NATIONAL ANNEX

TO

CYS EN 1991-2:2003 (Including AC:2010)

Eurocode 1: Actions on structures

Part 2: Traffic loads on bridges

CYPRUS ORGANISATION FOR STANDARDISATION

NATIONAL ANNEX

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(Including AC:2010)

Eurocode 1: Actions on structures

Part 2: Traffic loads on bridges

This National Annex has been approved by the Board of Directors of the Cyprus Organisation for Standardisation (CYS) on 24.01.2020.

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INTRODUCTION

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

NA 1 SCOPE

This National Annex is to be used together with CYS EN 1991-2:2003 including AC:2010. Any reference in the rest of this text to CYS EN 1991-2:2003 means the above document.

This National Annex gives:

a) Nationally determined parameters for the following clauses of CYS EN 1991-2:2003 where National choice is allowed (see Section NA 2)

- 1.1(3)
- 2.2(2) NOTE 2
- 2.3(1)
- 2.3(4)
- 3(5)
- 4.1(1) NOTE 2
- 4.1(2) NOTE 1
- 4.2.1(1) NOTE 2
- 4.2.1(2)
- 4.2.3(1)
- 4.3.1(2) NOTE 2
- 4.3.2(3) NOTES 1& 2
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- 4.3.3(2)
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- 4.4.1(3)
- 4.4.1(6)
- 4.4.2(4)
- 4.5.1 Table 4.4a NOTES a and b
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- 4.6.1(2) NOTE 2 & NOTE 4
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- 6.5.4.3(2) NOTES 1 & 2
- 6.5.4.4(2) NOTE 1
- 6.5.4.5
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- 6.6.1(3)
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- 6.7.3(1)P
- 6.8.1(11)P Table 6.10
- 6.8.2(2) Table 6.11
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- 6.9(7)
- Annex C(3)P
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- Annex D2(2)

b) Decisions on the status of CYS EN 1991-2:2003 informative Annexes (see Section NA 3)

c) References to non-contradictory complementary information to assist the user to apply CYS EN 1991-2:2003 (see Section NA 4)

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 1.1(3) Complementary Conditions for the design of buried structures, retaining walls and tunnels.

Possible complementary conditions may be defined for the individual project.

NA 2.2 Clause 2.2 (2) Infrequent values of loads

Infrequent values of loading should not be used.

NA 2.3 Clause 2.3 (1) Appropriate protection against collision.

The required safety barriers should be based on CYS EN 1317.

NA 2.4 Clause 2.3 (4) Impact forces due to boats, ships, or aeroplanes

For impact forces due to boat and ship impacts reference should be made to CYS EN 1991-1-7 and its National Annex. Additional requirements may be specified for the individual project.

NA 2.5 Clause 3(5) Bridges carrying both road and rail traffic.

The rules for bridges intended for both road and rail traffic should be agreed with the relevant authority for the individual project and should be based on, where appropriate, the load models for road and rail traffic as defined in CYS EN 1991-2 and its National Annex

NA 2.6 Clause 4.1(1) Models for loaded lengths greater than 200m.

Load models for loaded lengths greater than 200m should be defined by the relevant Authority for the individual project.

NA 2.7 Clause 4.1(2) Specific load models for bridges with limitation of vehicle weight.

For road bridges where effective means are provided to strictly limit the weight of any vehicle, specific load models should be defined by the relevant Authority.

NA 2.8 Clause 4.2.1(1) Complementary load models

Complementary load models and rules for their application may be defined by the relevant Authority.

NA 2.9 Clause 4.2.1(2) Models for special vehicles

Complementary load models for special vehicles and rules for their application may be defined by the relevant Authority.

NA 2.10 Clause 4.2.3(1) Conventional height of kerbs.

The minimum value of height of a kerb for defining the carriageway width should be taken as 100 mm.

NA 2.11 Clause 4.3.1 (2) Note 2 Use of Load Model 2

No additional rules for the use of LM2 are provided in this Annex.

NA 2.12 Clause 4.3.2(3) Note 1&2 Adjustment factors α for Load Model 1

Adjustment factors α_{Qi}, α_{qi}, and α_{qr} should be taken equal to unity.

NA 2.13 Clause 4.3.2(6) Use of simplified alternative Load Models.

The simplified alternative load models given in this clause should not be used.

