NATIONAL ANNEX

TO

CYS EN 1991 Eurocode 1: Actions on structures

Part 2: Traffic loads on bridges and other civil engineering works

For Public Enquiry – 28 January 2026

Prepared by: CYS TC 18 EUROCODES
Cyprus Organisation for Standardisation (CYS)

INTRODUCTION

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

NA 1 SCOPE

This National Annex is to be used together with CYS EN 1991-2:2023

This National Annex gives:

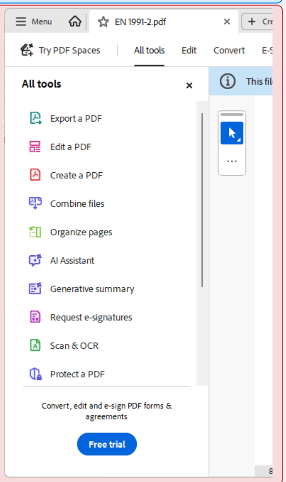
(a) Nationally determined parameters for the following clauses of CYS EN 1991-2:2023 where National choice is allowed (see Section NA 2)

- 4.3(1)
- 5.2(4)
- 6.1(1)
- 6.1(2)
- 6.2.1(1)
- 6.2.1(2)
- 6.2.3(1)
- 6.3.2(4)
- 6.3.2(9)
- 6.3.3(1)
- 6.3.3(4)
- 6.3.4(1)
- 6.3.5(1)
- 6.4.1(2)
- 6.4.1(4)
- 6.4.2(5)
- 6.5.1 – 2 choices
- 6.5.3(1)
- 6.6.1(2) – 2 choices
- 6.6.2(2)
- 6.6.4(1)
- 6.6.4(2)
- 6.6.7(4)
- 6.6.8(2)
- 6.6.8(4)
- 6.6.8(5)
- 6.6.9(1)
- 6.7.1(2)
- 6.7.3.3(2)
- 6.7.3.3(3)
- 6.7.3.3(5) – 2 choices
- 6.7.3.3(6)
- 6.7.3.4(1)
- 6.8(2)
- 6.8(3)
- 6.8(5)

- 6.8(6)
- 6.9.1(1)
- 6.9.2(1) – 4 choices
- 6.9.3(1) – 2 choices
- 6.9.3(2)
- 7.3.2(1)
- 7.3.3(1)
- 7.3.4(4)
- 7.4(1)
- 7.6.3(1)
- 8.1(3)
- 8.1(7) – 2 choices
- 8.3.2(4)
- 8.3.3(4)
- 8.3.6.4(5)
- 8.3.7(4)
- 8.4.4(1)
- 8.4.5.2(1)
- 8.4.5.4(1)
- 8.4.5.4(2) – 2 choices
- 8.4.6.1.1(2)
- 8.4.6.1.1(4)
- 8.4.6.1.1(5)
- 8.4.6.1.1(7)
- 8.4.6.1.2(3)
- 8.4.6.2(1)
- 8.4.6.2(2)
- 8.4.6.2(7)
- 8.4.6.2(8)
- 8.4.6.2(9)
- 8.4.6.3.1(3)
- 8.4.6.3.2(2)
- 8.4.6.3.3(4)
- 8.4.6.3.3(5)
- 8.4.6.5(4)
- 8.4.6.6(4)
- 8.4.6.6(6)
- 8.5.1(2)
- 8.5.1(8)
- 8.5.1(13)
- 8.5.3(6)
- 8.5.3(10)
- 8.5.3(11)
- 8.5.3(14)
- 8.5.4.1(5)
- 8.5.4.3(1)
- 8.5.4.3(2) – 2 choices

Commented [CC1]: There should be two choices

TC250 should be notified.



Commented [AD2R1]:

Commented [AD3R1]: Νομιζω είναι σωστό είναι το note?

Commented [CC4R1]: 8.4.6.1.2(2) Should be added in the list of NDPs to accept Table 8.5 (NDP).
If this is done then there is only one choice in 8.4.6.1.2(3).
Send to Tracey

- 8.5.4.4(3)
- 8.5.4.4(6)
- 8.5.4.5
- 8.5.4.5.1(2)
- 8.5.4.5.1(3)
- 8.5.4.6.1(1)
- 8.5.4.6.3(1)
- 8.5.4.6.3(4)
- 8.6.1(4)
- 8.6.1(6)
- 8.7.2(2)
- 8.7.2(7)
- 8.7.2(8)
- 8.7.4(2)
- 8.8.1(1)
- 8.8.1(2)
- 8.8.1(7)
- 8.8.2(3)
- 8.8.3.1(1)
- 8.8.3.2(1)
- 8.8.4(1)
- 8.9(2)
- 8.9(3)
- 8.9(4)
- 8.10.1(1)
- 8.10.1(7)
- 8.10.2(1) – 3 choices
- 8.10.3(1) – 2 choices
- 8.10.3(2)
- C.3(6) – 2 choices
- D.4(2)
- D.5(1)

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

(c) References to non-contradictory complementary information to assist the user to apply CYS EN 1991-2:2023. In this National Annex such information is provided for the following clauses in CYS EN 1991-2:2023 (see Section NA 4).

NA 2 NATIONALLY DETERMINED PARAMETERS

NA 2.1 Clause 4.3 (1) Accidental actions

No specific "appropriate protection" is defined.

NA 2.2 Clause 5.2 (4) Simultaneity of traffic loads

No particular rules are defined.

NA 2.3 Clause 6.1 (1) Field of application

No specific requirement for load models for loaded lengths greater than 200 m are defined.

NA 2.4 Clause 6.1 (2) Field of application

No specific load models are defined.

NA 2.5 Clause 6.2.1(1) Models of road traffic loads

No further provisions are defined regarding complementary load models, with associated combination rules where traffic outside the scope of the load models specified in this clause needs to be considered.

NA 2.6 Clause 6.2.1(2) Models of road traffic loads

No further provisions are defined regarding these models for special vehicles not compliant with the national regulations. Guidance on standard models for special vehicles and their application is given in Annex A.

