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Survey of national requirements used in conjunction with EN 206-1:2000

ICS 91.100.30

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British Standards

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National foreword

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A list of organizations represented on this committee can be obtained on request to its secretary.

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Survey of national requirements used in conjunction with EN 206-1:2000

État des prescriptions nationales utilisées avec l'EN 206-1:2000

Überblick nationaler Anforderungen, die im Zusammenhang mit EN 206-1:2000 verwendet werden

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Foreword

This document (CEN/TR 15868:2009) has been prepared by Technical Committee CEN/TC 104 “Concrete and related products”, the secretariat of which is held by DIN.

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1 Scope

This CEN Report provides a summary of national requirements used with EN 206-1:2000. The aims of this CEN Report are to:

a) provide a picture of how EN 206-1 is being applied in practice;

b) identify areas where EN 206-1 is being interpreted in different ways;

c) identify areas where CEN Member Countries have found simplification to be necessary;

d) identify additional national requirements;

e) show areas where CEN Member Countries have found it necessary to override the requirements of EN 206-1.

EN 206-1 uses the phrase ‘national provisions’. However, recent CEN Guidance wishes to retain this term for regulatory requirements only. This survey uses the term ‘national requirements’ to include regulations, standards and other documents that form the basis of local practice.

As a summary of national requirements, the information in this CEN Report is incomplete and may have been subject to later revisons. It is insufficient and not intended to provide the basis for design and specification: for this the national requirements (see Table 1.1) should be studied.

Table 1.1 identifies CEN Member Countries who did not respond to the questionnaire. The other tables in this CEN Report only include information from CEN Member Countries who responded and CEN Member Countries who did not respond are not identified.

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CEN Member Countries

Austria	AT
Belgium	BE
Cyprus	CY
Czech Republic	CZ
Denmark	DK
Estonia	EE
Finland	FI
France	FR
Germany	DE
Greece	GR
Hungary	HU
Iceland	IS
Ireland	IE
Italy	IT

CEN Member Countries

Latvia	LV
Lithuania	LT
Luxembourg	LU
Malta	MT
Netherlands	NL
Norway	NO
Poland	PL
Portugal	PT
Slovakia (Slovak Republic)	SK
Slovenia	SI
Spain	ES
Sweden	SE
Switzerland	CH
United Kingdom	UK

Affiliates

Albania	AL
Bulgaria	BG
Croatia (Hrvatska)	HR
Romania	RO
Turkey	TR

2 Location of national requirements

Table 1.1 gives the title of the documents that contain the national requirements, together with an English translation of the title. Any person wishing to design and specify concrete in another CEN Member Country should consult the documents cited in Table 1.1. Please note that the documents will be written in the national language(s) of the CEN Member Country. It should also be noted that the survey was conducted during 2005 to 2006 and the answers reflect practice at that time, which may not be the same as current practice.

Table 1.1 — Location of national requirements

CEN Member Countries[a]	Location of national requirements
Austria	ÖNORM B 4710-1: Beton — Teil 1: Festlegung, Herstellung, Verwendung und Konformitätsnachweis (Regeln zur Umsetzung der ÖNORM EN 206-1) (Concrete — Part 1: Specification, production, use and verification of conformity (Rules for the implementation of ÖNORM EN 206-1))
Belgium	NBN B 15-001: Supplément à la NBN EN 206-1 — Béton — Spécification, performances, production et conformité NBN B 15-001: Aanvulling op NBN EN 206-1 — Beton — Eisen, gedraging, vervaardiging en conformiteit (Supplement to NBN EN 206-1: Concrete — Specification, performance, production and conformity)
Cyprus	No response received
Czech Republic	CSN EN 206-1 Zmena Z2
Denmark	DS 2426: Beton — Materialer — Regler for anvendelse af EN 206-1 i Danmark (Concrete — Materials — Rules for the use of EN 206-1 in Denmark)
Estonia	No response received
Finland	Suomen rakentamismääräyskokoelma, B4 Betonirakenteet, Liite 3: Kansallinen liite standardiin SFS-EN 206-1 (National Building Code of Finland, B4 Concrete structures, Annex 3: national Annex to standard SFS-EN 206-1) Informative Guidance document: Betoninormit 2004, Suomen Betoniyhdistys (Concrete Code, Finnish Concrete Association)
France	National annex included in the NF EN 206-1 standard
Germany	DIN 1045-2: Tragwerke aus Beton, Stahlbeton und Spannbeton — Teil 2: Beton — Festlegung, Eigenschaften, Herstellung und Konformität — Anwendungsregeln zu DIN EN 206-1 (DIN 1045-2: Concrete, reinforced and prestressed concrete structures — Part 2: Concrete — Specification, properties, production and conformity — Application rules for DIN EN 206-1)
Greece	No response received
Hungary	No response received
Iceland	No response received
Ireland	National Annex; published with I.S. EN 206-1 as a single document.
Italy	UNI 11104: Calcestruzzo — Specificazione, prestazione produzione e conformità Istruzioni complementari per l'applicazione della EN 206-1 (Concrete — Specification, performance, production and conformity, Additional provisions for the application of EN 206-1)

Table 1.1 (*continued*)

CEN Member Countries[a]	Location of national requirements
Latvia	No response received
Lithuania	No response received
Luxembourg	DNA EN 206: Document National d'Application luxembourgeois de l'EN 206-1: Béton — Partie 1: Spécification, performances, production et conformité (DNA EN 206: Luxemburgish national application document of the EN 206-1: Concrete — Part 1: specification, performance, production and conformity)
Malta	There are no national provisions, but in the past, local industry has used recommendations in European, British or German standards
Netherlands	NEN 8005:2004: Nederlandse invulling van NEN-EN 206-1: Beton — Deel 1: Specificatie, eigenschappen, vervaardiging en conformiteit (Dutch supplement to NEN-EN 206-1: Concrete — Part 1: Specification, performance, production and conformity)
Norway	NS-EN 206-1 National Annex
Poland	No response received
Portugal	The Portuguese requirements are in the National Annex to NP EN 206-1 and to NP ENV 13670-1 and in the following National Civil Engineering Laboratory (LNEC) specifications, referenced in the NA of NP EN 206-1 LNEC E 461:2004: Metodologia para prevenir reacções expansivas internas (Methodology for avoiding internal expansive reactions) LNEC E 464:2005: Metodologia prescritiva para uma vida útil de 50 e 100 anos face às acções ambientais (Prescritive methodology for a 50 and 100 years design working life under the environmental exposures) LNEC E 465:2005: Metodologia para estimar as propriedades de desempenho do betão que permitam satisfazer a vida útil de projecto de estruturas de betão armado ou pré-esforçado sob as exposições ambientais XC e XS (Methodology for estimating the concrete performance properties allowing to comply with the design working life of the reinforced or prestressed concrete structures under the environmental exposures XC and XS)
Slovakia	STN EN 206-1: Zmena 1 Concrete — Part 1: Specification, performance, production and conformity supplements EN 206-1 with the national provisions STN 731210: Water-proof concrete and concrete types of the specific characteristics (Resistance to abrasion, Concrete for the massive constructions — Low hydrating warmth)
Slovenia	SIST 1026: Beton — 1.del: Specifikacija, lastnosti, proizvodnja in skladnost — Pravila za uporabo SIST EN 206-1 (SIST 1026: Concrete — Part 1: Specification, performance, production and conformity— Rules for the implementation of SIST EN 206-1)
Spain	Spain has not adopted EN 206-1
Sweden	SS 13 70 03: Betong – Användning av EN 206-1 I Sverige (Concrete — Application of EN 206-1 in Sweden) Vägledning för val av exponeringsklass enligt SS-EN 206-1, Betongrapport nr 11, Svenska Betongföreningen (Guidance for selection of exposure class according to SS-EN 206-1, Concrete report No 11, Swedish Concrete Association)

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Table 1.1 (*continued*)

