The second generation Structural Eurocodes: plans for addressing the changing climate

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wsp

M526 Workshop – 17 March 2021

Some key Eurocode facts and figures:

Some key Eurocode facts and figures:

500 000
Engineers

10-59

5000 Pages

1055 NDPs

34 Countries

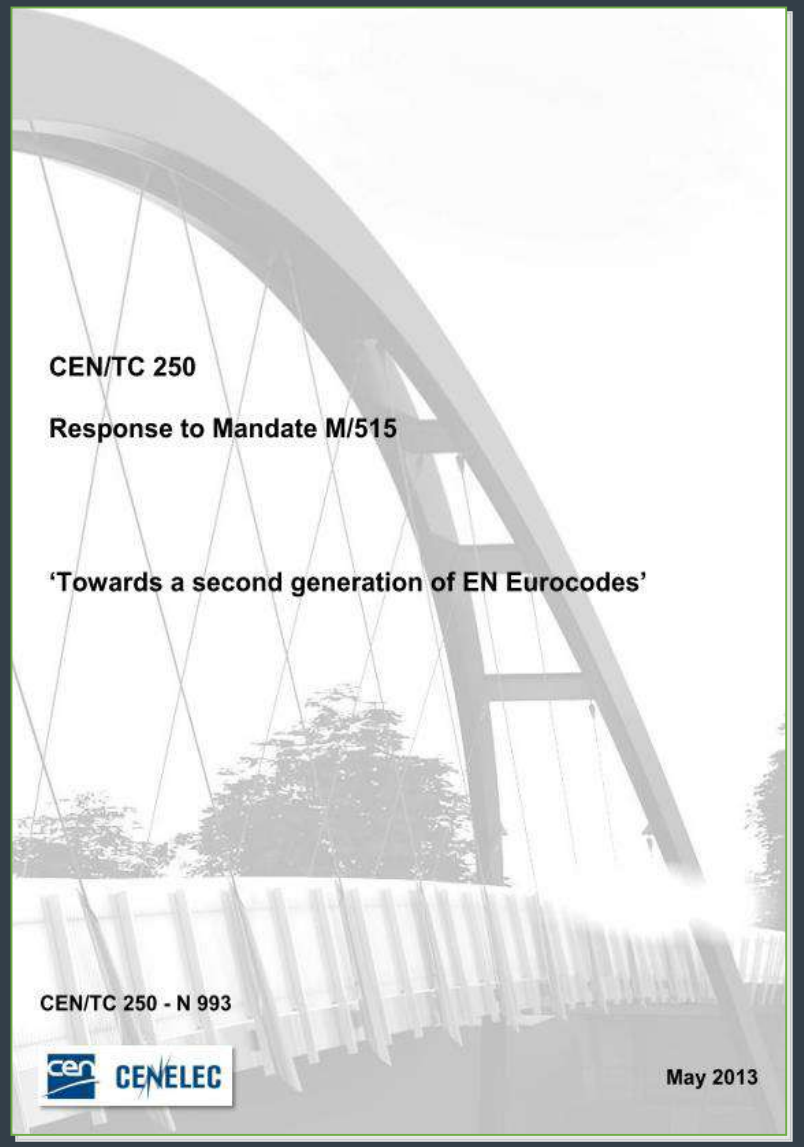
97
SCs/WGs/
TGs

EUROPEAN COMMISSION
ENTERPRISE AND INDUSTRY DIRECTORATE-GENERAL