NA 2.7 Clause 6.2.3(1) Divisions of the carriageway into notional lanes

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

NA 2.8 Clause 6.3.2 (4) Load Model 1

In the absence of specification, the values of α_{Q1}, α_{qi} and α_{qr} factors are equal to 1,0. Values of adjustment factors equal to 1 correspond to heavy industrial international traffic, representing a large part of the total traffic of heavy vehicles.

NA 2.9 Clause 6.3.2 (9) Load Model 1

No alternative rules for the application of tandem systems for local verifications are set.

NA 2.10 Clause 6.3.3(1) Load Model 2

The adjustment factor β_Q for the single axle system is equal to α_{Qi}.

NA 2.11 Clause 6.3.3(4) Load Model 2

No specific square contact surface for the wheels of Load Models 1 and 2 is set.

NA 2.12 Clause 6.3.4 (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.

NA 2.13 Clause 6.3.5 (1) Load Model 4 (crowd loading)

The magnitude of LM 4 is 5 kN/m^2 (dynamic amplification included).

NA 2.14 Clause 6.4.1 (2) Braking and acceleration forces

The upper limit for $Q_{Lk,max}$ is equal to 900 kN. $Q_{Lk,\ max}$ is normally intended to cover the maximum braking force of military vehicles according to STANAG.

NA 2.15 Clause 6.4.1 (4) Braking and acceleration forces

No horizontal forces associated with Load Model 3 are defined.

NA 2.16 Clause 6.4.2 (5) Centrifugal and other transverse force

No specific requirement for a minimum transverse loading is defined. In most cases, forces resulting from wind effects and collisions on kerbs provide a sufficient transverse loading.

NA 2.17 Clause 6.5.1 Characteristic values in persistent design situations

The groups of traffic loads are given in Table 6.5 (CYS).

Table 6.5 (CYS) — Assessment of groups of traffic loads (characteristic values of the multi-component action in persistent design situations)

		Carriageway						**Footways and cycle ways**
Load type		Vertical forces				Horizontal forces		Vertical forces only
Reference		6.3.2	6.3.3	6.3.4	6.3.5	6.4.1	6.4.2	7.3.2 (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						Combination value[b]
	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)							

a These can be defined in the National Annex (for the cases mentioned).
b This value is equal to 3 kN/m² unless the National Annex gives a different value.
c See 7.3.2. 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.

No additional information is provided regarding footnote a of Table 6.5 (CYS).

The combination value in footnote b of Table 6.5 (CYS) is equal to 3 kN/m^2.

NA 2.18 Clause 6.5.3 (1) Groups of loads in transient design situations

No specific alternative characteristic values associated with the tandem system or other load models for instance associated with LM 3 (special vehicles) is defined.

NA 2.19 Clause 6.6.1 (2) Fatigue load models – General

No specific requirement for the conditions of use of fatigue load models 1 and 2 is set.

No specific requirement for modifying the values of Fatigue Load Models 1 and 2 is set. In case they are modified, the modifications made to both models are supposed to be proportional. For Fatigue Load Model 3 a modification depends on the verification procedure.

NA 2.20 Clause 6.6.2 (2) Dynamic amplification factor

No change in the requirement for the Dynamic Amplification Factor is given.

NA 2.21 Clause 6.6.4 (1) Traffic category on the bridge

The traffic categories should be taken as indicated in Table 6.7 (CYS) for a slow lane when using Fatigue Load Models 3 and 4.

NA 2.22 Clause 6.6.4 (2) Traffic category on the bridge

The values of N_{obs} are given in Table 6.7 (CYS) for a slow lane when using Fatigue Load Models 3 and 4.

Table 6.7 (CYS) — Indicative number of heavy vehicles expected per year and per slow lane when using Fatigue Load Models 3 and 4

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 2.23 Clause 6.6.7 (4) Fatigue Load Model 3 (single vehicle model)

Possible conditions for application of this rule are given hereafter:

– one vehicle is as defined in clause 6.6.7 (1);

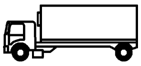
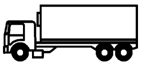
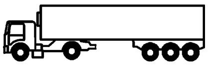
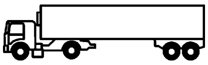
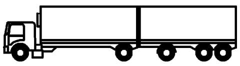
– the geometry of the second vehicle is as defined in clause 6.6.7 (1) and the weight of each axle is equal to 36 kN (instead of 120 kN);

– the distance between the two vehicles, measured from centre to centre of vehicles, is not less than 40 m.

NA 2.24 Clause 6.6.8 (2) Fatigue Load Model 4 (set of “standard” lorries)

The model shown in Table 6.9 (CYS), based on five standard lorries, simulates traffic which is deemed to produce fatigue damage equivalent to that due to actual traffic of the corresponding category defined in Table 6.7 (CYS). No additional information is provided.

Table 6.9 (CYS) — Set of equivalent lorries

Vehicle type			**Traffic type**			**Wheel type**
1	**2**	**3**	**4**	**5**	**6**	**7**
			Long distance*	Medium distance*	Local traffic*	
Lorry silhouette	Axle spacing m	Equivalent loads of each axle kN	Lorry percentage	Lorry percentage	Lorry percentage	
	4,5	70 130	20,0	40,0	80,0	A B
	4,20 1,30	70 120 120	5,0	10,0	5,0	A B B
	3,20 5,20 1,30 1,30	70 150 90 90 90	50,0	30,0	5,0	A B C C C
	3,40 6,00 1,80	70 140 90 90	15,0	15,0	5,0	A B B B
	4,80 3,60 4,40 1,30	70 130 90 80 80	10,0	5,0	5,0	A B C C C

* For the selection of a traffic type, it can broadly be considered that:
— "Long distance" means hundreds of kilometres,
— "Medium distance" means 50 km to 100 km,
— "Local traffic" means distances less than 50 km.
In reality, mixture of traffic types can occur.

NA 2.25 Clause 6.6.8 (4) Fatigue Load Model 4 (set of “standard” lorries)

The total number of vehicles per year is given in Table 6.7 (CYS), for Fatigue Load Models 3 and 4.

