

Eurocode 1: Basis of design and actions on structures —

**Part 2.1: Actions on structures —
Densities, self-weight and imposed
loads —**

**(together with United Kingdom
National Application Document)**

ICS 91.040

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Committees responsible for this Draft for Development

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- British Constructional Steelwork Association
- British Iron and Steel Producers' Association
- British Masonry Society
- Concrete Society
- Department of the Environment (Building Research Establishment)
- Department of the Environment (Property and Buildings Directorate)
- Highways Agency
- Institution of Structural Engineers
- National House Building Council
- Royal Institute of British Architects
- Steel Construction Institute

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National foreword

This Draft for Development was prepared by Subcommittee B/525/1 and is the English language version of ENV 1991-2-1:1995 *Basis of design and actions on structures — Part 2.1: Actions on structures — Densities, self-weight and imposed loads*, published by the European Committee for Standardization (CEN).

ENV 1991-2-1 results from a programme of work sponsored by the European Commission to make available a common set of rules for the design of building and civil engineering works. The full range of codes covers the basis of design and actions, the design of structures in concrete, steel, composite construction, aluminium, timber and masonry, and geotechnics and seismic design.

This publication is not to be regarded as a British Standard.

An ENV is made available for provisional application, but does not have the status of a European Standard. The aim is to use the experience gained to modify the ENV so that it can be adopted as a European Standard.

The values for certain parameters in the ENV Eurocodes may be set by individual CEN members so as to meet the requirements of national regulations. These parameters are designated by □ in the ENV.

During the ENV period reference should be made to the supporting documents listed in the National Application Document (NAD).

The purpose of the NAD is to provide essential information, particularly in relation to safety, to enable the ENV to be used for the design of buildings and civil engineering works to be constructed in the UK. The requirements of the NAD take precedence over corresponding provisions in the ENV.

Although the 1996 edition of BS 6399-1 is based on the Eurocode format for the classification of loads according to use, the British Standard has several distinct sub-categories within each Eurocode category, each usually assigned different load requirements. This more detailed British Standard specification results in a number of different loads defining current UK practice, rather than the single value quoted for the equivalent wider Eurocode category. To ensure safety and economy in line with current UK practice, in determining UK load values for this NAD, the current requirements of the British Standard have been included for as many specific uses as is practical. However, as a move towards harmonization, ENV values which have only a minor difference from the equivalent British Standard value have been accepted without amendment through this NAD.

Users of this document are invited to comment on its technical content, ease of use and any ambiguities and anomalies. These comments will be taken into account when preparing the UK national response to CEN on the question of whether the ENV can be converted to an EN.

Comments should be sent in writing to the Secretary of B/525/1, BSI, British Standards House, 389 Chiswick High Road, London W4 4AL, quoting the document reference, the relevant clause and, where possible, a proposed revision by February 1997. Comments after such time will still be possible through corporate bodies, such as engineering institutions.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to x, the ENV title page, pages 2 to 23 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

National Application Document

for use in the UK with ENV 1991-2-1:1995

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Introduction

This National Application Document (NAD) has been prepared by Subcommittee B/525/1. It has been developed from the following:

- a) a textual examination of ENV 1991-2-1;
- b) a parametric calibration against BS 6399-1, BS 6399-3 and BS 648.

1 Scope

This NAD provides information to enable ENV 1991-2-1 to be used for the structural and geotechnical design of buildings and civil engineering works to be constructed in the United Kingdom.

2 References

2.1 Normative references

This National Application Document incorporates, by reference, provisions from specific editions of other publications. These normative references are cited at the appropriate points in the text and the publications are listed on page ix. Subsequent amendments to, or revisions of, any of these publications apply to this National Application Document only when incorporated in it by updating or revision.

2.2 Informative references

This National Application Document refers to other publications that provide information or guidance. Editions of these publications current at the time of issue of this standard are listed on page ix, but reference should be made to the latest editions.

3 Use in design

Except as noted in this NAD, the values given in ENV 1991-2-1 may be used on the structural and geotechnical design of buildings and civil engineering works to be constructed in the United Kingdom.

3.1 Densities of building materials and stored materials

The values for densities of building materials and stored materials should be those given in Table 4.1 to Table 4.8 of ENV 1991-2-1:1995, except:

Replace the following values in Table 4.1 to be compatible with BS EN 338.

Class	C14	C16	C18	C22	C24	C27	C30	C35	C40	D50	D60	D70
γ	3,5	3,7	3,8	4,1	4,2	4,5	4,6	4,8	5,0	7,8	8,4	10,8

3.2 Self-weight of construction elements

Clause 5.3.3.1 (2)

The following values shall be used in 5.3.3.1 (2) if no specific information is provided on ballast depth.