NA 2.14 Clause 4.3.3(2) Adjustment factor β_Q for Load Model 2.

The Adjustment factor β_Q for the single axle system should be taken as equal to α_{Q1} .

$\beta_Q = \alpha_{Q1}$.

NA 2.15 Clause 4.3.3(4) Wheel contact surface for Load Model 2.

The contact surface of each wheel in Load Model 2 should be taken as a square of sides 0.4m

NA 2.16 Clause 4.3.4(1) Load Model 3 (Special Vehicles).

Where relevant, models of special vehicles should be defined and taken into account according to the guidance given in Annex A of CYS EN 1991-2-:2003.

NA 2.17 Clause 4.4.1(3) Horizontal forces associated with Load Model 3

No horizontal forces associated with Load Model 3 are defined in this Annex.

NA 2.18 Clause 4.4.1(6) Horizontal force transmitted by expansion joints or applied to structural members.

The horizontal force transmitted by expansion joints or applied to structural members that can be loaded by only one axle should be taken as $Q_{1k} = 0.6\ \alpha_{Q1k}$.

NA 2.19 Clause 4.4.2(4) Lateral forces on road bridge decks.

The transverse force due to skew braking or skidding, Q_{trk}, should be taken as 25% of the longitudinal braking force, Q_{lk}.

NA 2.20 Clause 4.5.1 Table 4.4 (a) Notes a and b Groups of traffic loads.

The groups of traffic loads should be taken as defined in Table 4.4a (CYS).

Table 4.4a (CYS)- Assessment of groups of traffic loads (characteristic values of the multi-component action)

		CARRIAGEWAY						FOOTWAYS AND CYCLE TRACKS
Load type		**Vertical forces**				**Horizontal forces**		**Vertical forces only**
Reference		4.3.2	4.3.3	4.3.4	4.3.5	4.4.1	4.4.2	5.3.2-(1)
Load system		LM1 (TS and UDL systems)	LM2 (Single axle)	LM3 (Special vehicles)	LM4 (Crowd loading)	Braking and acceleration forces [a]	Centrifugal and transverse forces [a]	Uniformly Distributed load
Groups of Loads	gr1a	Characteristic values						3 kN/m2
	gr1b		Characteristic value					
	gr2	Frequent values				Characteristic value	Characteristic value	
	gr3 [d]							Characteristic value [c]
	gr4				Characteristic value			Characteristic value
	gr5	See annex A		Characteristic value				
	Dominant component action (designated as component associated with the group)							

[c] See 5.3.2.1-(2). One footway only should be considered to be loaded if the effect is more unfavourable than the effect of two loaded footways.
[d] This group is irrelevant if gr4 is considered.

NA 2.21 Clause 4.5.2(1). Note 3 Other representative values of the multi-component action

No additional information provided

NA 2.22 Clause 4.6.1(2) NOTE 2 & NOTE 4 Conditions for use of fatigue Load Models.

Note 2: No additional information provided

Note 4: No additional information provided

NA 2.23 Clause 4.6.1 (3) NOTE 1 Definition of traffic categories and traffic flows.

The traffic categories and values of N_{obs} should be taken as indicated in Table 4.5 (CYS) for a slow lane when using Fatigue Load Models 3 and 4. On each fast lane (i.e. a traffic lane used predominantly by cars), additionally,10% of N_{obs} may taken into account.

Table 4.5 (CYS) – Indicative number of heavy vehicles expected per year and per slow lane

Traffic categories		N_{obs} per year and per slow lane
1	Roads and motorways with 2 or more lanes per direction with high flow rates of lorries	$2{,}0 \times 10^6$
2	Roads and motorways with medium flow rates of lorries	$0{,}5 \times 10^6$
3	Main roads with low flow rates of lorries	$0{,}125 \times 10^6$
4	Local roads with low flow rates of lorries	$0{,}05 \times 10^6$

NA 2.24 Clause 4.6.1 (6) Dynamic amplification factor due to expansion joints.

The Dynamic Amplification Factor given in equation 4.7 of CYS EN 1991-2:2003 should be used.

NA 2.25 Clause 4.6.4 (3) Fatigue Load Model 3 – conditions for application.

The conditions of application of this rule are those recommended in CYS EN 1991-2:2003, clause 4.6.4 (3)

NA 2.26 Clause 4.6.5 (1) Note 2 Fatigue Load Model 4 (set of "standard" lorries)

Standard lorries and lorry percentages should be according to clause 4.6.5 (1) of CYS EN 1991-2:2003.