NA 2.26 Clause 6.6.9 (1) Fatigue Load Model 5 (based on recorded road traffic data)

No additional information is provided for the use of Fatigue Load Model 5. Guidance for a complete specification and the application of Fatigue Load Model 5 is given in Annex B.

NA 2.27 Clause 6.7.1 (2) Collision and other actions for accidental design situations – General.

No additional information is provided regarding accidental loads corresponding to vehicles not respecting the load limits.

NA 2.28 Clause 6.7.3.3 (2) Collision forces on vehicle restraint systems

No additional information is provided regarding classes of characteristic capacities of restraint systems.

NA 2.29 Clause 6.7.3.3 (3) Collision forces on vehicle restraint systems

The accidental load effect shall be at least 1,25 times the characteristic local resistance of vehicle parapet both transversely and longitudinally.

NA 2.30 Clause 6.7.3.3 (5) Collision forces on vehicle restraint systems

The values for the classes are given in Table 6.11 (CYS).

Table 6.11 (CYS) — Classes for the recommended horizontal force transferred by vehicle restraint systems

Class	**Recommended horizontal force[a]** kN
A	200
B	300
C	450
D	600
[a] The horizontal force acts transversely.	

The horizontal force given in Table 6.11 (CYS) is applied 0,9 m above the level of the carriageway or footway and the reaction forces at the level of the fixation of the restraint system can be assumed to be distributed over a length of 4,0 m.

NA 2.31 Clause 6.7.3.3 (6) Collision forces on vehicle restraint systems

No other combination value is defined.

NA 2.32 Clause 6.7.3.4 (1) Collision forces on structural members

The vehicle collision forces on structural members are the same as the collision forces on piers and other supporting members calculated to EN 1991-1-7 (see 6.7.2).

NA 2.33 Clause 6.8 (2) Actions on pedestrian parapets

No additional information provided regarding the classification of the forces transferred to the bridge deck by pedestrian parapets in accordance with CEN/TR 16949.

NA 2.34 Clause 6.8 (3) Actions on pedestrian parapets

For bridges, the minimum loading class of the parapet should be class C.

NA 2.35 Clause 6.8 (5) Actions on pedestrian parapets

No additional information is provided.

NA 2.36 Clause 6.8 (6) Actions on pedestrian parapets

The minimum accidental load effect value is 1,25.

NA 2.37 Clause 6.9.1 (1) Load model for geotechnical structures — characteristic values – General

No additional information and application rules to other structure types, geotechnical structures and buried structures are provided.

NA 2.38 Clause 6.9.2 (1) Distributed vertical loads

Figure 6.11 (CYS) is applicable for LM1 for the design of abutments, wing walls, side walls, other parts of bridges in contact with the ground.

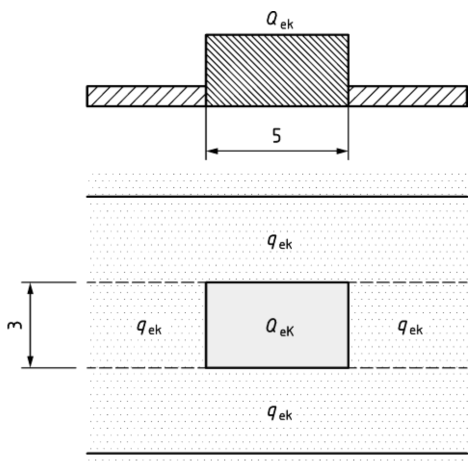


Figure 6.11 (CYS) — Road traffic load model for geotechnical structures

The characteristic value of the concentrated load *Q*ek is 600 kN spread over rectangular surface area of 3 m × 5 m (i.e. 40 kN/m^2).

The characteristic value of uniformly distributed load q_{ek} is 9 kN/m^2 applied on the remaining area of the carriageway.

The value of q_{ek} is 5 kN/m^2 for areas only accessed for maintenance.

NA 2.39 Clause 6.9.3(1) Simplified vertical loads allowing for redistribution

The value of $q_{ek,l}$ for LM1 shall be taken as 20 kN/m^2 on one lane of width 3 m and 9 kN/m^2 on other lanes. The heaviest loaded lane shall be selected to provide the most adverse effect in the design situation considered.

The value of $q_{ek,l}$ shall be taken as 5 kN/m^2 for areas only accessed for maintenance.

NA 2.40 Clause 6.9.3(2) Simplified vertical loads allowing for redistribution

The simplified vertical load model should not be used where the horizontal distance between the carriageway and the structure is less than a certain distance. The value of the distance is 1,0 m.

NA 2.41 Clause 7.3.2 (1) Uniformly distributed load

The uniformly distributed load q_{fk} is calculated using the formula 7.1.

$$q_{fk} = 2,0 + \frac{120}{L+30} \quad \text{kN/m}^2 \tag{7.1}$$

$$q_{fk} \geq 2,5 \ \text{kN/m}^2 \ ; \ q_{fk} \leq 5,0 \ \text{kN/m}^2$$

where

L is the length of the unfavourable part of influence surface in [m].

NA 2.42 Clause 7.3.3 (1) Concentrated load

The value of the concentrated load Q_{fwk} is equal to 10 kN acting on a square surface of sides 0,10 m.

NA 2.43 Clause 7.3.4 (4) Service vehicle

No further information is provided regarding the characteristics of service vehicles (axle weight and spacing, contact area of wheels), the dynamic amplification and all other appropriate loading rules.

NA 2.44 Clause 7.4 (1) Static model for horizontal forces — characteristic values (footbridges only)

The characteristic value of the horizontal force Q_{flk} shall be taken as equal to the greater of the following two values:

- 10 per cent of the total load corresponding to the uniformly distributed load (clause 7.3.2),
- 60 per cent of the total weight of the service vehicle, if relevant (clause 7.3.4).