Nominal total depth = 0,50 m

Maximum total depth = $(1,33 \times 0,50)$ m

Minimum total depth = $(0,50/1,33)$ m

3.3 Section 6

a) Clauses 6.2.1 (2) and 6.2.2 (2)

The reduction factors α_A according to 6.3.1.2 (3) and α_n according to 6.3.1.2 (4) should not be applied to UK values of load given in this NAD. Reference should be made to clause 5 of BS 6399-1 for load reductions.

b) Clause 6.3 Imposed loads — characteristic values

The values for imposed loads should be those given in BS 6399-1 and BS 6399-3 as shown in Table 1 to Table 3 of this NAD.

c) Clause 6.3.1.2 (2) P

The application area of the concentrated loads should be appropriate to their cause. Concentrated loads due to specialist equipment shall also be determined for the individual case.

d) Clause 6.4. Horizontal loads on partition walls and barriers due to persons

The values for imposed loads should be those given in BS 6399-1 as shown in Table 4 of this NAD.

4 Additional recommendations

4.1 Guidance on ENV 1991-2-1

NOTE 4.1.1 to 4.1.5 should be followed when designing in accordance with ENV 1991-2-1.

4.1.1 Section 1 General

Clause 1.5

For clarification the notation used in ENV 1991-2-1 is explained below.

Latin upper case letters:

- A reduction coefficient is not used;
- A loaded area in formula (6.1);
- A_0 a constant in formula (6.1).

Latin lower case letters:

- α reduction coefficient is not used;
- n number of storeys (> 2) above the loaded structural elements (used in formula 6.2).

4.1.2 Section 2 Classification of actions

Clause 2.2 (2)

Replace this clause with the following.

The imposed loads given in this Part of ENV 1991 should be considered as static loads that include an allowance for small, non-resonant dynamic effects.

4.1.3 Section 4 Densities of building materials and stored materials

Table 4.1

The values quoted do not cover proprietary lightweight materials, for which specific densities should be obtained from the supplier. Care is needed where these materials contribute to the favourable part of the restraining forces.

Densities for the following types of masonry units not given in the ENV may be used:

aggregate concrete	23 kN/m ³ ;
autoclaved aerated concrete	5–7 kN/m ³ ;
calcium silicate	20 kN/m ³ ;
clay	20–24 kN/m ³ ;
manufactured stone	19–23 kN/m ³ .

4.1.4 Section 5 Self-weight of construction elements

a) Clause 5.3.2.1 (1)

Where permanent partitions are indicated, their weight shall be included in the dead load, acting at the given partition location.

The equivalent uniformly distributed load of partitions which are not permanent may be taken as not less than one third of the load per metre run of the finished partitions. For offices this should not be less than 1,0 kN/m².

b) Clause 5.3.2.1 (3) P

In this clause “thin concrete slabs” should be taken to apply to slabs of less than 150 mm thickness.

c) Clause 5.3.2.1 (4) P

For simplicity, the weight of unrendered masonry walls may be based upon the density of the body material, ignoring the mortar.

4.1.5 Section 6 Imposed loads on buildings

a) Clause 6.2.2 (1) P

This clause defines the loads on the floor of each storey as fixed actions. Only uniformly distributed loading is used, not concentrated loads. Pattern loading including eccentricity and unbalanced loading should be considered in accordance with UK practice.

b) *Clause 6.2.2 (2)*

Once the loads from several storeys have been reduced, the resulting load is treated as a single load case.

c) *Table 6.1*

The examples should be used for guidance. The design should be based on the highest load which is likely to be applied.

d) *Clause 6.3.2.1 (1) P*

For vehicles with a total weight > 160 kN on two axles, reference should be made to ENV 1991-3.

e) *Clause 6.3.4.2 (5) P*

The reference to Table 4.3 should be to Table 6.6.

f) *Table 6.7*

This table is applied to partition walls only when they have the function of a barrier.

4.2 Recommendations on subjects not covered in ENV 1991-2-1a) *Clause 1.1.2 (7)*

ENV 1991-2-1 does not give barrier loads for car parks. Values from BS 6399-1 should be used.

b) *Clause 1.1.2 (8)*

ENV 1991-2-1 does not specify dynamic loads causing vibrations or significant dynamic effects. Guidance is given in BS 6399-1.

c) *Clause 6.4*

ENV 1991-2-1 does not specify loads applicable to the infill of barriers. See BS 6399-1