NA 2.27 Clause 4.6.6 (1) Fatigue Load Model 5 (based on recorded traffic data).

No guidance is given in this National Annex for the use of this model.

NA 2.28 Clause 4.7.2.1(1) Collision forces on piers and other supporting members.

For the application of this clause, refer to CYS EN 1991-1-7 and its National Annex. For stiff piers the minimum values recommended in the main body of CYS EN 1991-2:2003 (4.7.2.1 (1) Note) should be used. These values are repeated below:

a. Impact force: 1000 kN in the direction of vehicle travel or 500 kN perpendicular to that direction.

b. Height above the level of adjacent ground surface: 1.25m

NA 2.29 Clause 4.7.2.2(1) NOTE 1 Collision forces on decks.

For the application of this clause, refer to CYS EN 1991-1-7 and its National Annex.

NA 2.30 Clause 4.7.3.3(1) NOTE 1 Effects of collision forces on vehicle restraint systems.

The appropriate class of forces given in the Table 4.9 (CYS) shall be selected depending on specific applications.

Table 4.9 (CYS) – Recommended classes for the horizontal force transferred by vehicle restraint systems

Recommended class	Horizontal force (kN)
A	100
B	200
C	400
D	600

NA 2.31 Clause 4.7.3.3(1) NOTE 3 Effects of collision forces on vehicle restraint systems.

The vertical force acting simultaneously with the horizontal collision force shall be taken equal to $0.75\alpha_{Q1}\,Q_{1k}$

NA 2.32 Clause 4.7.3.3(2) Structure supporting the vehicle parapet

The Structure supporting the vehicle parapet should be designed to sustain locally an accidental load effect corresponding to 1.25 times the characteristic local resistance of vehicle parapet.

NA 2.33 Clause 4.7.3.4 Collision forces on structural members.

Collision forces on structural members should be the same as defined in 4.7.2.1(1) of the main body of the code and this Annex (NA 2.28) acting 1.25 m above the carriage level.

NA 2.34 Clause 4.8 (1) NOTE 2. Actions on pedestrian parapets.

The required Class of pedestrian parapet of the particular situation should be chosen in accordance with EN 1317-6. The characteristic value of forces transferred to the structure should be taken as the design loads given in EN 1317-6 for the relevant Class of pedestrian parapet.

A line force of 1,0 kN/m acting, as a variable load, horizontally or vertically on the top of the parapet is the minimum value for footways or footbridges.

For service side paths, the recommended minimum value is 0,8 kN/m. Exceptional and accidental cases are not covered by these recommended minimum values.

NA 2.35 Clause 4.8 (3) Supporting structures to pedestrian parapets, which are not adequately protected against vehicle collisions.

A value of 1,25 shall be used.

NA 2.36 Clause 4.9.1(1) NOTE 1 Model for vertical loads on abutments and wing walls adjacent to bridges.

Load model 1, defined in 4.3.2, shall be used.

NA 2.37 Clause 5.2.3 (2) Load Models for inspection gangways.

The models, to be used separately in order to get the most unfavourable effects, are an uniformly distributed load of 2 kN/m2 and a concentrated load of 3 kN applicable to a square surface of 0,20×0,20 m2.

NA 2.38 Clause 5.3.2.1(1) NOTE Uniformly distributed load.

The uniformly distributed load q_{fk} shall be taken as equal to 5 kN/m^2

NA 2.39 Clause 5.3.2.2.(1) Concentrated load.

The characteristic value of the concentrated load Q_{fwk} given in CYS EN 1991-2 shall be used.

NA 2.40 Clause 5.3.2.3 (1) Service vehicle.

If no permanent obstacle prevents a vehicle being driven onto the bridge deck, the use of the vehicle defined in 5.6.3 as the service vehicle (characteristic load) should be used; in this case, there will be no need to apply 5.6.3, i.e. to consider the same vehicle as accidental.

NA 2.41 Clause 5.4 (2) Horizontal force on footbridges.

The characteristic value of the horizontal load on footbridges should be taken as given in CYS EN 1991-2.

NA 2.42 Clause 5.6.1 (1) General actions for accidental design situations for footbridges.

Other collision forces may be defined for the individual project.