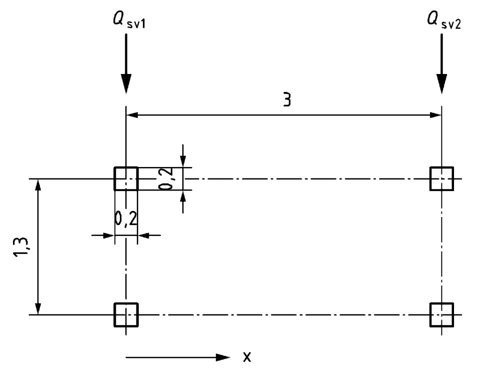
NA 2.45 Clause 7.6.3 (1) Accidental presence of vehicles on the footbridge

The following load model shall represent the accidental presence of vehicles on a footbridge:

- a two-axle load group of 80 kN and 40 kN, separated by a wheel base of 3 m (Figure 7.1 (CYS) Accidental Loading);
- a track (wheel-centre to wheel-centre) of 1,3 m;
- square contact areas of side 0,2 m at coating level;

– the braking force associated with the load model is equal to 60 % of the vertical load.

Dimensions in metres



Key

Q_{sv1} = 80 kN

Q_{sv2} = 40 kN

Figure 7.1 (CYS) — Accidental Loading

NA 2.46 Clause 8.1 (3) Field of application

No alternative load models are provided.

NA 2.47 Clause 8.1 (7) Field of application

The loading requirements for temporary bridges can be based on EN1991-2. Different loads are not specified.

No additional design requirements for temporary bridges depending upon the conditions in which they are used are set.

NA 2.48 Clause 8.3.2 (4) Load Model 71

The factor α should be as specified by the relevant authority or agreed for a specific project by the relevant parties.

NA 2.49 Clause 8.3.3 (4) Load Models SW/0 and SW/2

No additional information is provided regarding the application of Load Model SW/2 on lines.

NA 2.50 Clause 8.3.6.4 (5) Transverse distribution of actions by the sleepers and ballast

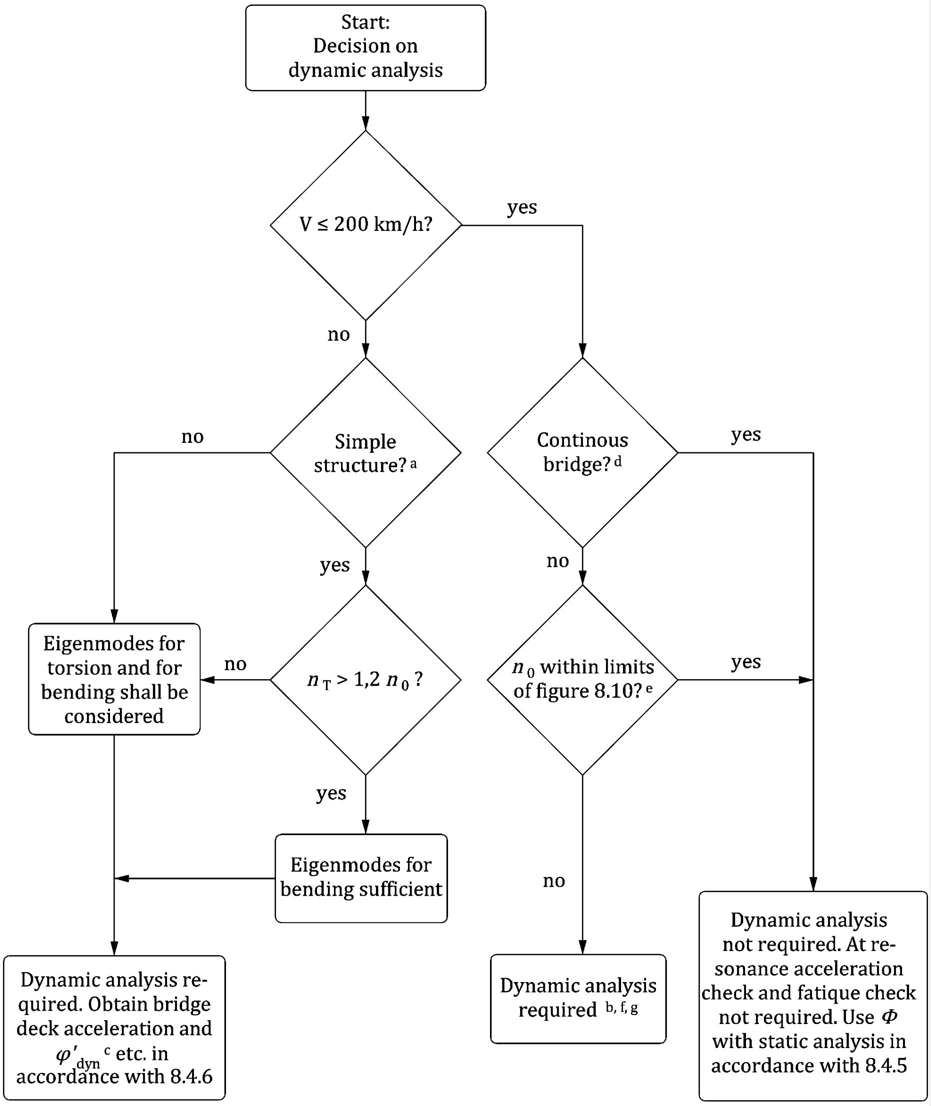
No additional information is provided regarding the transverse distribution to be used.

NA 2.51 Clause 8.3.7 (4) Actions for non-public footways

No additional information is provided regarding alternative requirements for non-public footways, maintenance walkways or platforms etc.

NA 2.52 Clause 8.4.4 (1) Conditions for requiring a dynamic analysis

The conditions for determining whether a dynamic analysis is required shall be established by the use of the flow chart in Figure 8.9 (CYS).