Sustainable Growth and EU 2020
Sustainable Industrial Policy and Construction

Brussels, 12 December 2012
M/515 EN

MANDATE FOR AMENDING EXISTING EUROCODES AND EXTENDING THE SCOPE OF STRUCTURAL EUROCODES



CEN/TC 250

Response to Mandate M/515

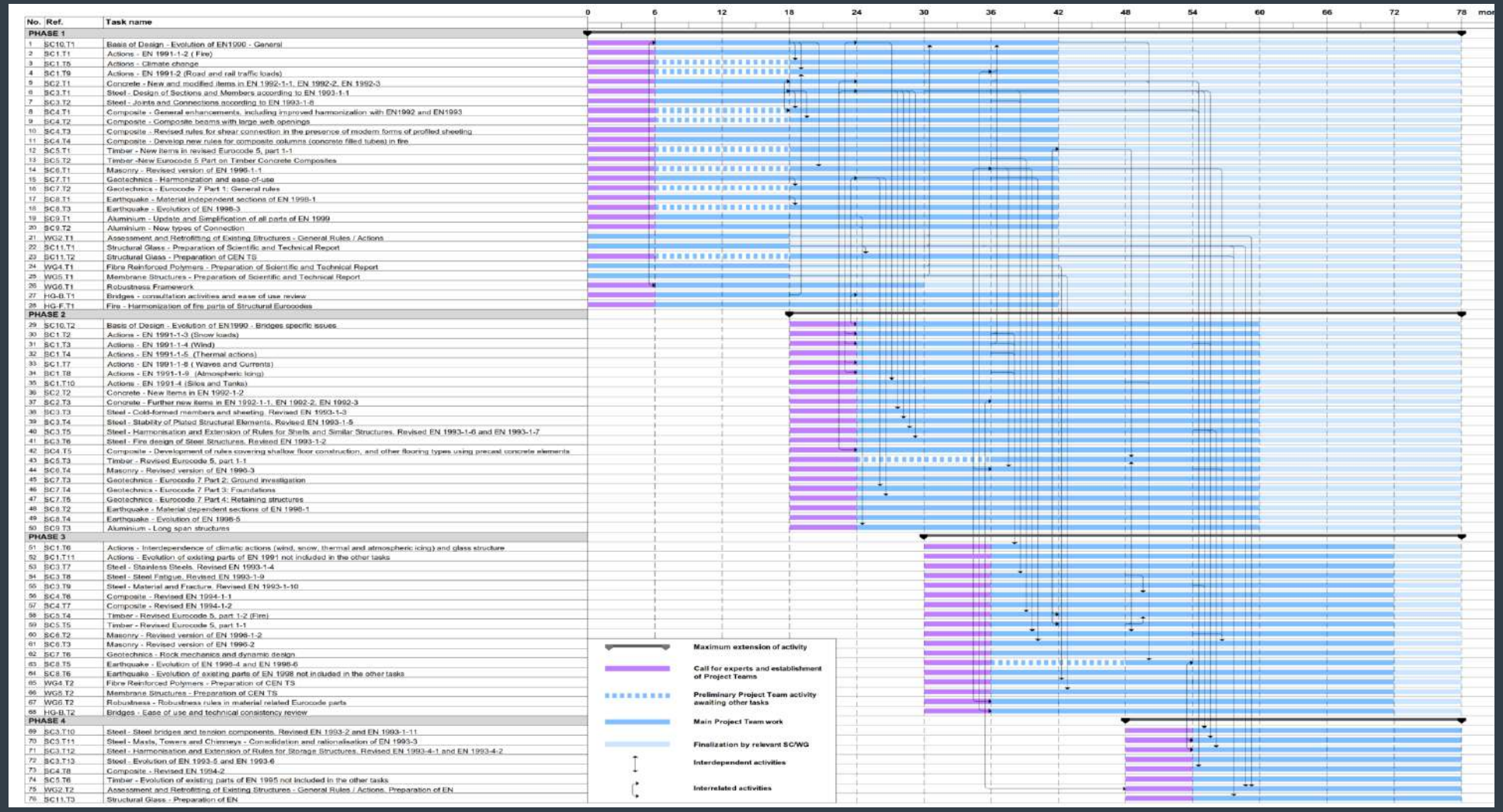
'Towards a second generation of EN Eurocodes'

CEN/TC 250 - N 993

CEN CENELEC

May 2013

CEN/TC 250 Work Programme (as proposed)