CEN Member Countries[a]	Location of national requirements
Switzerland	SN EN 206-1:2000: Beton — Teil 1: Festlegung, Eigenschaften, Herstellung und Konformität (mit Nationalem Vorwort und Nationalem Anhang) (SN-EN 206-1:2000: Concrete — Part 1: Specification, performance, production and conformity (with National Preface and National Annex)) SN EN 206-1:2000/A1:2004: Beton — Teil 1: Festlegung, Eigenschaften, Herstellung und Konformität (SN EN 206-1:2000/A2:2005: Concrete — Part 1: Specification, performance, production and conformity) Ergänzung zum Nationalen Anhang NB der Norm SN EN 206-1:2000: Teil 1: Verwendung von Zementen und Zusatzstoffen gemäss dem Prinzip der gleichwertigen Betonleistungsfähigkeit (in Arbeit) (Amendments to the National Annex of the SN EN 206-1: Part 1: Use of cements and mineral additions according to the equivalent performance concept of concrete properties (in preparation)) Ergänzung zum Nationalen Anhang der Norm SN EN 206-1:2000: Teil 1: Anwendung des k-Wert Konzeptes gemäss dem Prinzip der gleichwertigen Betonleistungsfähigkeit (in Arbeit); der Anhang wird *Nationaler Anhang NC* genannt (Application of the k-value concept according to the principle of the equivalent concrete performance)
United Kingdom	BS 8500: Concrete — Complementary British Standard to BS EN 206-1 — Part 1: Method of specifying and guidance for the specifier — Part 2: Specification for constituent materials and concrete

[a] None of the CEN affiliates chose to respond to this survey.

3 Exposure classes

In Table 2.1 exposure classes that have been grouped together are given. A significant number of CEN Member Countries have found the need to simplify the system. In its simplest form this reduces to interior, outside, severe and (chemically) aggressive. A significant number of CEN Member Countries have grouped classes (not always in the same way). For example, XC3 and XC4 are grouped together and often the XF1 is combined with XC4 and XF2 with XD3 or the concrete quality is the same. However, not all CEN Member Countries have to consider freeze-thaw action and so it may not be possible to group the carbonation-induced corrosion exposure classes (XC) and freeze-thaw exposure classes (XF) at a CEN level.

The reasons for grouping them together vary and include:

a) simplifying the system to meet local needs;

b) one exposure class cannot exist without the other exposure class in the local environment;

c) not easy for engineers to select one exposure from another;

d) the resulting concrete specification is the same.

Some CEN Member Countries have not grouped the exposure classes, but have the same quality of concrete for several exposure classes. If they are following EC2, this may lead to different minimum covers to reinforcement, but the same concrete quality.

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As the examples in EN 206-1:2000, Table 1 are informative, Table 2.2 shows the extent to which the informative examples have been adopted in CEN Member Countries and gives the additional national examples of these exposure classes. There is a clear message in the responses showing that the informative examples for the XC1 and XC2 exposures should clearly identify that the water is non-aggressive.

The responses to Table 2.3 show that EN 206-1, Table 2 is applied to the majority of situations in CEN Member Countries including mobile groundwater. As such the limitation in Table 2 to static groundwater should be reviewed.

The principle of classification by deterioration process has been widely accepted. However, there seems to be a need to review the sub-divisions of the exposure classes as part of the review of durability to see if simplification is possible. Any changes to exposure classes should be co-ordinated with changes to the design codes.

The fib model code on service life design may lead to a better way of sub-dividing the exposure classes, but it is premature to take this path until the models have been thoroughly checked for robustness, reality, sensitivity, reliability and economy.

NOTE 1 It may be appropriate to review EN 206-1, annexes E and J.

NOTE 2 In future reviews of EN 206-1, it may be possible to use the fib model code to define the exposures in terms of relative humidity, temperature and days of rainfall, the performance requirements in terms of carbonation resistance and 'deemed to satisfy' limiting values, but in the view of the ad hoc group this is not achievable for the 2010 revision of EN 206-1.

If it is decided to keep the exposure class as a designation for a concrete, an alternative approach to exposure sub-classes would be to create sets of concretes for each main exposure class. CEN Member Countries would then be free to select the appropriate designations for their 'indoor' and 'outdoor' exposures.

Table 2.4 assesses the extent to which CEN Member Countries select the same exposure classes for the same elements. There is a clear difference in view over whether indoor reinforced concrete should be classed as X0 or XC1. This is sometimes reinforced by defining the relative humidity for the X0 exposure at low values that are unlikely to exist in normal buildings. The need to allow the designer some flexibility to select the appropriate class is also a common feature of this table. The inclusion of a freeze-thaw exposure class reflects local conditions.

Table 2.1 — Exposure classes that have been grouped together

CEN Member Countries	Grouped exposure classes
Austria	(XC1) = XC1 (A) (XC2, XC3, XC4) = XC2 (A)
Belgium	In Belgium exposure classes are recommended in an indirect way. They are linked to "environmental classes". "Environmental classes" are defined as environments which are very relevant to the Belgian concrete practice. They are indicated by the letter E (for Environment), followed by a letter (I for Interior, E for Exterior, S for Seawater, A for Aggressive) and a numeral for a more detailed description. For each environmental class the relevant exposure classes are identified for unreinforced and reinforced concrete.
Czech Republic	-
Denmark	(X0, XC1) = Interior (XC2, XC3, XC4, XF1, XA1) = Exterior without risk of water saturation (XD1, XS1, XS2, XF2) = Exterior with risk of water saturation and additional chlorides/alkalis to the surface (XD2, XD3, XS3, XF4, XA3) = Severe exterior with risk of accumulation of chlorides/alkalis
Finland	None

Table 2.1 (*continued*)

CEN Member Countries	Grouped exposure classes
France (for in-situ concrete)	(XC1, XC2) (XC3 XC4, XD1, XF1) (XS1, XS2)
Germany	(XD1, XS1); (XD2, XS2); (XD3, XS3) – grouped with respect to limiting values of concrete composition
Ireland	None
Italy	(XC1, XC2), (XS2, XS3), (XF2, XF3) in table 'Limiting values for composition and properties of concrete' (UNI 11104)
Luxembourg	No grouping for the specification! Following exposure classes shows equal values for the limits of composition: (XC1, XC2) (XC3, XC4) (XD1, XD2) (XF2, XF3) The exposure classes must be considered and documented separately for the specification
Netherlands	None
Norway	This depends on the matter under consideration. Groups might be different with respect to different matters such as, concrete composition, concrete cover, crack width requirements etc. With respect to concrete composition the following can be considered a grouping: (X0) (XC1,XC2, XC3, XC4, XF1) (XD1, XS1, XA1, XA2, XA4*) *XA4 is a special class for manure in agricultural buildings (XF2, XF3, XF4) (XD2, XD3, XS2, XS3, XA3) (XSA*) *XSA is a special class for particularly aggressive environments, other environments than those above
Portugal	(XS, XD); (XC4, XF1)
Slovakia	None so far, but we suggest (XC3, XC4) and (XD1, XD2) to be merged together
Slovenia	None
Sweden	No classes have been grouped
Switzerland	None
United Kingdom and Northern Ireland	(XC3, XC4) In 2006 revision of BS 8500-1, the recommendations for resisting the XD and XS exposures are adequate for resisting the associated XC exposure

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Table 2.2 — Examples of exposure classes