Key

V is the Maximum Line Speed at the Site [km/h];

L is the span length [m];

n_0 is the first natural bending frequency of the bridge loaded by permanent actions [Hz]. For a simply supported bridge, subjected to bending only, the natural frequency can be estimated using the Formula (8.1):

$$n_0 \text{ [Hz]} = \frac{17{,}75}{\sqrt{\delta_0}} \qquad (8.1)$$

where

δ_0 is the deflection at mid span due to permanent actions [mm] and is calculated, using a short term modulus for concrete bridges or composite steel and concrete bridges, corresponding to a loading period appropriate to the natural frequency of the bridge.

n_T is the first natural torsional frequency of the bridge loaded by permanent actions [Hz]

a Valid for simply supported bridges with only longitudinal line beam or simple plate behaviour with negligible skew effects on rigid supports.

b A dynamic analysis is required where the Frequent Operating Speed of a Real Train equals a Resonant Speed of the structure. See 8.4.6.6.

c φ'_{dyn} is the dynamic enhancement of static loading for a Real Train determined from a dynamic analysis of the structure given in 8.4.6.5(3).

d Valid providing the bridge meets the requirements for resistance, deformation limits given in EN 1990:2023, A.2.8.4 and the maximum coach body acceleration (or associated deflection limits) corresponding to a very good standard of passenger comfort given in EN 1990:2023, A.2.8.4.3.

e For bridges with a first natural frequency n_0 within the limits given by Figure 8.10 and a Maximum Line Speed at the Site not exceeding 200 km/h, a dynamic analysis is not required.

f For bridges with a first natural frequency n_0 exceeding the upper limit (1) in Figure 8.10, a dynamic analysis is expected to be carried out in accordance with Annex C. The dynamic analysis is expected to be considering the factors in 8.4.2(1) NOTE 1 (i) to (xi). It can be assumed that resonance will not occur.

g For bridges with a first natural frequency n_0 below the limit (2) in Figure 8.10, a dynamic analysis is performed to obtain the bridge deck acceleration and φ'_{dyn}[c] etc. in accordance with 8.4.6. Also see 8.4.6.1.1(7).

Figure 8.9 (CYS) — Flow chart for determining whether a dynamic analysis is required

NA 2.53 Clause 8.4.5.2 (1) Definition of the dynamic factor Φ

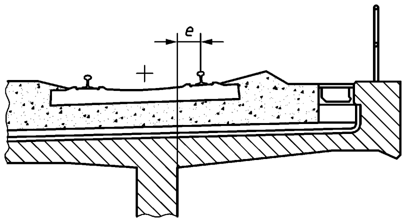
No choice between Φ_2 and Φ_3 is made.

NA 2.54 Clause 8.4.5.4 (1) Determinant length L_Φ

The values of determinant lengths given in Table 8.2(CYS) shall be used.

Table 8.2 (CYS) — Determinant lengths L_Φ

Case	Structural element	Determinant length L_Φ[c]
Steel deck plate: closed deck with ballast bed (orthotropic deck plate) (for local and transverse stresses)		
	Deck with cross girders and continuous longitudinal ribs:	
1.1	Deck plate (for both directions)	3 times cross girder spacing
1.2	Continuous longitudinal ribs (including small cantilevers up to 0,50 m)[a]	3 times cross girder spacing
1.3	Cross girders	2 times cross girder spacing
1.4	End cross girders	3,6 m[b]

Case	Structural element	Determinant length L_{Φ}[c]
	Deck plate with cross girders only:	
2.1	Deck plate (for both directions)	2 times cross girder spacing + 3 m
2.2	Cross girders	2 times cross girder spacing + 3 m
2.3	End cross girders	3,6 m[b]
Steel grillage: open deck without ballast bed[b] (for local and transverse stresses)		
3.1	Rail bearers:	
	— as an element of a continuous grillage	3 times cross girder spacing
	— simply supported	Cross girder spacing + 3 m
3.2	Cantilever of rail bearer[a]	3,6 m[b]
3.3	Cross girders (as part of cross girder/ continuous rail bearer grillage)	2 times cross girder spacing
3.4	End cross girders	3,6 m[b]
Concrete deck slab with ballast bed (for local and transverse stresses)		
4.1	Deck plate as part of box girder or upper flange of main beam	
	— spanning transversely to the main girders	3 times span of deck plate
	— spanning in the longitudinal direction	3 times span of deck plate
	— cross girders	2 times cross girder spacing
	— transverse cantilevers supporting railway loading	 — $e \leq 0{,}5$ m: 3 times the distance between the webs — $e > 0{,}5$ m: [a] **Figure 8.11 — Transverse cantilever supporting railway loading**
4.2	Deck slab continuous (in main girder direction) over cross girders	2 times cross girder spacing
4.3	Deck slab for half through and trough bridges:	
	— spanning perpendicular to the main girders	2 times span of deck slab + 3 m

Case	Structural element	Determinant length L_Φ[c]
	— spanning in the longitudinal direction	2 times span of deck slab
4.4	Deck slabs spanning transversely between longitudinal steel beams in filler beam decks	2 times the determinant length in the longitudinal direction
4.5	Longitudinal cantilevers of deck slab	— $e \leq 0,5$ m: 3,6 m[b] — $e > 0,5$ m: [a]
4.6	End cross girders or trimmer beams	3,6 m[b, d]
Main girders		
5.1	Simply supported girders and slabs (including steel beams embedded in concrete)	Span in main girder direction
5.2	Girders and slabs continuous over n spans with $L_m = 1/n\ (L_1 + L_2 + .. + L_n)$ (8.8)	$L_\Phi = k \times L_m$, (8.7) but not less than max L_i ($i = 1, ..., n$) $n = 2$ / 3 / 4 / ≥ 5 $k = 1,2$ / 1,3 / 1,4 / 1,5
5.3	Portal frames and closed frames or boxes:	
	— single-span	Consider as three-span continuous beam (use 5.2, with vertical and horizontal lengths of members of the frame or box)
	— multi-span	Consider as multi-span continuous beam (use 5.2, with lengths of end vertical members and horizontal members)
5.4	Single arch, archrib, stiffened girders of bowstrings	Half span
5.5	Series of arches with solid spandrels retaining fill	2 times the clear opening
5.6	Suspension bars (in conjunction with stiffening girders)	4 times the longitudinal spacing of the suspension bars
Structural supports		
6	Columns, trestles, bearings, uplift bearings, tension anchors and for the calculation of contact pressures under bearings.	Determinant length of the supported members

[a] In general all cantilevers greater than 0,50 m supporting rail traffic actions need a specific dynamic analysis in accordance with 8.4.6.

[b] Φ_3 should be applied.

[c] For Cases 1.1 to 4.6 inclusive L_Φ is subject to a maximum of the determinant length of the main girders.