No.	Ref.	Task name
PHASE 1		
1	SC10.T1	Basis of Design - Evolution of EN1990 - General
2	SC1.T1	Actions - EN 1991-1-2 (Fire)
3	SC1.T5	Actions - Climate change
4	SC1.T9	Actions - EN 1991-2 (Road and rail traffic loads)
5	SC2.T1	Concrete - New and modified items in EN 1992-1-1, EN 1992-2, EN 1992-3
6	SC3.T1	Steel - Design of Sections and Members according to EN 1993-1-1
7	SC3.T2	Steel - Joints and Connections according to EN 1993-1-8
8	SC4.T1	Composite - General enhancements, including improved harmonization with EN1992 and EN1993
9	SC4.T2	Composite - Composite beams with large web openings
10	SC4.T3	Composite - Revised rules for shear connection in the presence of modern forms of profiled sheeting
11	SC4.T4	Composite - Develop new rules for composite columns (concrete filled tubes) in fire
12	SC5.T1	Timber - New items in revised Eurocode 5, part 1-1
13	SC5.T2	Timber -New Eurocode 5 Part on Timber Concrete Composites
14	SC6.T1	Masonry - Revised version of EN 1996-1-1
15	SC7.T1	Geotechnics - Harmonization and ease-of-use
16	SC7.T2	Geotechnics - Eurocode 7 Part 1: General rules
17	SC8.T1	Earthquake - Material independent sections of EN 1998-1
18	SC8.T3	Earthquake - Evolution of EN 1998-3
19	SC9.T1	Aluminium - Update and Simplification of all parts of EN 1999
20	SC9.T2	Aluminium - New types of Connection
21	WG2.T1	Assessment and Retrofitting of Existing Structures - General Rules / Actions
22	SC11.T1	Structural Glass - Preparation of Scientific and Technical Report
23	SC11.T2	Structural Glass - Preparation of CEN TS
24	WG4.T1	Fibre Reinforced Polymers - Preparation of Scientific and Technical Report
25	WG5.T1	Membrane Structures - Preparation of Scientific and Technical Report
26	WG6.T1	Robustness Framework
27	HG-B.T1	Bridges - consultation activities and ease of use review
28	HG-F.T1	Fire - Harmonization of fire parts of Structural Eurocodes
PHASE 2		
29	SC10.T2	Basis of Design - Evolution of EN1990 - Bridges specific issues
30	SC1.T2	Actions - EN 1991-1-3 (Snow loads)
31	SC1.T3	Actions - EN 1991-1-4 (Wind)
32	SC1.T4	Actions - EN 1991-1-5 (Thermal actions)
33	SC1.T7	Actions - EN 1991-1-9 (Waves and Currents)
34	SC1.T8	Actions - EN 1991-1-9 (Atmospheric Icing)
35	SC1.T10	Actions - EN 1991-4 (Silos and Tanks)
36	SC2.T2	Concrete - New items in EN 1992-1-2
37	SC2.T3	Concrete - Further new items in EN 1992-1-1, EN 1992-2, EN 1992-3
38	SC3.T3	Steel - Cold-formed members and sheeting. Revised EN 1993-1-3
39	SC3.T4	Steel - Stability of Plated Structural Elements. Revised EN 1993-1-5
40	SC3.T5	Steel - Harmonisation and Extension of Rules for Shells and Similar Structures. Revised EN 1993-1-6 and EN 1993-1-7
41	SC3.T6	Steel - Fire design of Steel Structures. Revised EN 1993-1-2
42	SC4.T5	Composite - Development of rules covering shallow floor construction, and other flooring types using precast concrete elements
43	SC5.T3	Timber - Revised Eurocode 5, part 1-1
44	SC6.T4	Masonry - Revised version of EN 1996-3
45	SC7.T3	Geotechnics - Eurocode 7 Part 2: Ground investigation
46	SC7.T4	Geotechnics - Eurocode 7 Part 3: Foundations
47	SC7.T5	Geotechnics - Eurocode 7 Part 4: Retaining structures
48	SC8.T2	Earthquake - Material dependent sections of EN 1998-1
49	SC8.T4	Earthquake - Evolution of EN 1998-5
50	SC9.T3	Aluminium - Long span structures
PHASE 3		
51	SC1.T6	Actions - Interdependence of climatic actions (wind, snow, thermal and atmospheric icing) and glass structure
52	SC1.T11	Actions - Evolution of existing parts of EN 1991 not included in the other tasks
53	SC3.T7	Steel - Stainless Steels. Revised EN 1993-1-4
54	SC3.T8	Steel - Steel Fatigue. Revised EN 1993-1-9
55	SC3.T9	Steel - Material and Fracture. Revised EN 1993-1-10
56	SC4.T6	Composite - Revised EN 1994-1-1
57	SC4.T7	Composite - Revised EN 1994-1-2
58	SC5.T4	Timber - Revised Eurocode 5, part 1-2 (Fire)
59	SC5.T5	Timber - Revised Eurocode 5, part 1-1
60	SC6.T2	Masonry - Revised version of EN 1996-1-2
61	SC6.T3	Masonry - Revised version of EN 1996-2
62	SC7.T6	Geotechnics - Rock mechanics and dynamic design
63	SC8.T5	Earthquake - Evolution of EN 1998-4 and EN 1998-6
64	SC8.T6	Earthquake - Evolution of existing parts of EN 1998 not included in the other tasks
65	WG4.T2	Fibre Reinforced Polymers - Preparation of CEN TS
66	WG5.T2	Membrane Structures - Preparation of CEN TS
67	WG6.T2	Robustness - Robustness rules in material related Eurocode parts
68	HG-B.T2	Bridges - Ease of use and technical consistency review
PHASE 4		
69	SC3.T10	Steel - Steel bridges and tension components. Revised EN 1993-2 and EN 1993-1-11
70	SC3.T11	Steel - Masts, Towers and Chimneys - Consolidation and rationalisation of EN 1993-3
71	SC3.T12	Steel - Harmonisation and Extension of Rules for Storage Structures. Revised EN 1993-4-1 and EN 1993-4-2
72	SC3.T13	Steel - Evolution of EN 1993-5 and EN 1993-6
73	SC4.T8	Composite - Revised EN 1994-2
74	SC5.T6	Timber - Evolution of existing parts of EN 1995 not included in the other tasks
75	WG2.T2	Assessment and Retrofitting of Existing Structures - General Rules / Actions. Preparation of EN
76	SC11.T3	Structural Glass - Preparation of EN