Class designation	Examples where exposure classes may occur		
X0	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete inside buildings with very low air humidity	CH CZ[a] BE FI FR[b] IE IT LU NL NO PT UK[c] SI SE SK	AT DE DK
	Other local examples		
	Humidity below 35 %	AT	
	A very dry environment is not (or rarely) found in Belgium	BE	
	Unreinforced concrete basements in environment without frost Unreinforced concrete inside buildings	CZ	
	Concrete inside buildings with low air humidity Foundations below ground for low and normal safety classes		
	Information guidance: dry, heated indoor spaces	FI	
	Foundations without reinforcement or without embedded metal and not subjected to freeze/thaw attack; interior components without reinforcement or without embedded metal	DE	
	House strip foundations, unreinfoced or nominally reinforced; in non-aggressive soils	IE	
	Unreinforced concrete inside buildings. Unreinforced concrete either placed below grade or submerged in non-aggressive water. Unreinforced concrete undergoing cycles of drying and wetting but not subjected to abrasion, frost or chemical attacks	IT	
	Unreinforced concrete. Concrete permanently submerged in non-aggressive water	NL SE	
	Certain soil-covered foundations (non-aggressive soil/water) Unreinforced concrete surfaces inside structures. Unreinforced concrete completely buried in non-aggressive soil. Unreinforced concrete permanently submerged in non-aggressive water Unreinforced concrete in cyclic wet and dry conditions not subject to abrasion, freezing or chemical attack	UK PT	
	Reinforced concrete in structures with very low air humidity	PT	
	Permanent relative air humidity of less than 30 %. Concrete of the foundations without reinforcement and without freeze/thaw	SK	
XC1	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete inside buildings with low air humidity	CH CZ[d] BE DK FR IE IT LU NL SI NO PT SE SK UK	AT DE
	Concrete permanently submerged in (non-aggressive) water	BE DE SI PT	DK
	Other local examples		
	Parts of structures inside buildings with low air humidity (inc kitchens, bathrooms & laundries) in residential buildings Unsplashy bridges elements in contact with air	CZ[d]	
	Foundations below ground for low and normal safety classes	DK	

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
	Bathrooms, stairways, structures below the water level. Inner surface of a layered wall surface. Underwater parts of bridges	FI	
	Components in rooms with normal air humidity (inc kitchens, bathrooms, laundries in residential buildings); concrete permanently submerged in water	DE	
	Ordinary reinforced concrete or prestressed concrete with surfaces inside structures, excepting parts exposed to condensation or submerged in water	IT	
	Permanent relative air humidity between 30 % to 60 %	SK	
XC2	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete surfaces subject to long-term (non-aggressive) water contact	CH BE FR DE IT LU NL NO UK SI SE PT AT[e] SK	
	Many foundations	BE FI SI DE IE	PT
	Other local examples		
	Parts of water tanks	CZ	
	Foundations partly above ground Foundations below ground for high safety class External walls, columns and facades External beams with sheltered top surface Structural parts in contact with slightly aggressive chemical water	DK	
	Bridge foundations, transition slabs	FI	
	Parts of water tanks; foundation members	DE	
	Portions of structures devised for containing liquids, foundations. Ordinary reinforced or prestressed concrete mainly submerged in water or below non-aggressive grade	IT	
	Reinforced and prestressed concrete completely buried in non-aggressive soil	UK	
	Reinforced concrete into non-aggressive soil	PT	
	Permanent relative air humidity of over 85 %. Parts of the water tanks, inside areas like canteens, bathrooms, laundries, areas of the sheltered pools and stables	SK	

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
XC3	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete inside buildings with moderate or high air humidity	CH CZ[f] BE FR DE IT LU NL NO UK SI SE SK	DK PT
	External concrete sheltered from rain	BE DE IE UK SI IT	PT
	Other local example		
	Parts of structures in contact with outside air e.g. halls, interiors with high air humidity (kitchens of community feeding, bath, laundries, swimming-pools, stables	CZ DE PT	
	Foundations partly above ground Foundations below ground for high safety class External walls, columns and facades External beams with sheltered top surface Structural parts in contact with slightly aggressive chemical water	DK	
	Facades and other vertical outdoor surfaces sheltered from rain. Car park slabs swimming baths, saunas, industrial kitchens, many industrial buildings. Bridge superstructures sheltered from rain such as lower surfaces of decking slabs and beams, beams, columns, retaining walls and abutments and intermediate supports	FI PT	
	Either ordinary reinforced or prestressed concrete placed outdoors with external surfaces protected from rain or placed inside buildings with moderate to high air humidity	IT	
	Permanent relative air humidity between 60 % to 85 %. Parts of buildings that are in permanent or temporary contact with the outside air, e.g. open space halls	SK	
	None given as grouped with XC4	UK	
XC4	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete surfaces subject to water contact, not within exposure class XC2	CH BE FI FR IE IT LU NL NO PT UK SI SE SK	DE DK
	Other local examples		
	Outside buildings parts from concrete exposed to rain	CZ DE	
	Foundations partly above ground Foundations below ground for high safety class External walls, columns and facades External beams with sheltered top surface Structural parts in contact with slightly aggressive chemical water	DK	
	Balcony slabs, facades exposed to rain, footings. Bridge structures exposed to rain such as edge beams, lateral sides of abutments, retaining walls, columns	FI	
	Either ordinary reinforced or prestressed concrete place outdoors with surfaces undergoing alternatively dry and wet cycles. Architectural concrete in urban settings. Surfaces in contact with water not included in the XC2 class	IT	
	Reinforced concrete under dry-wet cycles	PT	
	Reinforced and prestressed concrete surfaces exposed to alternate wetting and drying	UK	

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
XD1	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Concrete surfaces exposed to airborne chlorides	CH BE FI FR DE IE IT LU NL NO PT UK SI SE SK	AT DK
	Other local examples		
	Parts of traffic areas, individual garage	CZ DE	
	External deck slabs, staircases and retaining walls External beams without sheltered top surface Light shafts External basement walls partly above ground Canals and other structural parts in contact with moderately aggressive chemical water	DK	
	Noise barriers on road sides. Indoor spaces of swimming baths	FI	
	Either ordinary reinforced or prestressed concrete used for portions of bridges and viaducts exposed to chloride-containing water sprays	IT	
	Garages	SK	
	Reinforced and prestressed concrete surfaces in parts of bridges away from direct spray containing de-icing agents. Parts of structures exposed to occasional or slight chloride conditions	UK	
XD2	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Swimming pools	CH BE FI FR (DE) IT LU NL NO PT SI SE SK	AT UK[g]
	Concrete exposed to industrial waters containing chlorides	BE DE IE PT SI	UK[g]
	Other local examples		
	Salt water baths; components exposed to industrial waters containing chlorides (Note: special requirements for concrete bridges and tunnels)	DE	
	External parking decks, balconies, balcony accesses and staircases Swimming pools Bridge column and edge beams Marine structures Structural parts in contact with highly aggressive chemical water	DK	
	Either ordinary reinforced or prestressed concrete used for structural elements that are totally submerged in water, including also chloride-containing industrial water (swimming pools)	IT	

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Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
XD3	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Parts of bridges exposed to spray containing chlorides	CH BE FI FR IT LU NL NO PT SE SK	AT DE
	Pavements	BE DE IE PT	
	Car park slabs	BE (DE) PT	
	Other local examples		
	Parts of bridges & engineering structures exposed to water with chlorides	CZ	
	External parking decks, balconies, balcony accesses and staircases Swimming pools Bridge column and edge beams Marine structures Structural parts in contact with highly aggressive chemical water	DK	
	Heated garages, bridge parts exposed to de-icing agents, such as edge beams, transition slabs, concrete railings, bridge piers and abutments and intermediate supports exposed to salty fog	FI	
	Parts of bridges frequently exposed to splashing; pavements; car park slabs (only with additional measures, i.e. crack-covering coating). (NOTE Special requirements for concrete bridges and tunnels).	DE	
	Either ordinary reinforced or prestressed concrete; structural elements directly subjected to de-icing agents or sprays containing de-icing agents. Either ordinary reinforced or prestressed concrete: element with one side submerged in chloride-containing water and the other one exposed to air. Portions of bridges, pavements and parking lots	IT	
	Reinforced and prestressed concrete surfaces directly affected by de-icing salts or spray containing de-icing salts (e.g. walls, abutments and columns within 10 m of the carriageway, parapet edge beams and buried structures less than 1 m below carriageway level)	UK SE	
	All bridges	SK	
	In Portugal, these examples shall generally be considered to belong to the exposure class XD1	PT	