[d] This rule is also applicable for other construction types (e.g. rolled steel beams in concrete, composite structures, prestressed concrete).

NA 2.55 Clause 8.4.5.4 (2) Determinant length L_Φ

If no value of LΦ is specified in Table 8.2 (CYS), then the determinant length should be taken as the length of the influence line for deflection of the element being considered unless alternative values are specified by the relevant authority or where not specified, agreed for a specific project by the relevant parties.

No alternative requirements are provided for asymmetric influence lines.

NA 2.56 Clause 8.4.6.1.1 (2) Loading

No additional information is provided regarding conditions to be applied for the Real Trains.

NA 2.57 Clause 8.4.6.1.1 (4) Loading

No additional information is provided regarding the characteristic axle loads and spacings for configurations of Real Trains.

NA 2.58 Clause 8.4.6.1.1 (5) Loading

No additional information is provided regarding the conditions for application of Load Model HSLM.

NA 2.59 Clause 8.4.6.1.1 (7) Loading

No additional requirements relating to the application of HSLM-A and HSLM-B to continuous and complex structures are provided.

NA 2.60 Clause 8.4.6.1.2 (3) Load combinations and partial factors for dynamic analysis

Loading requirements for dynamic analysis are given in Table 8.5 (CYS).

No further information is provided regarding loading requirements for dynamic analysis not covered in Table 8.5 (NDP).

Table 8.5 (CYS) — Summary of additional load cases depending upon number of tracks on bridge

Number of tracks on a bridge	Loaded track	Loading for dynamic analysis
1	one	Each Real Train and Load Model HSLM (if required) travelling in the permitted direction(s) of travel.
2 (Trains normally travelling in opposite directions)	either track	Each Real Train and Load Model HSLM (if required) travelling in the permitted direction(s) of travel.
	other track	None.

NA 2.61 Clause 8.4.6.2 (1) Speeds to be considered

No criteria for the Maximum Line Speed are set.

NA 2.62 Clause 8.4.6.2 (2) Speeds to be considered

No criteria for an increased Maximum Line Speed are set.

NA 2.63 Clause 8.4.6.2 (7) Speeds to be considered

No criteria for reduced Maximum Design Speed for individual Real Trains are set.

NA 2.64 Clause 8.4.6.2 (8) Speeds to be considered

No criteria for an additional factor for increasing the Maximum Design Speed are set.

NA 2.65 Clause 8.4.6.2 (9) Speeds to be considered

No additional requirements for checking structures used for commissioning tests of a Real Train are set.

NA 2.66 Clause 8.4.6.3.1 (3) Structural damping

The values of damping shown in Table 8.6 (CYS) should be used in the dynamic analysis.

No additional safe lower bound values for damping are set.

Table 8.6 (CYS) — Values of damping to be assumed for design purposes

Bridge Type	**ζ Lower limit of percentage of critical damping** %	
	Span L < 20 m	Span $L \geq$ 20 m
Steel and composite	ζ = 0,5 + 0,125 (20 − L)	ζ = 0,5
Prestressed concrete	ζ = 1,0 + 0,07 (20 − L)	ζ = 1,0
Filler beam and reinforced concrete	ζ = 1,5 + 0,07 (20 − L)	ζ = 1,5

NA 2.67 Clause 8.4.6.3.2 (2) Mass of the bridge

No requirements for accepting alternative density values are set.

NA 2.68 Clause 8.4.6.3.3 (4) Stiffness of the bridge

No requirements for accepting enhanced E_{cm} values are set.

NA 2.69 Clause 8.4.6.3.3 (5) Stiffness of the bridge

No requirements for other material properties are set.

NA 2.70 Clause 8.4.6.5 (4) Verifications of the limit states

The factor to be used for bridge deck accelerations is not set.

NA 2.71 Clause 8.4.6.6 (4) Additional verification for fatigue where dynamic analysis is required

The fatigue loading is not set.

NA 2.72 Clause 8.4.6.6 (6) Additional verification for fatigue where dynamic analysis is required

No requirements for an increased Maximum Design Speed are set.

NA 2.73 Clause 8.5.1 (2) Centrifugal forces

No requirements for an increased value of h_t is set. For some traffic types, e.g. double stacked containers, an increased value of h_t can be specified.

NA 2.74 Clause 8.5.1 (8) Centrifugal forces

No maximum speed for Load Model SW/2 for centrifugal effects is set.

NA 2.75 Clause 8.5.1 (13) Centrifugal forces

No additional requirements for centrifugal loads due to heavy freight traffic with a speed exceeding 120 km/h is set.

NA 2.76 Clause 8.5.3 (6) Actions due to traction and braking

No additional information is provided

NA 2.77 Clause 8.5.3 (10) Actions due to traction and braking

No requirements for braking for loaded lengths greater than 300 m are set.

NA 2.78 Clause 8.5.3 (11) Actions due to traction and braking

No additional information is provided regarding the lines carrying special traffic and associated loading details.

NA 2.79 Clause 8.5.3 (14) Actions due to traction and braking

No alternative requirements for the application of traction and braking forces on bridges carrying two or more tracks with the same permitted direction of travel are set.

NA 2.80 Clause 8.5.4.1 (5) Combined response of structure and track to variable actions - General principles

The requirements for other configurations of track can be specified for the individual project. Further guidance is given in CEN/TR 17231.

NA 2.81 Clause 8.5.4.3 (1) Combined response of structure and track to variable actions - General principles

The combined response of the structure and track to the "unloaded train" and load model HSLM can be neglected. No alternative requirements are specified

NA 2.82 Clause 8.5.4.3 (2) Combined response of structure and track to variable actions - General principles

No alternative values of ΔT_N are specified.

No other values for simplified calculations are specified.

NA 2.83 Clause 8.5.4.4 (3) Modelling and calculation of the combined track/structure system

Typical values of the plastic shear resistance of the track, k [kN/m] and limiting elastic displacement, $u0$ [mm] are given in Table 8.9 (CYS).

No alternative values of the plastic shear resistance of the track, k [kN/m] and limiting elastic displacement, u_0 [mm] are specified.