Maximum extension of activity

Call for experts and establishment of Project Teams

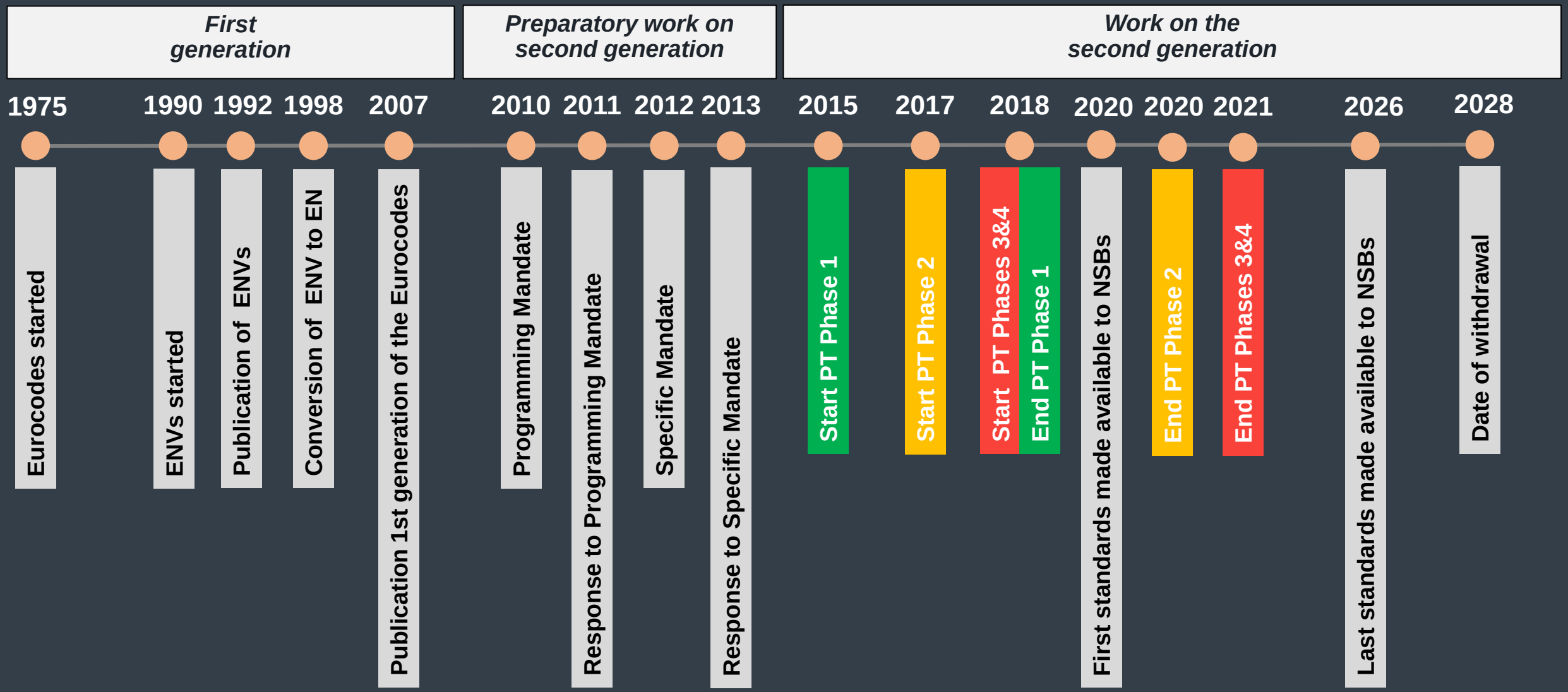
Preliminary Project Team activity awaiting other tasks