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
XS1	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Structures near to or on the coast	BE FI FR[h] DE IE IT NL NO UK SE	CH LU PT SK
	Other local examples		
	External components near to the coast	DE	
	External deck slabs, staircases and retaining walls External beams without sheltered top surface Light shafts External basement walls partly above ground Canals and other structural parts in contact with moderately aggressive chemical water	DK	
	Reinforced concrete in salt saturated maritime ambient. Reinforced concrete in coastal areas less than 200 m from the sea, directly exposed to air salts. This distance may be increased to 1 km in plane coastal areas and in the mouth of rivers	PT	
XS2	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Parts of marine structures	FI FR (DE) IE IT NL NO UK[i] SE	CH LU PT SK
	Other local examples		
	Permanently submerged components in harbours	DE	
	External deck slabs, staircases and retaining walls External beams without sheltered top surface Light shafts External basement walls partly above ground Canals and other structural parts in contact with moderately aggressive chemical water	DK	
	Either ordinary reinforced or prestressed concrete of marine structures totally under water	IT	
	Reinforced and prestressed concrete completely submerged and remaining saturated, e.g. concrete below mid-tide level	UK PT	

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Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur	
XS3	**Examples from EN 206-1, Table 1**	**Adopted locally** Yes / No
	Parts of marine structures	BE FR (DE) IE IT NL NO UK[i] SE / CH LU PT SK
	Other local examples	
	External parking decks, balconies, balcony accesses and staircases Swimming pools Bridge column and edge beams Marine structures Structural parts in contact with highly aggressive chemical water	DK
	Parts of marine and bridge structures exposed to fluctuation and splashing of sea water such as intermediate supports	FI
	Quay walls	DE
	Either ordinary reinforced or prestressed concrete with structural elements at the water's edge or exposed to sea water sprays and waves	IT
	Reinforced and prestressed concrete surfaces in the upper tidal zones and the splash and spray zones	UK
	Reinforced concrete in tidal, splash and spray zones, from 1 m below the minimum tidal to 10 m above maximum tidal, namely on the west coast of Portugal and on the Azores and Madeira islands. Reinforced concrete in which one of the surfaces is immersed in sea water and the other is air exposed (e.g. submerged tunnels). This exposure will require eventually supplementary protection measures	PT
XF1	**Examples from EN 206-1, Table 1**	**Adopted locally** Yes / No
	Vertical concrete surfaces exposed to rain and freezing	AT CH BE FI FR[k] (DE) IE IT LU NL NO PT UK SE SK /
	Other local examples	
	Facades, footings. Parts of bridge on roads outside the de-icing route such as decking slab, beams abutments and intermediate supports	FI
	External components	DE
	Foundations partly above ground Foundations below ground for high safety class External walls, columns and facades External beams with sheltered top surface Structural parts in contact with slightly aggressive chemical water	DK
	Vertical concrete elements, e.g. façades and columns, exposed to rain and freezing. Non-vertical surfaces not subjected to complete saturation but exposed to freezing, rain or water	IT
	Non-vertical concrete surfaces not highly saturated, but exposed to freezing and to rain or water	NL UK PT
	Facades of buildings and columns, parts of buildings not too wet	
	Inner parts of unheated industrial buildings, inside of silos, tunnels and other structures not exposed to rain but in humid conditions and exposed to freezing	SE

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
XF2	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Vertical concrete surfaces of road structures exposed to freezing and airborne de-icing agents	AT CH BE FI FR[k] IE IT LU NL NO UK SE SK	PT (DE)
	Other local examples		
	External deck slabs, staircases and retaining walls External beams without sheltered top surface Light shafts External basement walls partly above ground Canals and other structural parts in contact with moderately aggressive chemical water	DK	
	Noise barriers and footings on road sides. Parts of bridges on roads on the de-icing route, for example surface structure beams and decking slabs, abutments and intermediate supports	FI	
	Concrete members in spray and splash zones of traffic areas, with de-icing agent (mainly vertical concrete members) (other than XF4); sea water spray zone	DE	
	Elements like bridge portions, otherwise classified as XF1 that are exposed, either directly or indirectly, to de-icing agents	IT	
	Concrete surfaces not highly saturated, but exposed to freezing and to rain or water including de-icing agents	NL	
	De-icing agents are not directly in contact with the concrete surface. E.g. parts of the anti-noise walls, supporting walls, and those not included in XF4	SK	
	Non-vertical concrete surfaces exposed to rain or freezing	PT	
XF3	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Horizontal concrete surfaces exposed to rain and freezing	AT CH BE FI FR[k] IE IT LU NL NO UK SE SK	DE PT
	Other local examples		
	Opened water tanks. Structure parts in zone with variation of fresh water, spillway blocks of hydraulic structures	CZ	
	External deck slabs, staircases and retaining walls External beams without sheltered top surface Light shafts External basement walls partly above ground Canals and other structural parts in contact with moderately aggressive chemical water	DK	
	Balconies, bridge columns and other structures at the water level of inland water, dam structures, fresh water basins. Bridge parts on roads outside the de-icing route, for example edge beams transition slabs, column-like intermediate supports, base plates of frame bridges and unprotected structures in water fluctuation area of waterway bridges	FI	
	Open water tanks; components in fresh water tidal zone	DE	
	Horizontal building surfaces where water can accumulate and that may be exposed to freezing; elements exposed to frequent wetting and freezing	IT	
	All concrete surfaces	NL	

Table 2.2 (*continued*)

Class designation	Examples where exposure classes may occur		
(XF3)	External parts of buildings that are often subject to water and freezing, e.g. open-space water tanks, parts of buildings with variable surfaces of sweet-water level. Overflow parts of water buildings	SK	
	Horizontal concrete surfaces, such as parts of buildings, where water accumulates and which are exposed to freezing. Elements subjected to frequent splashing with water and exposed to freezing	UK	
XF4	**Examples from EN 206-1, Table 1**	**Adopted locally**	
		Yes	**No**
	Road and bridge decks exposed to de-icing agents	AT CH BE FI FR[k] IT LU NL NO UK SI SE SK	DE PT
	Concrete surfaces exposed to direct spray containing de-icing agents and freezing	BE IE UK	UK
	Splash zones of marine structures exposed to freezing	BE	
	Other local examples		
	Water tanks at the roads, concrete crash barriers	CZ	
	External parking decks, balconies, balcony accesses and staircases Swimming pools Bridge column and edge beams Marine structures Structural parts in contact with highly aggressive chemical water	DK	
	Parking levels, surface layers, garages. Edge beams, transition slabs, concrete railings of de-icing roads, base plates of frame bridges intermediate supports, when the road travelling beneath the bridge is de-iced. Unprotected structures of bridges in sea water from the level NW-1upwards	FI	
	Traffic areas treated with de-icing agents; predominantly horizontal components exposed to spray form traffic areas treated with de-icing agents; scraper raceways in sewage treatment plant; components in sea tidal zone	DE	
	Horizontal surfaces, e.g. roads and pavements, exposed to freezing and to the direct/indirect action of de-icing salts, elements exposed to freezing and to frequent wetting in the presence of de-icing salts or sea water	IT	
	For road and bridge decks a special standard is used in Slovakia. Similar to EN 13877. Local examples: constructions near the roads that are exposed to direct spray containing de-icing agents, e.g. pavement kerbs, leaders and gadroons, safety barriers, tanks near roads	SK	
	Outdoor swimming pools	SE	

a	Very low defined as a relative humidity less than 30 %
b	Not applicable to pre-stressed concrete
c	Only if unreinforced
d	Low defined as a relative humidity of 30 % to 60 %
e	Grouped with XC3 and XC4
f	Moderate defined as a relative humidity of 60 % to 85 %, or high, more than 85 %
g	The answer would be 'yes' for elements that are totally immersed in water containing chlorides
h	Up to 1 km from the sea shore
l	This example considered to be too vague to be of any practical use
k	When the destination of the concrete in a structure is not precisely defined, selection of exposure class is made in accordance with its location following guidance given in the national annex to EN 206-1