Table 8.9 (CYS) — Examples of values to be used in Figure 8.19 when actual values are unknown

		u_0 mm	k kN per metre length of track
Ballasted track	Unloaded	2,0	20
	Unloaded: Frozen ballast	0,5	30
	Loaded	2,0	60
	Loaded: Frozen ballast	0,5	60
Ballastless track	Unloaded	0,5	40
	Loaded	0,5	60

NA 2.84 Clause 8.5.4.4 (6) Modelling and calculation of the combined track/structure system

No future track characteristics are specified. Additional requirements can be specified by the relevant authority or, where not specified, agreed for a specific project by the relevant parties.

NA 2.85 Clause 8.5.4.5 Design criteria

No alternative requirements are specified.

NA 2.86 Clause 8.5.4.5.1 (2) Track

For rails on the bridge and on the adjacent abutment the permissible additional stress in the rail due to the combined response of the structure and track to variable actions may be allowed to be reduced as described in 8.5.4.5.1 (2) subject to the agreement of the relevant authority for the individual project.

NA 2.87 Clause 8.5.4.5.1 (3) Track

The maximum additional rail stresses are not specified for other track construction standards (in particular those that affect lateral resistance) and other types of rail. Further information on this subject is given in CEN/TR 17231.

NA 2.88 Clause 8.5.4.6.1 (1) Calculation methods – General

No alternative calculation methods are specified. Further information on this subject is given in CEN/TR 17231.

NA 2.89 Clause 8.5.4.6.3 (1) Calculation methods – Simplified calculation method for a single deck

No alternative criteria are specified.

NA 2.90 Clause 8.5.4.6.3 (4) Calculation methods – Simplified calculation method for a single deck

No alternative values of k are specified.

NA 2.91 Clause 8.6.1 (4) Aerodynamic actions from passing trains – General

No alternative characteristic values of the equivalent loads are set.

NA 2.92 Clause 8.6.1 (6) Aerodynamic actions from passing trains – General

No alternative values for the dynamic amplification factor are set.

NA 2.93 Clause 8.7.2 (2) Derailment actions from rail traffic on a railway bridge

No design situations for derailment are set.

NA 2.94 Clause 8.7.2 (7) Derailment actions from rail traffic on a railway bridge

No measures to mitigate the consequences of a derailment on structural elements situated above the level of the rails are set.

NA 2.95 Clause 8.7.2 (8) Derailment actions from rail traffic on a railway bridge

No additional requirements to retain a derailed train on the structure are set.

NA 2.96 Clause 8.7.4 (2) Other actions

No requirements for other actions and Accidental Design Situations are set.

NA 2.97 Clause 8.8.1 (1) Further application rules for traffic loads on railway bridges – General

No track positions and tolerances are set.

NA 2.98 Clause 8.8.1 (2) Further application rules for traffic loads on railway bridges – General

No minimum spacing of tracks and structural gauge clearance are set.

NA 2.99 Clause 8.8.1 (7) Further application rules for traffic loads on railway bridges – General

No requirements for the number of tracks to be considered loaded when checking drainage and structural clearance requirements are set.

NA 2.100 Clause 8.8.2 (3) Groups of Loads — Characteristic values of the multicomponent action

The factors given in Table 8.15 (CYS) shall be used.

Table 8.15 (CYS) — Assessment of Groups of Loads for rail traffic (characteristic values of the multicomponent actions)

Number of tracks on structure			Groups of loads			Vertical forces			Horizontal forces			Comment
			Reference EN 1991-2			8.3.2/ 8.3.3	8.3.3	8.3.4	8.5.3	8.5.1	8.5.2	
1	2	≥ 3	Number of tracks loaded	Load Group[h]	Loaded track	LM71[a] SW/0[a,b] HSLM[f,g]	SW/2[a,c]	Unloaded train	Traction, Braking[a]	Centrifugal force[a]	Nosing force[a]	
			1	gr11	T_1	1			1[e]	0,5[e]	0,5[e]	Max. vertical 1 with max. longitudinal

Number of tracks on structure			Groups of loads			Vertical forces			Horizontal forces			Comment
			Reference EN 1991-2			8.3.2/ 8.3.3	8.3.3	8.3.4	8.5.3	8.5.1	8.5.2	
1	2	≥ 3	Number of tracks loaded	Load Group[h]	Loaded track	LM71[a] SW/0[a,b] HSLM[f,g]	SW/2[a,c]	Unloaded train	Traction, Braking[a]	Centrifugal force[a]	Nosing force[a]	
			1	gr 12	T_1	1			0,5[e]	1[e]	1[e]	Max. vertical 2 with max. transverse
			1	gr 13	T_1	1[d]			1	0,5[e]	0,5[e]	Max. longitudinal
			1	gr 14	T_1	1[d]			0,5[e]	1	1	Max. transverse
			1	gr 15	T_1			1		1[e]	1[e]	Lateral stability with “unloaded train”
			1	gr 16	T_1		1		1[e]	0,5[e]	0,5[e]	SW/2 with max. longitudinal
			1	gr 17	T_1		1		0,5[e]	1[e]	1[e]	SW/2 with max. transverse
			2	gr 21	T_1 T_2	1 1			1[e] 1[e]	0,5[e] 0,5[e]	0,5[e] 0,5[e]	Max. vertical 1 with max longitudinal
			2	gr 22	T_1 T_2	1 1			0,5[e] 0,5[e]	1[e] 1[e]	1[e] 1[e]	Max. vertical 2 with max. transverse
			2	gr 23	T_1 T_2	1[d] 1[d]			1 1	0,5[e] 0,5[e]	0,5[e] 0,5[e]	Max. longitudinal
			2	gr 24	T_1 T_2	1[d] 1[d]			0,5[e] 0,5[e]	1 1	1 1	Max. transverse
			2	gr 26	T_1 T_2	 1	1 		1[e] 1[e]	0,5[e] 0,5[e]	0,5[e] 0,5[e]	SW/2 with max. longitudinal
			2	gr 27	T_1 T_2	 1	1 		0,5[e] 0,5[e]	1[e] 1[e]	1[e] 1[e]	SW/2 with max. transverse
			≥ 3	gr 31	T_i	0,75 0,75			0,75[e]	0,75[e]	0,75[e]	Additional load case

(light grey)	Dominant component action as appropriate
(grey)	to be considered in designing a structure supporting one track (Load Groups 11–17)
(hatched)	to be considered in designing a structure supporting two tracks (Load Groups 11–27 except 15). Each of the two tracks shall be considered as either T_1 (Track one) or T_2 (Track 2)
(dark)	to be considered in designing a structure supporting three or more tracks; (Load Groups 11 to 31 except 15. Any one track shall be taken as T_1, any other track as T_2 with all other tracks unloaded. In addition, the Load Group 31 has to be considered as an additional load case where all unfavourable lengths of track T_i are loaded.