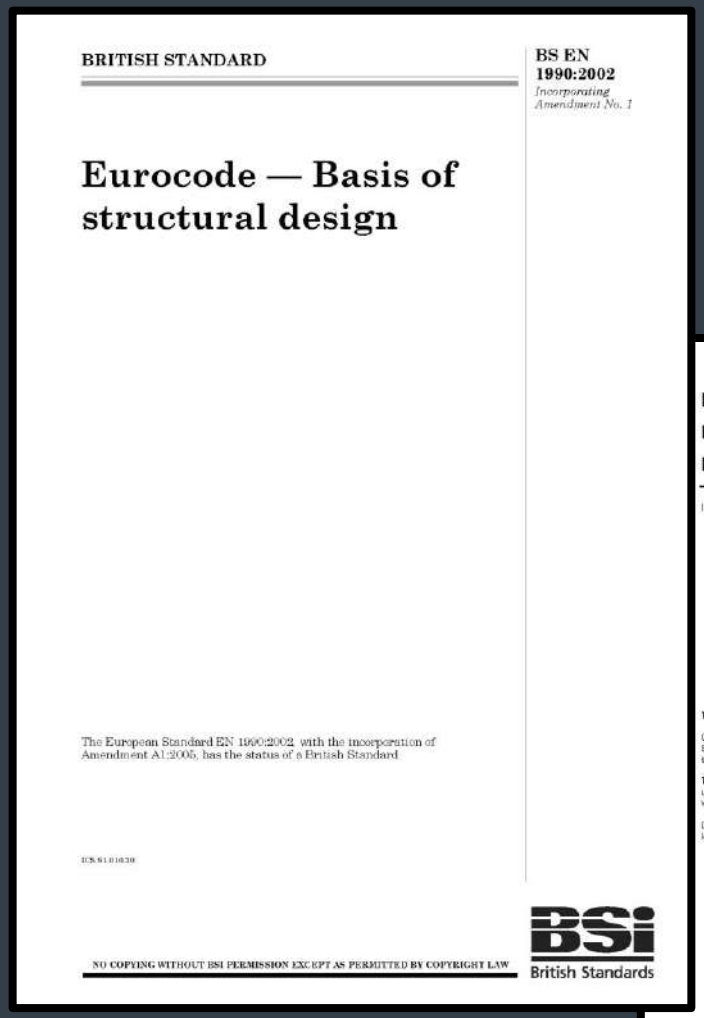
Main Project Team work

Finalization by relevant SC/WG

Interdependent activities

Interrelated activities


First generation
Preparatory work on second generation
Work on the second generation
1975
1990
1992
1998
2007
2010
2011
2012
2013
2015
2017
2018
2020
2020
2021
2026
2028
Eurocodes started
ENVs started
Publication of ENVs
Conversion of ENV to EN
Publication 1st generation of the Eurocodes
Programming Mandate
Response to Programming Mandate
Specific Mandate
Response to Specific Mandate
Start PT Phase 1
Start PT Phase 2
Start PT Phases 3&4
End PT Phase 1
First standards made available to NSBs
End PT Phase 2
End PT Phases 3&4
Last standards made available to NSBs
Date of withdrawal



BRITISH STANDARD

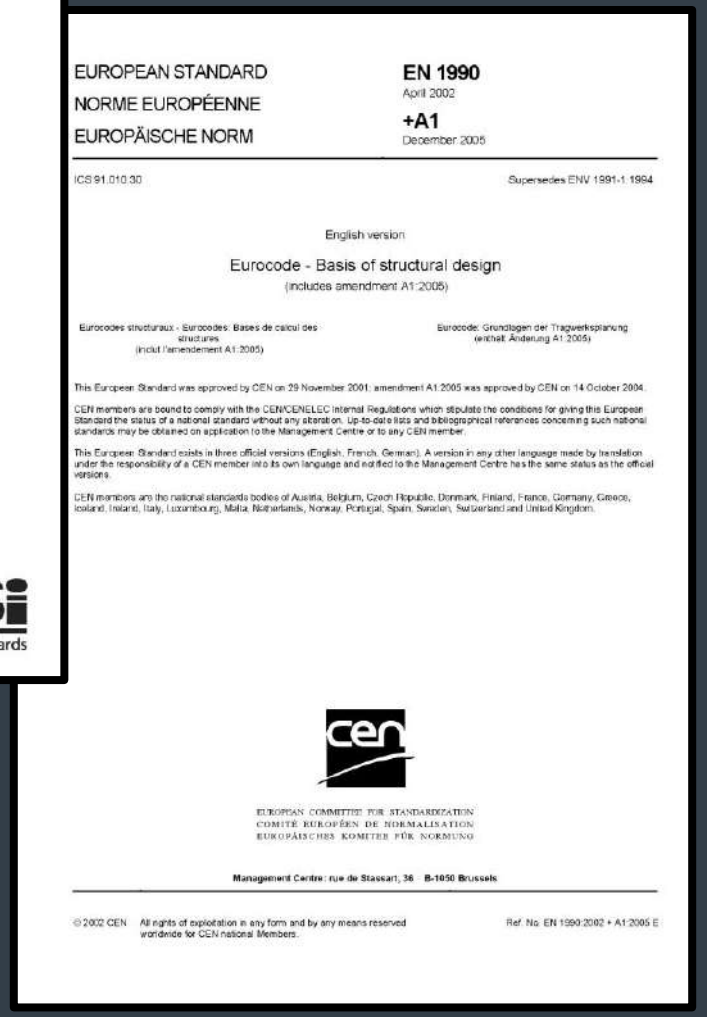
BS EN 1990:2002
Incorporating Amendment No. 1

Eurocode — Basis of structural design

The European Standard EN 1990:2002, with the incorporation of Amendment A1:2005, has the status of a British Standard

ICS 91.010.30

BSI British Standards



EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1990
April 2002
+A1
December 2005

ICS 91.010.30 Supersedes ENV 1991-1:1994

English version

Eurocode - Basis of structural design
(includes amendment A1:2005)

Eurocodes structuraux - Eurocodes: Bases de calcul des structures (inclut l'amendement A1:2005)

Eurocode: Grundlagen der Tragwerksplanung (enthält Änderung A1:2005)

This European Standard was approved by CEN on 29 November 2001; amendment A1:2005 was approved by CEN on 14 October 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