NA 2.43 Clause 5.6.2.1 (1) Collision forces on piers of footbridges.

For the application of this clause, refer to CYS EN 1991-1-7 and its National Annex.

For stiff piers the following minimum values shall be used.

a) Impact force : 1000 kN in the direction of vehicle travel or 500 kN perpendicular to that direction ;
b) Height above the level of adjacent ground surface : 1,25 m.

NA 2.44 Clause 5.6.2.2 (1) Collision forces on decks of footbridges.

For the application of this clause, refer to CYS EN 1991-1-7 and its National Annex.

NA 2.45 NA.2.43 Clause 5.6.3 (2) Accidental presence of a heavy vehicle.

No other characteristics of the load model are given in this Annex.

NA 2.46 Clause 5.7 (3) Dynamic models for pedestrian loads on footbridges.

No Dynamic models for pedestrian loads and associated comfort criteria are given in this Annex.

NA 2.47 Clause 6.1 (2) Traffic outside the scope of EN 1991-2, alternative load models.

No alternative load models are given in this annex.

NA 2.48 Clause 6.1 (3) P Other types of railways.

No loading and characteristic values of actions for the types of railways described in 6.1.(3)P are given in this annex

NA 2.49 Clause 6.1 (7) Temporary bridges.

No loading requirements for the design of temporary railway bridges which may generally be based on this document are given in this Annex. The National Annex gives no special requirements for temporary bridges.

NA 2.50 Clause 6.3.2 (3)P Values of α factor.

No further guidance is given in this annex regarding the values the α factor should take

NA 2.51 Clause 6.3.3 (4) P Choice of lines for heavy rail traffic.

The designation may be made for the individual project.

NA 2.52 Clause 6.4.4 (1) Requirements for a static or a dynamic analysis.

The requirements for determining whether a dynamic analysis is required shall be established by the use of the flow chart in figure 6.9 of the main body of the code.

NA 2.53 Clause 6.4.5.2 (3) P Choice of dynamic factor.

Generally, Φ_3 shall be used.
Alternative values may be specified by the relevant Authority for the individual project.

NA 2.54 Clause 6.4.5.3 (1) Alternative values of determinant length.

The values of determinant lengths given in Table 6.2 shall be used.

NA 2.55 Clause 6.4.5.3, Table 6.2 Determinant length where not specified in Table 6.2.

The loading to be used for establishing the determinant length of transverse cantilevers shall be agreed with the relevant Authority.

NA 2.56 Clause 6.4.6.1.1 (6), Table 6.4, Note. Additional requirements for the application of HSLM.

Additional requirements for the application of HSLM-A and HSLM-B may be specified by the individual project and agreed by the relevant Authority.

NA 2.57 Clause 6.4.6.1.1 (7) Loading and methodology for dynamic analysis.

The loading and methodology for the analysis should by specified for the individual project and agreed by the relevant Authority.

NA 2.58 Clause 6.4.6.1.2 (3) Table 6.5, Note a. Additional load cases depending upon number of tracks.

The loading should be specified for the individual project and agreed by the relevant Authority.

NA 2.59 Clause 6.4.6.3.1(3) Table 6.6 Values of dumping.

Where it is proposed to use alternative values for damping, the alternative values should be agreed with the relevant Authority.

NA 2.60 Clause 6.4.6.3.2 (3) Alternative density values of materials.

Alternative density values may be used subject to the agreement of the relevant Authority.

NA 2.61 Clause 6.4.6.3.3 (3) Note 1, Note 2 Enhanced Young´s modulus, Other material properties.

Alternative Young´s Modulus values may be used subject to the agreement of the relevant Authority.

Alternative other material properties may be used subject to the agreement of the relevant Authority.

NA 2.62 Clause 6.4.6.4 (4) Reduction of peak response at resonance and alternative additional damping values.

The method to be used should be agreed with the relevant Authority.

NA 2.63 Clause 6.4.6.4 (5) Allowance for track defects and vehicle imperfections.

Alternative requirements may be specified by the relevant Authority for the individual project.

NA 2.64 Clause 6.5.1(2) Increased height of centre of gravity for centrifugal forces.

Alternative values for h_t may be specified for the individual project.

NA 2.65 Clause 6.5.3 (5) Actions due to braking for loaded lengths greater than 300m.

The individual project may specify additional requirements.