Table 1 — Imposed loads on floors in buildings

Loaded areas		q_k [kN/m ²]		Q_k [kN]	
		ENV value	UK value	ENV value	UK value
Category A (see note 1)	— general (see note 2)	2,0	2,0 (see note 3)	2,0	2,0
	— stairs	3,0	3,0	2,0	4,0
	— balconies	4,0	4,0 (see note 4)	2,0	1,5 kN/m run at outside edge
Category B		3,0	2,5	2,0	2,7
Category C (see note 5)	C1 (see note 6)	3,0	3,0	4,0	2,7
	C2 (see note 7)	4,0	4,0	4,0	4,0
	C3	5,0	4,0	4,0	4,0
	C4 [see 4.2 b)]	5,0	5,0	7,0	4,0
	C5 [see 4.2 b)]	5,0	5,0 (see note 8)	4,0	4,0
Category D	D1	5,0	4,0	4,0	4,0
	D2	5,0	note 9	7,0	note 9
Category E		6,0	note 10	7,0	note 10
NOTE 1 For all usages within self-contained dwelling units, $q_k = 1,5$, $Q_k = 1,4$.					
NOTE 2 For specific use as a communal kitchen, $q_k = 3,0$, $Q_k = 4,5$.					
NOTE 3 For bedrooms and dormitories except in hotels and motels, $q_k = 1,5$.					
NOTE 4 For guest houses, residential clubs and communal areas in blocks of flats, $q_k = 3,0$.					
NOTE 5 For corridors etc, see BS 6399-1.					
NOTE 6 For all communal dining areas and lounges, including cafes and restaurants, $q_k = 2,0$, $Q_k = 2,7$. For reading rooms without book storage, $q_k = 2,5$, $Q_k = 4,5$.					
NOTE 7 For places of worship, $q_k = 3,0$, $Q_k = 2,7$.					
NOTE 8 For stages susceptible to overcrowding in public assembly areas, $q_k = 7,5$.					
NOTE 9 Not defined in ENV 1991-2-1 and therefore no equivalent UK value can be given.					
NOTE 10 See BS 6399-1 loading based upon specific use and if appropriate, stored height.					

Table 2 — Imposed loads on garages and vehicle traffic areas

Traffic areas	q_k [kN/m ²]		Q_k [kN]	
	ENV value	UK value	ENV value	UK value
Category F vehicle weight ≤ 30 kN	2,0	2,5	10,0	9,0
Category G vehicle weight $> 30, \leq 160$ kN	5,0	note 1	45,0	note 1
NOTE 1 To be determined for specific use.				

Table 3 — Imposed loads on roofs

Roofs	q_k [kN/m ²]		Q_k [kN]	
	ENV value	UK value	ENV value	UK value
Category H Roof slope (see note 2) $< 20^\circ$ $= 40^\circ$	0,75 0,0	0,6 0,4 (see note 4)	1,5 1,5	0,9 (see note 3) 0,9
NOTE 1 See also BS 6399-3 for snow loads. Snow loads and imposed roof loads from this table are alternative load cases.				
NOTE 2 For slopes between 20° and 40° the value of q_k may be determined by linear interpolation.				
NOTE 3 Assumes spreader boards will be used.				
NOTE 4 For slopes between 40° and 60° the value of q_k may be determined by linear interpolation, with a value of q_k at 60° of zero.				

Table 4 — Horizontal loads on partition walls and barriers due to persons

Loaded areas	q_k [kN/m]	
	ENV value	UK value
Category A	0,5	0,74 (see note 1)
Category B	1,0	0,74 (see note 2)
Category C1	1,0	1,5
Category C2, C4 and D	1,5	1,5
Category C3	1,5	0,74
Category C5	3,0	3,0
NOTE 1 For all areas within self-contained dwellings, except external balconies and edges of roofs, $q_k = 0,36$.		
NOTE 2 For light access stairs not more than 600 mm wide, $q_k = 0,22$. For light pedestrian traffic routes in industrial and storage buildings $q_k = 0,36$.		

Table 5 — References in ENV 1991-2-1

Clause in ENV 1991-2-1 giving reference to other codes or standards	Document referred to	Document title	Status	UK document
1.2 1.4(1) 2.1(1)P 2.2(1)P 3.1(1)P 5.3.1.1(3) 5.3.1.3(3) 5.3.2.1(3)P 6.1(4)P 6.3.1.2(3)	ENV 1991-1	<i>Basis of design</i>	ENV	DD ENV:1991-1
6.3.3(3)9	ENV 1991-2-6	<i>Loads and deformations imposed during execution</i>	ENV	—
1.1.2(7)note 2.2(1)P	ENV 1991-2-7	<i>Accidental actions</i>	ENV	—
1.1.2(6)P	ENV 1991-3	<i>Traffic loads on bridges</i>	ENV	DD ENV:1991-3
6.3.3(4)P	ENV 1991-4	<i>Actions in silos and tanks</i>	ENV	DD ENV:1991-4
5.3.3.2(3)	ENV 1993	<i>Design of steel structures</i>	ENV	DD ENV:1993
2.1(2)P	ENV 1997	<i>Geotechnical design</i>	ENV	DD ENV:1997
1.2 1.5(1)note	ISO 3898:1987	<i>Basis of design for structures. Notations. General symbols</i>		—
Table 4.1 Table 4.3	ENV 206	<i>Concrete performance, production, placing and compliance procedure</i>	ENV	DD ENV:206
Table 4.1	prEN 771	<i>Specification for masonry units</i>		—
Table 4.1	prEN 338	<i>Structural timber strength classes</i>	EN	BS EN 338
Table 4.2	UIC 60	<i>General regulations concerning electric traction lines</i>	—	—