NATIONAL ANNEX TO CYS EN 1998-2:2005 (Including A1:2009, A2:2011 and AC:2010)

Eurocode 8: Design of structures for earthquake resistance

Part2: Bridges

CYPRUS ORGANISATION FOR STANDARDISATION

NATIONAL ANNEX

TO

CYS EN 1998-2:2005 (Including A1:2009, A2:2011 and AC:2010)

Eurocode 8: Design of structures for earthquake resistance

Part2: Bridges

This National Annex has been approved by the Board of Directors of the Cyprus Organisation for Standardisation (CYS) on 12.07.2019.

Note: Correction on 09.08.2019 - NA 2.10

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 1998-2:2005 (Including A1:2009, A2:2011 and AC:2010). Any reference in the rest of this text to CYS EN 1998-2:2005 means the above document

This National Annex gives:

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

- 1.1.1 (8)
- 2.1 (3)P
- 2.1 (4)P
- 2.1 (6)
- 2.2.2 (5)
- 2.3.5.3 (1)
- 2.3.6.3 (5)
- 2.3.7 (1)
- 3.2.2.3
- 3.3 (1)P
- 3.3 (6)
- 4.1.2 (4)P
- 4.1.8 (2)
- 5.3 (4)
- 5.4 (1)
- 5.6.2 (2)P b
- 5.6.3.3 (1)P b
- 6.2.1.4 (1)P
- 6.5.1 (1)P
- 6.6.2.3 (3)
- 6.6.3.2 (1)P
- 6.7.3 (7)
- 7.4.1 (1)P
- 7.6.2 (1)P
- 7.6.2 (5)
- 7.7.1 (2)
- 7.7.1 (4)
- J.1 (2)
- J.2 (1)

(b) Decision on the informative use of Annexes A, B, C, D, E, F, H, JJ and K (see Section NA 3)

(c) References to non-contradictory complementary information to assist the user to apply CYS EN 1998-2:2005 (see Section NA 4).

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 1.1.1 (8) Scope of CYS EN 1998-2:2005

Annexes A, B, C, D, E, F, H, JJ and K of CYS EN 1998-2:2005 may be used as Informative Annexes, whereas Annexes G and J of CYS EN 1998-2:2005 shall be used as Normative Annexes.

NA 2.2 Clause 2.1 Design seismic action

(3)P The value for the reference return period TNCR is set equal to 475 years.

(4)P Bridges are classified in three importance classes, as follows:

Importance class II comprises bridges of average importance with the exceptions noted below.

Importance class III comprises bridges of critical importance for maintaining communications, especially in the immediate post-earthquake period, bridges the failure of which is associated with a large number of probable fatalities and major bridges where a design life greater than normal is required.

Importance class I comprises bridges of less than average importance. A bridge shall be classified to importance class I when both of the following conditions are met:

- the bridge is not critical for communications, and
- the adoption of either the reference probability of exceedance, PNCR, in 50 years for the design seismic action, or of the standard bridge design life of 50 years is not economically justified.

(6) The values of the importance factor γI for importance classes I, II, and III are defined as follows:

γ_I = 0,85 for importance class I

γ_I = 1,00 for importance class II

γ_I = 1,30 for importance class III

NA 2.3 Clause 2.2.2 (5) No-collapse (ultimate limit state)

The seismic action shall not be considered as an accidental action under any conditions. Clauses 2.2.2 (3) and 2.2.2 (4) of CYS EN 1998-2:2005 are always applicable.

NA 2.4 Clause 2.3.5.3 (1) Local ductility at the plastic hinges

The expression of the length of plastic hinges *Lp* for concrete members is given by equation E.19 of Annex E of CYS EN 1998-2:2005.

NA 2.5 Clause 2.3.6.3 (5) Control of displacements - Detailing

The value of fraction for the design seismic displacement p_E is set equal to 0,4, and for the thermal movement p_T is set equal to 0,5.

NA 2.6 Clause 2.3.7 (1) Simplified criteria

Clause 2.3.7 (1) of CYS EN 1998-2:2005 is not applicable in Cyprus.

NA 2.7 Clause 3.2.2.3 Near source effects

A seismotectonic fault is considered to be active when there is an average historic slip rate of at least 1 mm/year and topographic evidence of seismic activity within the Holocene times (past 11000 years).

NA 2.8 Clause 3.3 Spatial variability of the seismic action

(1)P The value of the continuous deck limiting length, $L_{\lim}$, is specified as

$$L_{\lim} = \frac{L_g}{1.5}$$

where the length L_g is defined in clause 3.3 (6) Table 3.1N of CYS EN 1998-2:2005.

(6) The values of the distance L_g, beyond which ground motions are considered as completely uncorrelated, depending on the ground type are given in Table 3.1N (CYS):

Table 3.1N (CYS): Distance beyond which ground motions are considered uncorrelated

Ground Type	A	B	C	D	E
L_g (m)	600	500	400	300	500

The factor accounting for the magnitude of ground displacements occurring in apposite direction at adjacent supports β_r is defined as follows:

β_r = 0,5 when all three supports have the same ground type

β_r = 1,0 when the ground type at one of the supports is different than at the other two.

NA 2.9 Clause 4.1.2 (4)P Masses

The values of ψ_{21} factor for traffic loads assumed concurrent with the design seismic action are defined as:

ψ_{21} = 0 for bridges with normal traffic and footbridges

ψ_{21} = 0,2 for road bridges with severe traffic, and

ψ_{21} = 0,3 for railway bridges with severe traffic.