NA 2.66 Clause 6.5.3 (9) P Alternative requirements for the application of traction and braking forces.

The requirements of 6.5.3 (9) P apply.

NA 2.67 Clause 6.5.4.1(5) Combined response of structure and track, requirements for non-ballasted track.

The requirements for non-ballasted track should be specified for the individual project.

NA 2.68 Clause 6.5.4.3 (2) Notes 1 and 2. Alternative requirements for temperature range

The requirements of 6.5.4.3 (2) should apply.

NA 2.69 Clause 6.5.4.4(2) Note 1 Longitudinal shear resistance between track and bridge deck.

The values of longitudinal resistance for the analysis of rail/ballast/bridge stiffness should be agreed with the relevant Authority.

NA 2.70 Clause 6.5.4.5 Alternative design criteria.

Alternative requirements may be specified for the individual project.

NA 2.71 Clause 6.5.4.5.1 (2) Minimum value of track radius.

For ballasted tracks with additional lateral restraints to the track and for directly fastened tracks the minimum value of track radius, given in the main body of the code, may be reduced subject to the agreement of the relevant authority.

NA 2.72 Clause 6.5.4.5.1 (2) Limiting values for rail stresses.

For other track construction standards (in particular those that affect lateral resistance) and other types of rail the maximum additional rail stresses should be agreed with the relevant Authority

NA 2.73 Clause 6.5.4.6 Alternative calculation methods.

Alternative calculation methods may be specified for the individual project.

NA 2.74 Clause 6.5.4.6.1(1) Alternative criteria for simplified calculation methods.

The criteria given in this clause should be met.

NA 2.75 Clause 6.5.4.6.1 (4) Longitudinal plastic shear resistance between track and bridge deck.

Alternative values of *k* may be specified for the individual project.

NA 2.76 Clause 6.6.1 (3) Aerodynamic actions, alternative values.

The values given in 6.6.2 to 6.6.6. shall be used.

NA 2.77 Clause 6.7.1 (2)P Derailment of rail traffic, additional requirements.

Additional requirements and alternative loading may be specified for the individual project.

NA 2.78 Clause 6.7.1 (8) P Derailment of rail traffic, measures for structural elements situated above the level of the rails and requirements to retain a derailed train on the structure.

Measures to mitigate the effects of a derailment may be specified for the individual project.

NA 2.79 Clause 6.7.3 (1)P Other actions.

The requirements for other actions including actions for any Accidental Design Situation may be specified for the individual project.

NA 2.80 Clause 6.8.1(11) P Table 6.10 Number of tracks loaded when checking drainage and structural clearances.

Structural clearance requirements should be checked with rail traffic actions corresponding to the number of tracks loaded in accordance with the requirements of number of tracks to be loaded in Table 6.10 for «Traffic Safety Checks: Vertical deformation of the deck".

Deformation due to railway traffic may be neglected when checking drainage requirements.

NA 2.81 Clause 6.8.2 (2) Assessment of groups of loads.

The factors given in Table 6.11 of CYS EN 1991-2:2003 shall be used.

NA 2.82 Clause 6.8.3.1 (1) Frequent values of multi-component actions.

The factors given in Table 6.11 of CYS EN 1991-2:2003 shall be used.

NA 2.83 Clause 6.8.3.2(1) Quasi-permanent values of multi-component actions.

The value given in 6.8.3.2 (1) shall be used. Quasi-permanent traffic actions are taken as 0.

NA 2.84 Clause 6.9 (6) Fatigue load models, structural life.

The design working life shall be generally be taken as 100 years.

NA 2.85 Clause 6.9 (7) Fatigue load models, specific traffic.

A special traffic mix may be defined for the individual project and agreed with the relevant Authority.

NA 2.86 Annex C (3) P Dynamic factor.

Generally, expression (C.1) shall be used. Alternative requirements may be specified for the individual project.

NA 2.87 Annex C (3) P Method for dynamic analysis.

The method to be used should be agreed with the relevant Authority.

NA 2.88 Annex D2 (2) Partial safety factor for fatigue loading.

The recommended value of γ_{Ff} = 1,00 shall be used.

NA 3 Decision on the status of informative annexes

NA 3.1 The informative annexes A, B, E, F, G and H may be used.

NA 4 References to non-contradictory complementary information.

NA 4.1 No references to non-contradictory complementary information is given in this annex.

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