by the Scientific and Technical Chamber of Cyprus (following an assignment of this task to the Chamber by the Ministry of Interior) and approved by the Ministry of Interior, is part of the National Annex of CYS EN1998-3:2005+AC:2013 and is aiming to become a tool for designers for the determination of seismic action in relation to what is mentioned in 1.1 above. Relevant to this, for the same purpose, is the Cyprus Standard CYS EN 1998 - 3 Eurocode 8: Design of Structures for Earthquake Resistance, Part 3: Assessment of Bearing Capacity and Retrofitting of Buildings.

2. CODIFICATION OF INTERVENTIONS IN EXISTING STRUCTURES

2.1 General

In paragraphs 2.2 and 2.3 below, the two main parameters that must be taken into account for the selection of the seismic design action, in cases of interventions in existing structures, are given.

2.2 Type of Intervention (Modification and/or Extension)

Regarding the type of intervention, there are two main cases as follows:

α) Horizontal Extension to an existing structure (with or without joint).

β) Vertical Extension (Extension of floor(s)) to an existing structure.

2.2.1. Horizontal Extensions

With regard to horizontal extensions to an existing structure, it is recommended to have a provision for the creation of a suitable seismic joint, so that the addition behaves as an independent structure. In this case, the addition is treated as if it were a new construction and its design is based on Eurocode CYS EN 1998 – 1, and it is not required to assess the existing structure. In case of absence of a suitable seismic joint, then the new construction shall be designed and dimensioned according to CYS EN 1998-1, while the parts of the existing structure affected by the new construction shall be assessed and retrofitted according to CYS EN1998 – 3 and to the basis of ground acceleration values given by this document (Tables A-1 to A-3).

2.2.2. Vertical Extensions

With regard to vertical extensions (e.g. floor(s) extension) the construction as a whole shall be considered as a single structure and the seismic action considered for assessment and design shall be taken from this document (Tables A-1 to A-3). The existing structure shall be assessed and retrofitted, if required, according to CYS EN 1998 – 3, while the structural system of the additional floors shall be designed and dimensioned according to Eurocode CYS EN 1998 – 1.

2.3 Date of Initial Licensing of the Existing Structure

Based on the study period, different solutions are proposed for cases where the existing structure, to which an extension will be made, has been licensed: (a) before 2012 (year in which the Eurocodes were officially introduced in Legislation) and (b) from January 1st 2012 onwards.

3. PERFORMANCE REQUIREMENTS AND COMPLIANCE CRITERIA

3.1. As already mentioned, critical parameters related to the issue are the selection of Limit States, for which the assessment of the existing structure will be performed, as well as the selection of the return period of the seismic action.

3.2. Based on Eurocode CYS EN 1998 – 3, a decision should be made initially as to whether all three or two or only one of the Limit States (LS), given below, should be checked:

1. Limit State: Near Collapse (NC)
2. Limit State: Significant Damage (SD)
3. Limit State: Damage Limitation (DL)

3.3. In the Cyprus Annex of CYS EN ***1998-3:2005+AC:2013,*** the following are defined for the assessment of the Limit States and the selection of the value of the return period:

(α) Buildings with importance class IV (as defined in Table 4.3 of CYS EN 1998-1) must be inspected for all the three Limit States defined in 2.1(1)A of CYS EN 1998-3. For all the other importance classes the Limit States to be examined will be selected by the project owner(s), following a suggestion and in agreement with the designer.

(β) The value of the return period of seismic action, corresponding to each Limit State should also be selected by the project owner(s), following a suggestion and in agreement with the designer. The protection that is usually considered suitable for ordinary new structures is considered to be achieved by selecting the following values of the return period:

- *2475 years, which corresponds to a probability of exceedance of 2% in 50 years for the Limit State Near Collapse (NC),*
- *475 years, which corresponds to a probability of exceedance of 10% in 50 years for the Limit State Significant Damage (SD) and*
- *225 years, which corresponds to a probability of exceedance of 20% in 50 years for the Limit State Damage Limitation (DL).*

3.4. In the event that a vertical or a horizontal extension is made to an existing structure, then the new structure should be properly designed and dimensioned, and also the capacity assessment and the design of interventions in the existing structure should be performed in such a way, so that at least one of the Limit States is satisfied.