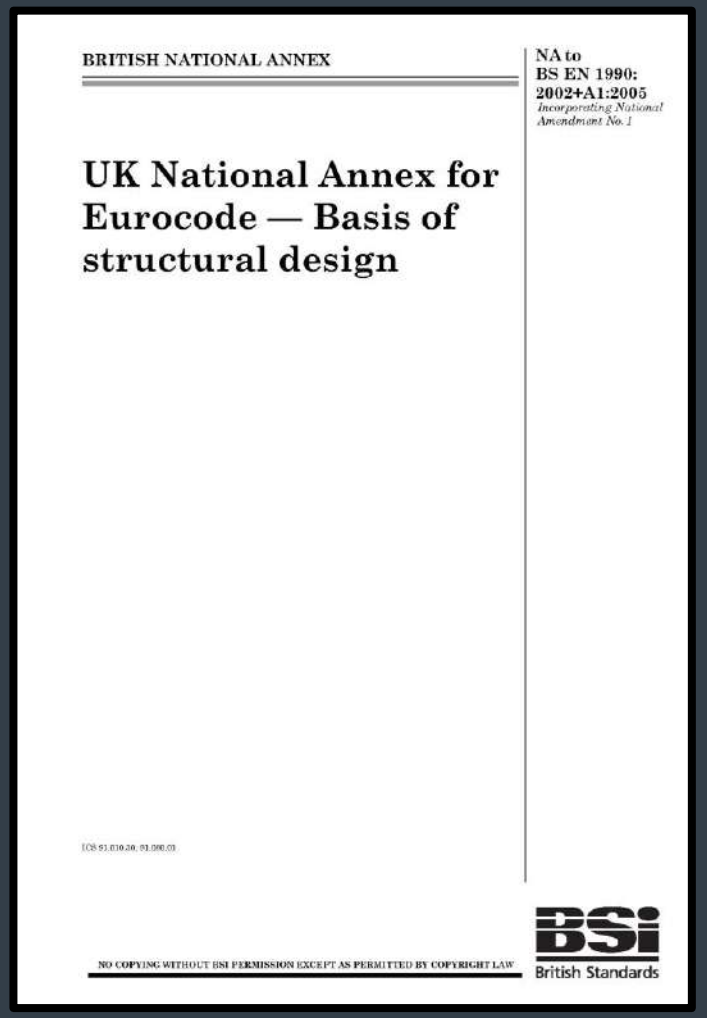
CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

cen

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 1990:2002 + A1:2005 E



BRITISH NATIONAL ANNEX

NA to BS EN 1990: 2002+A1:2005
Incorporating National Amendment No. 1

UK National Annex for Eurocode — Basis of structural design

ICS 91.010.30, 91.080.01

BSI British Standards

NA contains values of Nationally Determined Parameters (NDPs)

Maps for environmental actions are NDPs

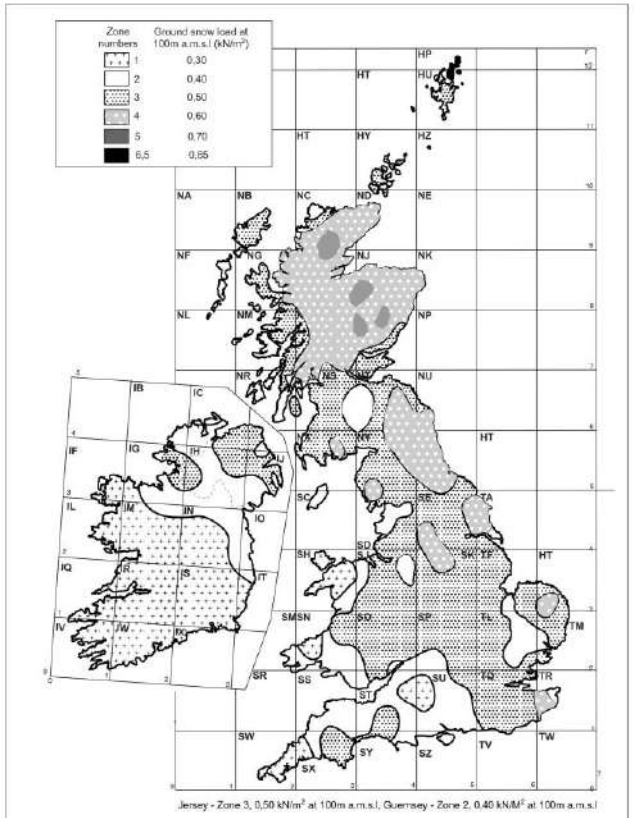


Figure NA.1 — Characteristic ground snow load map

Figure NA.1 **Value of fundamental basic wind velocity $v_{b,map}$ (m/s) before the altitude correction is applied**