Additional examples for XA exposures from the Czech Republic and Slovakia

	Other local examples for XA exposures	
XA1	Tanks of sewage clarification plants, cesspools, septic tanks, buildings basements	CZ
	Slightly aggressive chemical environment according to table 2. Tanks of water purifying plants, sumps, septic tanks and foundations	SK
XA2	Building parts in corrosive foundation soil, buildings basements	CZ
	Moderately aggressive chemical environment according to table 2. Foundations on buildings in aggressive soils	SK
XA3	Manufacturing tanks of sewage clarification plants with chemical corrosive water, basements of buildings, stores for chemical de-icing substances and soil conditioners. Bunkers in farm sector. Cooling towers with industrial smoke. (See [d] and [f])	CZ
	Highly aggressive chemical environment according to table 2. Industrial water purifying plants with chemically aggressive water, silage holes, feeding canals, cooling towers, etc.	SK
Slovakian specifications: at the level of exposure class XA3 if: — there are aggressive chemicals not listed in EN 206-1, Table 2 or — there is chemical pollution or — the groundwater is mobile and contains chemicals listed in EN 206-1, Table 2, secondary protection of the concrete is required and/or a special investigation is required		
Slovakian specifications to table EN 206-1: with exposure classes XC, XD, XS, it is possible to substitute each lower level with the higher one. Considering XA, it is possible only if it has the same chemical characteristics as shown in EN 206-1, Table 2. Considering XF, it is possible to substitute exposure class XF1 by XF3, and exposure class XF2 by XF4. For constructions exposed to exposure classes X0, it is possible to use concrete of any exposure class.		

Additional exposure classes from Austria and Germany 'concrete exposed to wear'

XM1 [a]	Industrial floor slabs with a load-bearing or stiffening function, subjected to traffic from vehicles with pneumatic tyres
XM2 [a]	Industrial floor slabs subjected to traffic from forklift trucks with pneumatic tyres or solid rubber wheels
XM3 [a]	Industrial floor slabs subjected to traffic from forklift trucks with elastomer or steel wheels; surfaces subjected to frequent traffic from tracklaying vehicles; hydraulic structures in agitated waters (e.g.

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	settling basins)
[a]	Exposure of concrete to wear (XM1 = moderate wear; XM2 = considerable wear; XM3 = extreme wear)

Table 2.3 — Chemical attack outside the scope of EN 206 1, Table 2

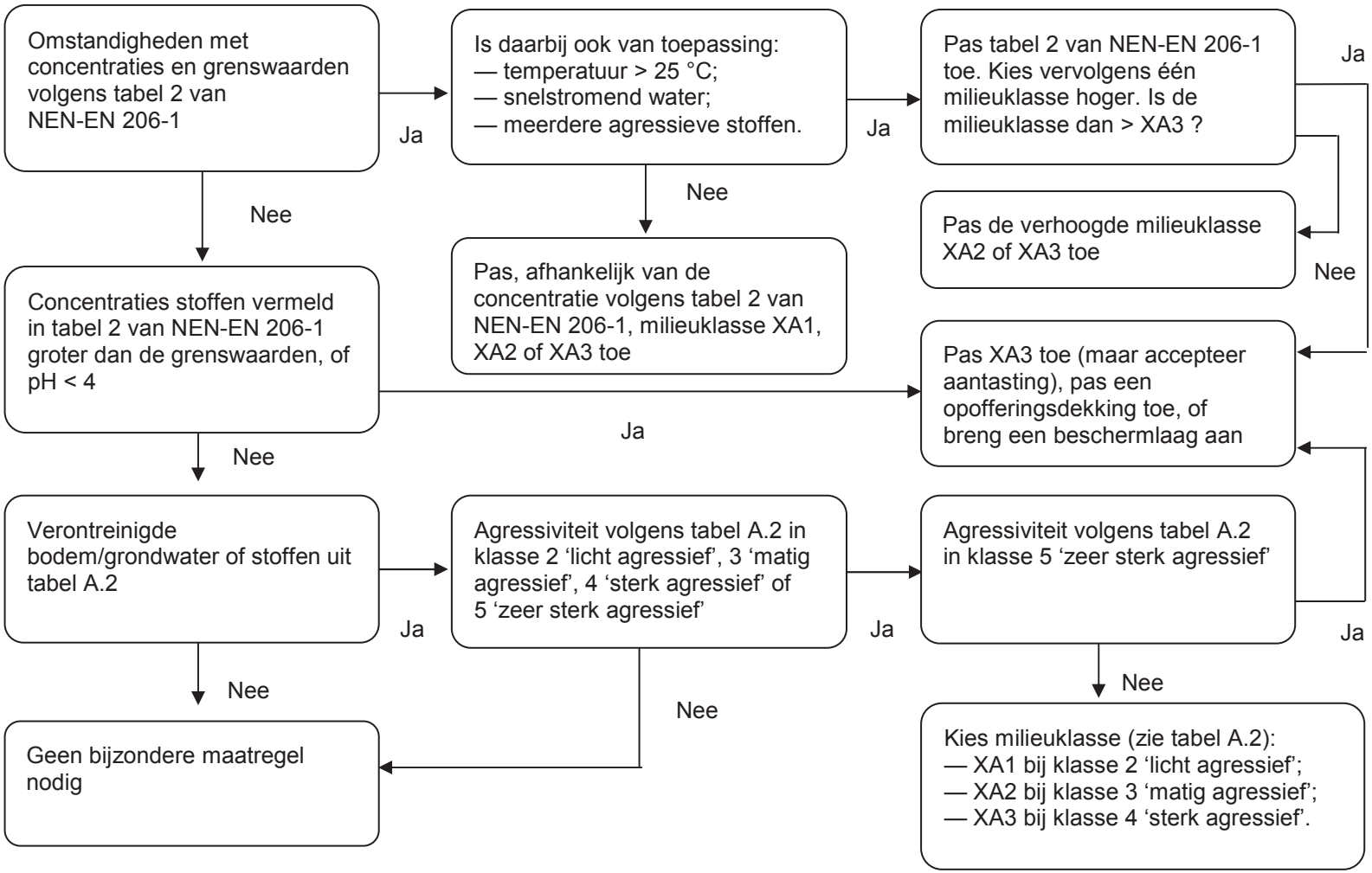
CEN Member Countries	Exposure classification/national guidance
Austria	No additional provisions
Belgium	No provisions
Czech Republic	No provisions
Denmark	No provisions
Finland	No provisions
France	Provisions are given in FD P18-011 which is called up in NF EN 206-1
Germany	NOTE in table 1 of DIN 1045-2: In exposure class XA3 or under environmental actions outside the limits of table 2 of DIN EN 206-1: if other aggressive chemicals are present, ground water or soil is chemically polluted, or there is a combination of high water velocity and chemicals from table 2 of DIN EN 206-1: the requirements relating to concrete or protective measures given in subclause 5.3.2 of the present standard shall apply. DIN 1045-2, 5.3.2: Where concrete is exposed to chemical attack of exposure class XA3 or higher, or to fast flowing water combined with chemical attack as set out in table 2 of DIN EN 206-1, measures shall be taken to protect the concrete (such as the application of protective coatings or permanent cladding) unless expert opinion proposes an alternative solution. In the presence of aggressive chemicals other than those given in table 2 of DIN EN 206-1 or if the substrate is chemically contaminated, the impact of the chemical attack shall be investigated and precautionary action taken, where necessary. Paragraph 1 of table 2 is supplemented by the following NOTE: See DIN 4030-1 for the occurrence and effects of chemically aggressive soil and ground water.
Ireland	Specifiers would generally follow guidance in BRE Special Digest 1/BS8500
Italy	No provisions
Luxembourg	No provisions
Netherlands	In NEN 8005:2004 a flowchart is given in Annex A for the assessment of chemical attack and the selection of exposure classes XA1 to XA3. This flowchart may be used in cases mentioned in the NOTE in section 6 of table 1 of NEN-EN 206-1. Informative Annex A of NEN 8005:2004 is attached at the end of this survey.
Norway	No particular provisions, soil conditions in Norway are generally of low aggressiveness.
Portugal	The EN 206-1 provisions stated in Table 2 were not changed.
Slovakia	Provisions including the above mentioned national notice.
Slovenia	In SIST 1026, additional exposure classes are added for concrete exposed to surface abrasion as follows: XB1 — moderate exposure (bearing industrial pavements for vehicles with pneumatic wheels). XB2 — severe exposure (industrial pavements with full rubber wheels; structures in contact with running water; wearing course of pavement for light/moderate loads). XB3 — extremely severe exposure (industrial pavements for vehicles with elastomer/steel wheels; wearing course of pavement for heavy/very heavy loads; structures in contact with sand-bearing running water).
Sweden	Cases not dealt with in Table 2 require special investigation. Some provisions are given in Concrete Report No 11, Swedish Concrete Association. Fundamental facts can be found in the Concrete Handbook — Material, 1997 (In Swedish).
Switzerland	No provisions
United Kingdom	Because these cases form the majority of situations in the UK, the UK uses an ‘aggressive chemical environment for concrete (ACEC)’ classification. This is given in Building Research Establishment Special Digest 1 and BS 8500-1. A revision of BRE SD1 has been published in 2005 and BS 8500-1 is being revised to align with the new Special Digest.