NA 2.10 Clause 4.1.8 (2)P Regular and irregular seismic behaviour of ductile bridges

The upper limit for the value of ρ_o is set equal to 2,0.

NA 2.11 Clause 5.3 (4) Capacity design

The value of the overstrength factor is set equal to

γ_o = 1,35 for concrete members, and

γ_o = 1,25 for steel members.

NA 2.12 Clause 5.4 (1) Second order effects

Approximate methods for estimating second order effects in linear analysis under seismic actions are based on the assumption that the increase of bending moments of the plastic hinge section due to second order effects is

$$\Delta M = \frac{1+q}{2} d_{Ed} N_{Ed}$$

where N_{Ed} is the axial force and d_{Ed} is the relative transverse displacement of the ends of the considered ductile member, both in the design seismic situation.

NA 2.13 Clause 5.6.2 (2)P b Structures of limited ductile behaviour

The value of the additional safety factor against brittle failure γ_{Bd1} is set equal to 1,25.

NA 2.14 Clause 5.6.3.3 (1)P b Shear resistance of members outside the region of plastic hinges

To determine the value of the additional safety factor γ_{Bd} on shear resistance of ductile members outside the region of plastic hinges, equation (5.8b) is recommended since it is more conservative.

NA 2.15 Clause 6.2.1.4 (1)P Required confining reinforcement

All types of confinement reinforcement are allowed.

NA 2.16 Clause 6.5.1 (1)P Verification of ductility of critical sections

Clause 6.5.1 (1)P of CYS EN 1998-2:2005 is not applicable in Cyprus.

NA 2.17 Clause 6.6.2.3 (3) Elastomeric bearings

According to Clause 2.2.2 (5) of CYS EN 1998-2:2005, the seismic action shall not be considered as an accidental action under any conditions.

NA 2.18 Clause 6.6.3.2 (1)P Holding-down devices

The value of the percentage of the compressive (downward) reaction p_H due to the permanent load that is exceeded by the total vertical reaction on a support due to the design seismic action, for holding-down devices is specified as follows:

p_H = 80% in bridges of ductile behaviour, where the vertical reaction due to the design seismic action is determined as a capacity design effect,

p_H = 50% in bridges of limited ductile behaviour, where the vertical reaction due to the design seismic action is determined from the analysis under the design seismic action alone (including the contribution of the vertical seismic component).

NA 2.19 Clause 6.7.3 (7) Abutments rigidly connected to the deck

The upper value of the design seismic displacement d_{lim} to limit damage of the soil or embankment behind abutments rigidly connected to the deck is given in Table 6.2N (CYS):

Table 6.2N (CYS): Recommended limit value of design seismic displacement at abutment rigidly connected to the deck

Bridge Importance class	Displacement Limit d_{lim} (mm)
III	30
II	60
I	No limitation

NA 2.20 Clause 7.4.1 (1)P Design spectra

The value of period T_D for the design spectrum of bridges with seismic isolation is specified as T_D = 2,5 sec.

NA 2.21 Clause 7.6.2 Isolating system

(1)P The value of the amplification factor γ_{IS} on design displacement of isolator units is specified at $\gamma_{IS} = 1,50$.

(5) The value γ_m for elastomeric bearings is specified at $\gamma_m = 1,00$.

NA 2.22 Clause 7.7.1 (2) Lateral restoring capability

The value of the factor δ is set equal to 0,5.

NA 2.23 Clause 7.7.1 (4) Lateral restoring capability

The value of the numerical coefficient γ_{du} is set equal to 1,2.

NA 2.24 Clause J.1 (2) Factors causing variation of design properties

The minimum isolator temperature for the seismic design situation, $T_{min,b}$, should correspond to the climatic conditions of the bridge location. The method for determining the value of the minimum isolator temperature is as follows:

$$T_{min,b} = T_{av} - \psi_2 (T_{av} - T_{min}) + \psi_2 \Delta T_1$$

where

T_{av} is the annual average shade air temperature at the location of the bridge. It may be taken as the average of the characteristic values of the maximum and minimum ambient shade air temperatures at the bridge location, in accordance with EN 1991-1-5:2003, 6.1.3.2 i.e. $T_{av} = (T_{max} + T_{min})/2$. If no specific information is available the value T_{av} = 10ºC may be used.

ψ_2 is the combination factor for thermal actions for seismic design situations, in accordance with EN 1990:2002 and EN 1990:2002/A1:2005, Annex A2 and

$\Delta T_1 = T_{e,min} - T_{min}$ is the difference between the minimum uniform bridge temperature component $T_{e,min}$ and the minimum shade air temperature T_{min}, in accordance with EN 1991-1-5: 2003 and EN 1991-1-5:2003/AC:2009, 6.1.3.1(4).

NA 2.25 Clause J.2 (1) Evaluation of the variation

The values of λ-factors for commonly used isolators are given in Annex JJ, which may be used as Informative Annex.

NA 3 DECISION ON USE OF THE INFORMATIVE ANNEXES A, B, C, D, E, F, H, JJ and K

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 3.4 Annex D

Annex D may be used.

NA 3.5 Annex E

Annex E may be used.

NA 3.6 Annex F

Annex F may be used.

NA 3.7 Annex H

Annex H may be used.

NA 3.8 Annex JJ

Annex JJ may be used.

NA 3.9 Annex K

Annex K may be used.

NA 4 REFERENCES TO NON-CONTRADICTORY COMPLEMENTARY INFORMATION

None

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NA to CYS EN 1998-2:2005 (Including A1:2009, A2:2011 and AC:2010)

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