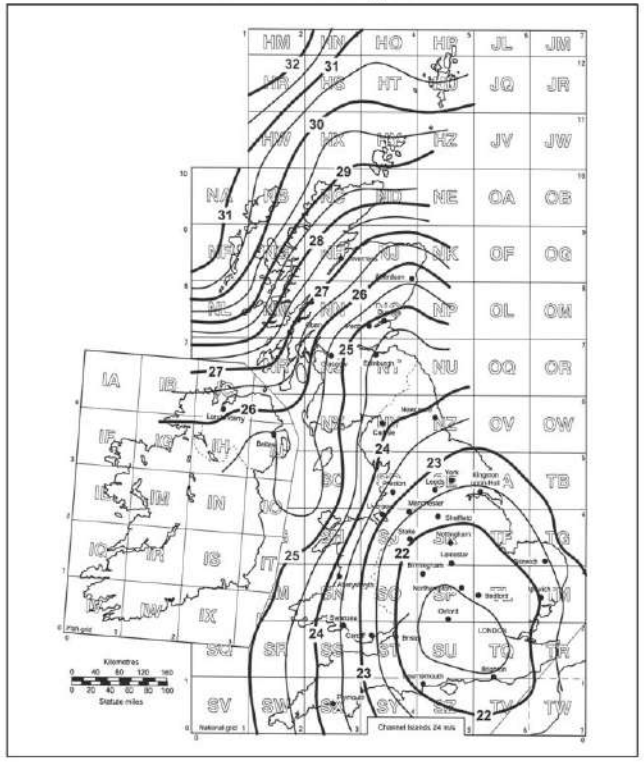
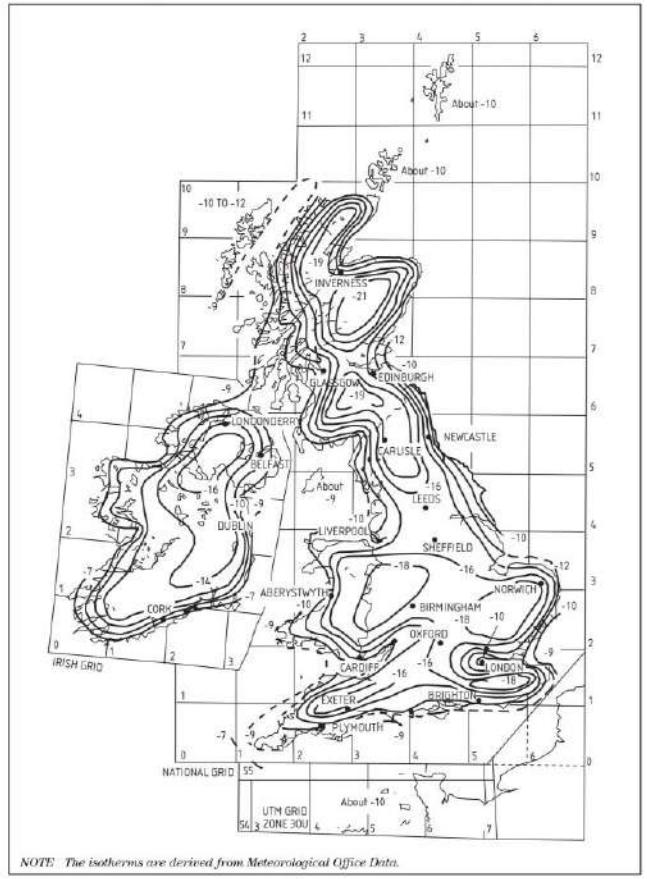


Figure NA.1 **Isotherms of minimum shade air temperature (°C)**



NOTE The isotherms are derived from Meteorological Office Data.

Proposed introduction of ‘Scaling Factors’ for Climate Change

Wind (EN 1991-1-4)

(1) The fundamental value of the basic wind velocity, $v_{b,0}$, should be taken as the characteristic 10 minutes mean wind velocity, irrespective of wind direction and time of year, at 10 m above ground level in open country terrain with low vegetation such as grass and isolated obstacles with separations of at least 20 obstacle heights.

NOTE 1 This terrain corresponds to terrain category II in **Error! Reference source not found.** and is illustrated in B.1.

NOTE 2 The fundamental value of the basic wind velocity, $v_{b,0}$ can be set in the National Annex.

NOTE 3 Annex A gives indicative values of the fundamental value of the basic wind velocity, $v_{b,0}$ on a European map. These values are superseded by values and procedures in the National Annex. Such values do not cover climate change.

(2) The effects of climate change shall be taken into account by multiplying the fundamental value of basic wind velocity, $v_{b,0}$ by a scaling factor, $FC_{w,cc}$, greater than or equal to 1.

NOTE Minimum values for the scaling factor $FC_{w,cc}$ can be set in the National Annex.

(3) Additional project-specific requirements to account for the effects of climate change may be as specified by the relevant authority or, where not specified, agreed for a specific project by the relevant parties

Proposed introduction of ‘Scaling Factors’ for Climate Change

Thermal (EN 1991-1-5)

(1)P Characteristic values of minimum and maximum shade air temperatures for the site location shall be obtained.