Attachment related to the response of The Netherlands to Table 2.3

Bijlage A

(informatief)

Tabel A.1 — Keuzeschema voor de beoordeling van de chemische agressiviteit



Tabel A.2 — Overzicht chemicaliën met globale indicatie van de agressiviteit voor beton

Naam	Reactie-type [a]	Agres-siviteit [b]
zuren		
azijnzuur	O	3-4
boorzuur	O	2
carbolzuur (fenol)	O/U	2-3
citroenzuur	O	4
fosforzuur	O	4
humuszuur	O	4
melkzuur	O	3
mierenzuur	O	3
oxaalzuur	O	1
salpeterzuur	O	5
tannine (looistof)	O	1-2
waterstoffluoride	O	5
wijnsteenzuur	O	1
zoutzuur	O/C	5
zwavelwaterstof	O	2
zwavelzuur	O/E	5
zouten en alkaliën		
carbonaten van		
ammonium	U	2
kalium	E	2
natrium (soda)	E	2
chloriden van		
aluminium	U/C	3
ammonium (salmiak)	U/C	3
calcium	C	1
kalium	C/E	1
koper	C	1
kwik	C	1
magnesium	U/C	3
natrium (pekel, zout)	C/E	2
ijzer	C	2
zink	C	2
fluoriden		
ammonium	U	4
hydroxyden van		
ammonium		1
calcium		1
kalium (loog)	E	2
natrium (loog)	E	2
nitraten van		
ammonium	U	5
calcium		1
kalium (salpeter)	U/E	3
natrium	U/E	3

Naam	Reactie-type [a]	Agres-siviteit [b]
sulfaten van		
aluminium	E	4
ammonium	U/E	5
calcium	E	4
kalium	E	4
koper	E	4
mangaan	E	4
magnesium	U/E	5
natrium	E	4
nikkel	E	4
ijzer	E	4
zink	E	4
petroleum-destillaten		
benzine		1
kerosine		1
naftaleen		1
petroleum		1
lichte olie		1
zware olie		1
dieselolie		1
koolteer-destillaten		
anthraceen		1
benzeen		1
cumeen		1
kreosoot (olie)	U	2
kresol	U	2
paraffine		1
teer		1
tolueen		1
xyleen		1
plantaardige oliën		
amandelolie	U	3
chinese houtolie	U	3
katoenzaadolie	U	3
kokosolie	U	3
lijnolie	U	3
maanzaadolie	U	3
olijfolie	U	3
pinda-olie	U	3
raapolie	U	3
ricinusolie	U	3
soyaboonolie	U	3
terpentijn	U	3
walnootolie	U	3

Tabel A.2

Naam	Reactie-type [a]	Agres-siviteit [b]
dierlijk vet en vetzuren		
beenderolie	O	2
varkensvet	O	2
visolie	O	2
slachtafval	O	3
diversen		
alcohol		1
aceton		1
ammoniak (water)		1
bier	O	2
bleekwater	C	2
borax		1
caustic soda		1
cider, appelwijn	O	4
ether		1
etherische olie		1
fenol	U	3
formaldehyde	U	3
glucose	U	3
glycerine	U	2
honing		1
houtpap, houtslijp		1
kalium-permanganaat		1
kalk		1

Naam	Reactie-type [a]	Agres-siviteit [b]
(diversen)		
karnemelk	O	3
koolzuurgas		1
kuilvoer (silage)	O	5
lood		1
looistoffen		1
melasse, suikerstroop	U	3
melk		1
mest	O/U	4
suiker: droog		1
suikeroplossing	U	3
tetra		1
tolueen		1
tri(chlooretyleen)		1
ureum		1
urine	O/U	3
vaseline		1
vruchtensap	O	4
waterglas		1
wei	O	3
wijn		1
zacht water [c]	O	3
zeep		1
zwavel		1

[a] O = Oplossing E = Expansie
U = Uitwissling C = Corrosie wapening

[b] 1 = onschadelijk 4 = sterk agressief
2 = licht agressief 5 = zeer sterk agressief
3 = matig agressief

[c] Water met een totale hardheid kleiner dan 0,55 mmol/l, bepaald volgens NEN 6441.

OPMERKING De agressiviteit in werkelijke omstandigheden wordt bepaald door de concentratie, de pH, de temperatuur en de mate van verversing.

Table 2.4 — Recommended exposure classes for selected concrete elements

Notation used in this table
Where more than one exposure class is in brackets, separated by a comma and has an [a] outside the bracket, this indicates that the exposure classes are grouped
Where choice is left to the engineer, the word 'or' is used, e.g, XC3 or XC4
Where a plus sign is used, this indicates the exposure is a combination of the cited classes, e.g. XC4 + XF3

Use of concrete	Exposure classification Give exposure class(es)	CEN Member Countries Add country code
Indoor unreinforced concrete	X0	NL UK AT FI FR PT SI CH DE IE LU SE CZ IT NO
	(X0, XC1)[a]	DK
	EI (X0) [b]	BE
Indoor reinforced concrete	X0	FI*
	XC1	FR UK AT NL DE LU CH SI CZ
	XC1 (except high humidity rooms)	PT
	XC1 or XC3	IE
	(X0, XC1)[a]	DK
	EI (XC1) [b]	BE
	X0 or XC1 or XC3	SE
	X0 or XC1	IT
	XO or XC1	NO

Table 2.4 (*continued*)