3.5. The seismic action for the design and assessment of the existing structure is selected for each one of the Limit States and a return period for the seismic action as shown in Table 3-1 below:

Table 3-1: Limit States and Return Period of Seismic Action

Return Period of Seismic Action (Years)	Probability of Exceedance in 50 years	Combination of Limit State & Return Period of Seismic Action		
		Near Collapse (NC)	Significant Damage (SD)	Damage Limitation (DL)
2475	2%	2475 (NC)	2475 (SD)	2475 (DL)
475	10%	475 (NC)	475 (SD)	475 (DL)
225	20%	225 (NC)	225 (SD)	225 (DL)

4. SEISMIC ACTION VALUES

4.1 General

4.1.1 The calculation of the seismic action for the assessment of existing structures and the design of new extensions of the structures is based on paragraph 2.1 of CYS EN 1998 – 1 and more specifically on sub-paragraph 2.1(4) and the equations that relate the importance factor with the return period or the probability of exceedance of the seismic action. Tables A-1 to A-3 of this document apply which include the modified reference peak accelerations, $\alpha'_{gR,}$ that correspond to each combination of return period and Limit State.

4.1.2 The values of modified reference peak ground acceleration, α'_{gR}, included in Tables A-1 to A-3, are derived from the product of the importance factor γ_I and the reference peak ground acceleration α_{gR}, where:

$\gamma_I \approx (T_{LR}/T_L)^{-1/k}$ **or**

$\gamma_I \approx (P_L/P_{LR})^{-1/k}$

The reference peak ground accelerations α_{gR} correspond to the seismic zones included in the Map of Seismic Zones of Cyprus (Cyprus National Annex to CYS EN 1998-1:2004 +A1: 2013 +AC:2009). The values of the tables correspond to importance class II as it is defined in CYS EN 1998-1. For structures belonging to other important classes the values of the tables shall be multiplied by the corresponding importance factor.

4.1.3 Terms T_{LR}, T_L, P_L and P_{LR} of the above equations are defined in paragraph 2.1 of CYS EN 1998 - 1.

4.2 Project Design Period before 2012

For existing structures which have been designed before 2012 and are subject to interventions, as defined in paragraph 2, the ground accelerations given in Tables A-1 to A-3 shall apply. The return period as well as the Limit State will be agreed between the owner(s) and the designer.

4.3 Project Design Period from 1st January 2012 onwards

For existing structures which have been designed from 1st January 2012 onwards and are subject to interventions, as defined in paragraph 2, the ground accelerations and the Limit States which were taken into account in the original design and submitted for licensing of the initial design shall apply, as a minimum.

SEISMIC ACTION VALUES (MODIFIED REFERENCE PEAK GROUND ACCELERATIONS)

Table A-1: Modified Reference Peak Ground Accelerations for Seismic Zone 1 (α_{gR} = 0,15g)

Return Period of Seismic Action (Years)	Probability of Exceedance in 50 years	Modified Reference Peak Ground Accelerations (g)		
		Near Collapse (NC)	Significant Damage (SD)	Damage Limitation (DL)
2475	2%	0,26	0,26	0,26
475	10%	0,15	0,15	0,15
225	20%	0,12	0,12	0,12
100	39%		0,09	0,09

Table A-2: Modified Reference Peak Ground Accelerations for Seismic Zone 2 (α_{gR} = 0,20g)

Return Period of Seismic Action (Years)	Probability of Exceedance in 50 years	Modified Reference Peak Ground Accelerations (g)		
		Near Collapse (NC)	Significant Damage (SD)	Damage Limitation (DL)
2475	2%	0,35	0,35	0,35
475	10%	0,20	0,20	0,20
225	20%	0,16	0,16	0,16
100	39%		0,12	0,12

Table A-3: Modified Reference Peak Ground Accelerations for Seismic Zone 3 (α_{gR} = 0,25g)

Return Period of Seismic Action (Years)	Probability of Exceedance in 50 years	Modified Reference Peak Ground Accelerations (g)		
		Near Collapse (NC)	Significant Damage (SD)	Damage Limitation (DL)
2475	2%	0,43	0,43	0,43
475	10%	0,25	0,25	0,25
225	20%	0,19	0,19	0,19
100	39%		0,15	0,15

Note 1: For new structures, the reference peak ground acceleration, defined by CYS EN 1998 – 1, corresponds to seismic action with a return period of 475 years, which is equivalent to a probability of exceedance of 10% in the 50 years of the structure's life.

Note 2: The combination of 100 years return period of the seismic action with the limit state Near Collapse (NC) is not provided as a choice.

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