NOTE Information on minimum and maximum shade air temperatures (e.g. maps of isotherms or tabulated values) can be found in the National Annex.

(2) The effects of climate change shall be taken into account by modifying the characteristic value of minimum (T_{min}) and maximum (T_{max}) shade air temperatures by the term ΔT_{cc}.

NOTE Minimum values for the term ΔT_{cc} can be set in the National Annex.

(3) Additional project-specific requirements to account for the effects of climate change may be as specified by the relevant authority or, where not specified, agreed for a specific project by the relevant parties.

Consideration of Climate Change Scaling factors

- It is recognised that derivation is not straightforward

Consideration of Climate Change Scaling factors

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Probabilistic methodology for the assessment of the impact of climate change on structural safety

Pietro Croce, Paolo Formichi, Filippo Landi

Department of Civil and Industrial Engineering, Structural Division, University of Pisa, Pisa, Italy. E-mail: p.croce@ing.unipi.it

Structural design is often governed by climatic actions, such as snow, wind, thermal and atmospheric icing loads, that will occur during the design service life. Since in structural standards climatic actions are usually derived from historical data series assuming stationary climate, alterations induced by climate change should be specifically evalu... methodology for t... the analysis of obs... Factor of change ... generated by an ac... climate model out... considering the n... parameters. Speci... moving time wind... maxima of the inv... climate change o... target reliability o...

Keywords: Climat...

applied sciences

MDPI

Article

Climate Change: Impacts on Climatic Actions and Structural Reliability

Pietro Croce *, Paolo Formichi and Filippo Landi

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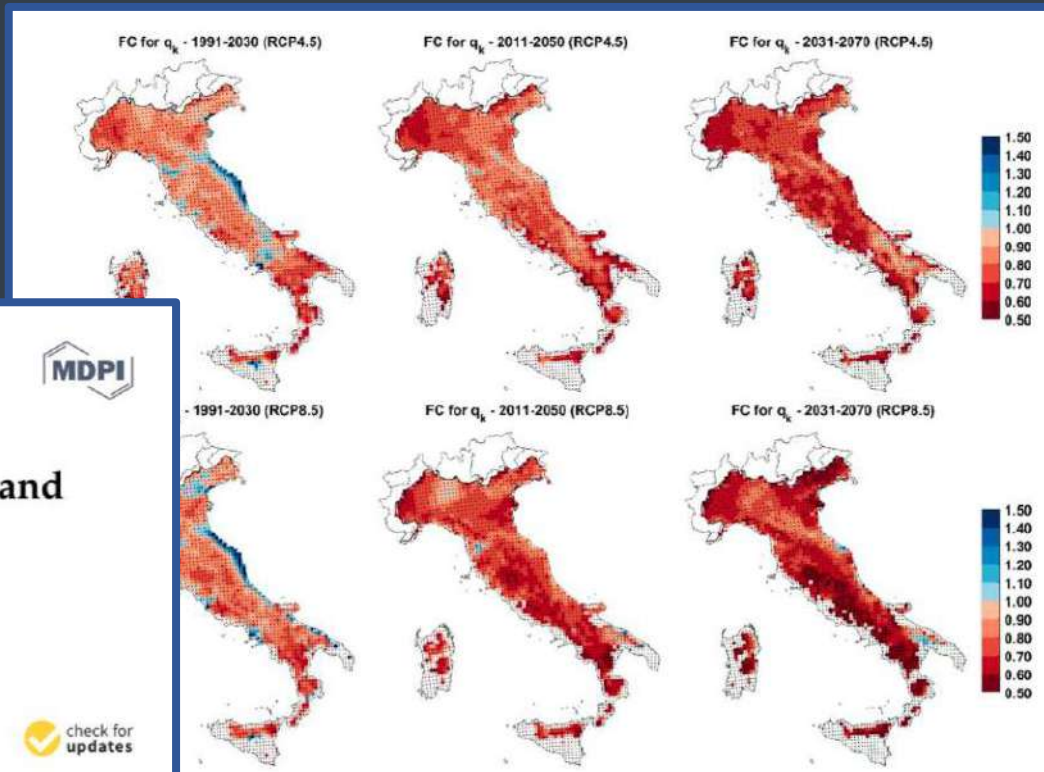
Received: 10 November 2019; Accepted: 8 December 2019; Published: 11 December 2019

check for updates

Featured Application: This study provides a general methodology for the assessment of the impact of climate change on reliability of structures, combining observations and climate projections, to the aim of giving guidance for the adaptation of climatic load maps in structural Codes.



Characteristic ground snow load q_k factors of change in Italy referring to 1951–1990. RCP4.5 RCP8.5 (2nd row).

Consideration of Climate Change Scaling factors

- It is recognised that derivation is not straightforward
- Guidance to support NA development would be valued