Use of concrete	Exposure classification Give exposure class(es)	CEN Member Countries Add country code
Exposed vertical surfaces of inland concrete buildings with no significant levels of external chlorides	XC1 + XF1	AT
	XC4 + XF1	FR SI
	XC2 (or XC2 or XF1)	PT
	(XC2 or XC4) + XF1	IE
	XC1 or XC2 or XC3 or XC4 and XF1 (depends on situation)	CZ
	EE3 (XC4 + XF1) [b]	BE
	(XC2, XC3, XC4, XF1, XA1) [a]	DK
	XC3 (or XC4) + XF1	FI
	(XC3 + XF1) or (XC4 + XF1)	NL
	(XC3, XC4)[a] + XF1	UK
	XC4 + XF1	CH DE LU SE
	(XC2, XC3; XC4, XF1) [a]	NO
	XC1, XC2 + XF1	IT
Exposed vertical surfaces of concrete buildings near the coast but not in direct contact with sea spray	Not relevant	AT CH CZ LU
	XC3 or XC4 + XS1? (designers decision) + XF1	FI
	(XS1, XS2) [a] (up to 1 km from the sea)	FR
	XS1, XS1+ XC4	PT
	XC4 + XS1	SI
	(XC2, XC3; XC4, XF1) [a] + XS1	NO
	(XD1, XS1, XS2, XF2, XF3, XA2) [a]	DK
	XC3 or XC4 + XS1 + XF1	NL
	ES2 (XC4 + XS1 + XF1) [b]	BE
	XC4 + XS1 + XF2	DE SE
	XF1 + XC4 + XS1	IE
	XS1 + (XC3, XC4) [a] +XF1	UK
	XS1	IT
Reinforced buried foundations in exposure class XA1 (slightly aggressive chemical environment = NL)	XA1 + XC2	FI FR IE LU AT IT SI DE NL
	XA1 + XC2	PT
	(XC2, XC3, XC4, XF1, XA1) [a]	DK
	XC2	UK
	(EA1 + EE2) (XA1 + XC2) [b]	BE
	None	CH
	X0 or XC1 or XC2 or XC4	SE
	XA1	CZ NO
Unreinforced pavements	XF4 + XM2	AT
	XF2	PT
	XF4	LU SE
	XF1 or XF4 or XA1 (depending on location)	IT
	(XD1, XS1, XS2, XF2, XA2) [a]	DK
	XF3 or XF4	CH CZ DE NL NO FR IE FI SI UK
	EE4 (XF4) [b]	BE

Table 2.4 (*continued*)

Use of concrete	Exposure classification Give exposure class(es)	CEN Member Countries Add country code
Reinforced pavements	XF4 + XM2	AT
	(XC4 + XF3) or (XC4 + XD3 + XF4) (de-icing)	FI NL
	XF3 or XF4	FR
	(XD3 + XF4)	SI
	XC4 + XD3 + XF4	CH LU UK
	XF2 or XF4 (depends on situation)	CZ
	(XD2, XD3, XS3, XF4, XA3) [a]	DK
	EE4 (XC4 + XD3 + XF4) [b]	BE
	Not common	DE SE
	XD3 + XC4 + XF3 or XF4	IE
	XD3 + XF4	UK
	XC3 or XC4 + XF1 + XF4 + XA1; alternatively (XD3 + XF3) (depending on location)	IT
	XC3 or XC4; (XC3 or XC4) + (XS1 or XS3)+XA1	PT
	(XD2, XD3)[a] + (XF2, XF3, XF4)[a] + (XC2, XC3, XC4)[a] as appropriate	NO
Bridge abutment	XF2 or XF4 (roads)	AT
	(XC3 or XC4) + XF1 or (XC3 or XC 4) + XD3 + XF2 (de-icing)	FI
	XC4 + XF2 or XF4 if de-icing agent	FR
	XF2 or XC4 or XF4 (depends on situation)	CZ
	XD3 + XF2 + XC4	IE
	(XD2, XD3, XS3, XF4, XA3) [a]	DK
	XC4 + XF3 or XD3 + XC4 + XF4 Plus XA1 or XA2 depending on the aggressive chemical class given in EN 206-1, Table 2 or Annex A of NEN 8005:2004 (see Table 2.3)	NL
	XD3+(XC3, XC4)[a] +XF2+ACEC class depending on the soil	UK
	EE4 (XC4 + XD3 + XF4) [b] Supposing contact with de-icing salt and the soil is not aggressive	BE
	(XC3 or XC4) + (XS1 or XS2 or XS3)	PT
	Class depending on the soil + XF3	SI
	(XC4 + XD1 + XF3) or (XC + XD3 + XF4)	CH
	Class depending on the soil XC4, XD1 (airborne chloride)/XD2 (splash zones), XF2	DE
	XC4 + XD1 + XF2	LU
	XD3 + XF4 or XD1 + XF2	SE
	XD1-XD3 + XF1 to XF4 + XA (depending on location and soil)	IT
	XD3, XS1, XS2, XS3, XF3, XF4, (XC2, XC3, XC4)[a] as appropriate	NO

* Dry heated indoor spaces.

a Grouped classes.

b In Belgium exposure classes are recommended in an indirect way. They are linked to “environmental classes”. “Environmental classes” are defined as environments which are very relevant to the Belgian concrete practice. They are indicated by the letter E (for Environment), followed by a letter (I for Interior, E for Exterior, S for Seawater, A for Aggressive) and a numeral for a more detailed description. For each environmental class the relevant exposure classes are identified for unreinforced and reinforced concrete.

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4 Constituent materials

Most constituents for concrete have been standardized at the European level and the aim of this part of the survey is to identify constituents that are outside European standardization. If a number of CEN Member countries have the need for a standard on a particular constituent, this is indicative of a need to develop a European standard. However, if a constituent is standardized in a single CEN Member Country or a local product, e.g. a particular type of natural pozzolana, there seems to be little justification for developing a European standard.

National standards for cement are listed in Table 3.1. Most cements are (or are in the process of being) standardized at the European level. The exception is natural prompt cement which is the subject of a developing European Technical Approval. CEN/TC 51 is working on standardization of sulfate-resisting cements which should lead to the withdrawal of the national sulfate-resisting cement standards.

A number of the listed national cements are better described as being additional properties of cement already standardized in Europe, e.g. low alkali, high early strength, white cement.

National standards for additions are described in Table 3.2. National standards for silica fume and ground granulated blastfurnace slag will be replaced by European standards.

NOTE CEN/TC 104 has already agreed to extend the silica fume standard to cover all silica fumes that are on the European market.

There are several national standards/ETAs for fly ashes outside the scope of EN 450-1 and other pozzolanas. The information supplied is insufficient to identify the types of pozzolanas, but they are likely to include various types of natural pozzolanas and high calcium fly ashes.

A few CEN Member Countries have national standards for limestone additions. Some CEN Member Countries also use limestone filler aggregate conforming to EN 12620 as a Type I addition.

Table 3.3 lists national standards for aggregates for concrete. Some of the listed documents give the national choices of categories from the European standard on aggregates for concrete, EN 12620. As EN 12620 provides categories that cover all the materials that are found in Europe, it is not surprising that some CEN Member Countries have selected categories that reflect local experience.

The scope of EN 12620 covers natural, manufactured and recycled aggregates. In reality, the 2002 version of EN 12620 does not deal adequately with recycled aggregates.

NOTE Work is in progress within CEN/TC 154 to provide European test methods, classification and requirements for recycled aggregates.

Table 3.4 lists national standards for admixtures. Only three CEN Member Countries reported national product standards for admixtures outside the scope of EN 934. This is slightly surprising as it is known that there are admixtures available in Europe that are outside the scope of EN 934-2.

NOTE When CEN/TC 104 discussed extending the scope of EN 934-2, there was the view that CEN should not standardize admixtures where the main characteristic could not be specified and verified by testing, e.g. the pumping effect of a pumping aid. Work is in progress on defining corrosion-resisting admixtures and method of test.

The last table in this Part, Table 3.5, covers other constituents for concrete. The only responses cited national standards on fibres for concrete. The European standards for steel and polymer fibres are likely to lead to the withdrawal of these national standards.

There is no evidence of a need for further European standardization work on admixtures not covered by EN 934 or fibres for concrete not covered by prEN 14889.

Information for ground granulated blastfurnace slag is given in Annex C.