Number of tracks on structure			Groups of loads			Vertical forces			Horizontal forces			Comment
			Reference EN 1991-2			8.3.2/ 8.3.3	8.3.3	8.3.4	8.5.3	8.5.1	8.5.2	
1	2	≥ 3	Number of tracks loaded	Load Group[h]	Loaded track	LM71[a] SW/0[a,b] HSLM[f,g]	SW/2[a,c]	Unloaded train	Traction, Braking[a]	Centrifugal force[a]	Nosing force[a]	

a All relevant factors (α, Φ, f, ...) are to be taken into account.
b SW/0 is only taken into account for continuous structural elements and decks.
c SW/2 is only taken into account if it is stipulated for the line.
d Factor may be reduced to 0,5 if favourable effect, it cannot be zero.
e In favourable cases these non-dominant values are taken equal to zero.
f HSLM and Real Trains where required in accordance with 8.4.4 and 8.4.6.1.1.
g If a dynamic analysis is required in accordance with 8.4.4 see also 8.4.6.5(3) and 8.4.6.1.2.
h See also EN 1990:2023, Table A.2.9

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NA 2.101 Clause 8.8.3.1 (1) Frequent values of the multicomponent actions

The factors applied to frequent values of the multicomponent actions given in Table 8.15 (CYS) shall be used.

NA 2.102 Clause 8.8.3.2 (1) Quasi-permanent values of the multicomponent actions

The quasi-permanent values of multi-component actions are 0,0.

NA 2.103 Clause 8.8.4 (1) Traffic loads in Transient Design Situations

No traffic loads for Transient Design Situations are set.

NA 2.104 Clause 8.9 (2) Traffic loads for fatigue

No additional requirements for the rail traffic mix are set.

NA 2.105 Clause 8.9 (3) Traffic loads for fatigue

No additional requirements for a special rail traffic mix are set.

NA 2.106 Clause 8.9 (4) Traffic loads for fatigue

No additional requirements for the alternative rail traffic mix are set.

NA 2.107 Clause 8.10.1 (1) Static load models for geotechnical structures — characteristic values – General

No additional application rules and application to geotechnical structures and buried structures are given.

NA 2.108 Clause 8.10.1 (7) Static load models for geotechnical structures — characteristic values – General

The traction and braking forces set out in 8.5.3 shall be used.

NA 2.109 Clause 8.10.2 (1) Distributed vertical loads

The width b in Figure 8.28 (CYS) shall be taken as 3 m.

The characteristic value of the concentrated load Q_{ek} is 1000 kN spread over rectangular surface area of 6,4 m × b. For a width b of 3 m, this concentrated load shall correspond to a uniformly distributed load of 52 kN/m^2.

The characteristic value of uniformly distributed load q_{ek} is 80 kN/m spread over a width of b.

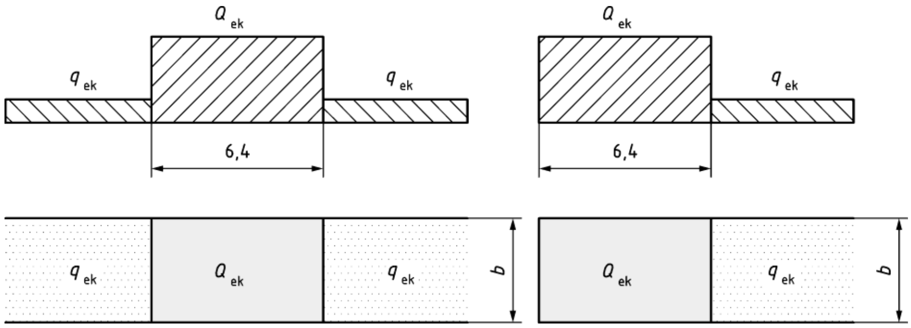

Figure 8.28 (CYS) — Equivalent load arrangement for Load Model 71 for geotechnical structures (*a*, left) Single concentrated patch load and uniformly distributed load on both sides (*b*, right) Single concentrated patch load and uniformly distributed load on one side only

NA 2.110 Clause 8.10.3 (1) Simplified vertical loads allowing for redistribution

The value of $q_{ek,1}$ is 100 kN/m, when considering Load Model 71.

The value of $q_{ek,1}$ is 150 kN/m, when considering Load Model SW/2. Load Model SW/2 is applied as defined in clause 8.3.3.

NA 2.111 Clause 8.10.3 (2) Simplified vertical loads allowing for redistribution

The value of the distance is 1,0 m.

NA 2.112 Clause C.3 (6) Dynamic factors for Real Trains

No decision between the application of Formulae (C.1) or (C.2) is made.

The relevant authority is not specified.

NA 2.113 Clause D.4 (2) General design method

The value of γ_{Ff} is 1,00.

NA 2.114 Clause D.5 (1) Train types for fatigue

No additional special types of trains for fatigue assessment are specified.

NA 3 DECISION ON USE OF THE INFORMATIVE ANNEXES A, B, E, F AND G

NA 3.1 Annex A

Annex A may be used.

NA 3.2 Annex B

Annex B may be used

NA 3.3 Annex E

Annex E may be used

NA 3.4 Annex F

Annex F may be used

NA 3.5 Annex G

Annex G may be used

NA 4 REFERENCES TO NON-CONTRADICTORY COMPLEMENTARY INFORMATION

None