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Table 3.1 — National cement standards

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Austria	ÖNORM B 3327-1: Zemente gemäß ÖNORM EN 197-1 für besondere Verwendungen — Teil 1: Zusätzliche Anforderungen (Cements according to ÖNORM EN 197-1 for special use — Part 1: Additional requirements)	No
Belgium	NBN B 12-108: Ciment à haute résistance aux sulfates — Cement met hoge bestandheid tegen sulfaten (Highly sulphate resisting cement) NBN B 12-109: Ciment à teneur limitée en alkalis — Cement met begrensd alkali-gehalte (Cement with restricted alkali content) NBN B 12-110: Ciment Portland à haute résistance initiale — Portlandcement met hoge aanvangsterkte (High early strength Portland cement) NBN B 12-111: Ciment sur-sulfaté — Overgesulfateerd (Supersulfated cement)	
Czech Republic	CSN EN 206-1: Zmena Z2 (paragraph NA.9 — Cement usability) (CSN 72 2103: Sulfate-resisting cement)	
Denmark	DS/INF 135: Klassifikation af cement (Classification of cement regarding alkali and sulfate resistance)	See UK reply
Finland	Sulfate resistance is added as voluntary in Informative national annex to SFS-EN 197-1	Yes
France	NF P 15-302: Liants hydrauliques — Ciments à usage tropical — composition, spécifications et critères de conformité NF P 15-314: Ciment prompt naturel (natural prompt cement) NF P 15-315: Ciment alumineux fondu (calcium aluminate cement) NF P 15-317: Ciments pour travaux à la mer (sea water resisting cement) NF P 15-319: Ciments pour travaux en eaux à haute teneur en sulfates (sulfate resisting cement) NF P 15-330: Ciments sur-sulfaté (supersulfated cement)	No ETA (CUAP) EN 14647 No Awaiting TC 51 document prEN XXXXX
Germany	DIN 1164-10: Zement mit besonderen Eigenschaften — Teil 10: Zusammensetzung, Anforderungen und Übereinstimmungsnachweis von Normalzement mit besonderen Eigenschaften (Special cement — Part 10: Composition, requirements and conformity evaluation for special common cement (Remark: Sulphate resisting cements, low alkali cements)) DIN 1164-11: Zement mit besonderen Eigenschaften — Teil 11: Zusammensetzung, Anforderungen und Übereinstimmungsnachweis von Normalzement mit verkürztem Erstarren (Special cement — Part 11: Composition, requirements and conformity evaluation for cement with short setting time) DIN 1164-12: Zement mit besonderen Eigenschaften — Teil 12: Zusammensetzung, Anforderungen und Übereinstimmungsnachweis von Normalzement mit einem erhöhten Anteil an organischen Bestandteilen (Special cement — Part 12: Composition, requirements and conformity evaluation for cement with higher quantity of organic constitutents)	SR cements: See UK reply No No
Ireland	Sulfate-resisting Portland cement conforming to BS 4027	

Table 3.1 (*continued*)

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Italy	UNI 9156: Sulphate resistant cements — Classification and composition	Yes
	UNI 9606: Calcium hydroxide leaching resistant cements — Classification and composition	No
	UNI 10764: Micro hydraulic binders — Specifications and requirements	No
	(M.D. 03.06.1968) Cement for dams	Yes (EN 14216)
	(M.D. 03.06.1968) Aluminate cement	Yes (EN 14647)
	(M.D. 31.08.1972) Rapid setting cement	ETA (CUAP)
Luxembourg	CDC-CIM: Cahier des charges ciments — Partie 1: Ciments à haute résistance aux sulfates (CDC-CIM: Specifications for cements — Part 1: High sulfate resisting cements)	
Netherlands	NEN 3550: 2006 (white and HS cement) Cement volgens NEN-EN 197-1, NEN-EN 197-4 of NEN-EN 14216, met aanvullende speciale eigenschappen — Definities en eisen (NEN 3550:2006 Cements conforming to NEN-EN 197-1, NEN-EN 197-4 or NEN-EN 15216, with additional special properties — Definitions and requirements) CUR Recommendation 48, 1999 (see NOTE 1) Geschiktheidsonderzoek van nieuwe cementen voor toepassing in beton (Assessment of new cements for use in concrete) (CUR Recommendation 48 (published in 1999 by CUR, Gouda) was developed in relation to NEN 5950:1995 (this standard has obviously been replaced with EN 206-1)) NOTE 1 CUR Recommendations are not NEN standards	NEN 3550:2006 covers cements conforming to NEN-EN 197-1, NEN-EN 197-4 or NEN-EN 14216 with as special properties the colour white and HS cements
Norway	NS 3086: Cement with special properties, cements with: Sulphate resistance, low alkali, and particularly rapid hardening	To be replaced with ENs
Portugal	There are no Portuguese standards, although some specifications on sulphate resisting cements appear in the LNEC E 464.	
Slovakia	STN 72 2103: Sulphate-resisting Portland cement conforming	
Slovenia	None	
Sweden	SS 13 42 02: Cement — Sammansättning och fordringar för cement med begränsad värmeutveckling (BV-cement) (Cement — Composition and requirements for low heat cements)	To be replaced by SS-EN 197-1/A1
	SS 13 42 03: Cement — Sammansättning och fordringar för cement med låg alkalihalt (LA-cement) (Cement — Composition and requirements for low alkali cements)	
	SS 13 42 04: Cement — Sammansättning och fordringar för sulfatresistenta cement (SR-cement) (Cement — Composition and requirements for sulphate resisting cements)	Awaiting TC 51 decision
Switzerland	Sulfate-resisting Portland cement conforming to SN EN 197-1	Yes
United Kingdom	Sulfate-resisting Portland cement conforming to BS 4027	Awaiting CEN TC 51 decision on SR cements
	The following cements are not cited in our complementary concrete provisions, but exist	
	High alumina cement conforming to BS 915	Yes by EN 14647
	Supersulfated cement conforming to BS 4248	Work has just started on an EN

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Table 3.2 — National additions standards

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Austria	ÖNORM B 3309: Aufbereitete hydraulisch wirksame Zusatzstoffe für die Betonherstellung (AHWZ) (Processed hydraulic additions for concrete production, marking of conformity)	No
Belgium	Guide d'agrément technique Laitier moulu de haut-fourneau — Technische Goedkeuringsleidraad Gemalen hoogovenslakken (Guideline for national technical approval Ground granulated blast furnace slags)	Yes, by hEN 15167
Czech Republic	No provisions	
Denmark	Sewage sludge incineration ash is allowed and the requirements are described in DS 2426 (see Table 1.1)	No
Finland	Ground blast furnace slag and silica fume are covered by 1.1	Yes
France	NF P 18-502: Fumées de silice (Silica fumes)	EN 13263-1 (partly)
	NF P 18-506: Laitier vitrifié moulu de haut-fourneau (ground granulated blastfurnace slag)	EN 15167-1
	NF P 18-508: Additions calcaires (Limestone additions)	No
	NF P 18-509: Additions siliceuses (Siliceous additions)	No
Germany	Silica fume (NTA = National Technical Approval)	EN 13263-1 and -2
	DIN 51043: Trass — Anforderung, Prüfung (Trass — requirements, tests)	No
	Fly ashes not covered by EN 450 (NTA = National Technical Approval)	No
Ireland	B.S. 6699 GGBS; B.S. 3892 -2 Pfa as Type I addition	hEN 15167 for GGBS
Italy	None	
Luxembourg	None	
Netherlands	CUR Recommendation 94:2004: Toepassing van poederkoolvliegas in mortel en beton (Use of pfa in mortar and concrete) (see NOTE 1) NOTE 1 CUR Recommendations are not NEN standards	CUR recommendation 94 is partly replaced by ETA 05/0095 and ETA 05/0168, both based on CUAP Fly ash for concrete
Norway	NS 3045 Silica fume	Yes
Portugal	NP 4220:1993: Pozolanas para betão — Definições, Especificações e verificação da conformidade (Pozzolans for concrete — Definitions, specifications and conformity verification)	—
	LNEC E 466:2005: Fíleres calcários para ligantes hidráulicos — Características e requisitos de conformidade (Limestone filers for hydraulic binders — Characteristics and conformity requirements)	Listing the requirements to be regulated
Slovakia	STN 72 2014: Aggregates from slag into the concrete	

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Table 3.2 (*continued*)

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Slovenia	If necessary, Slovenian Technical Approval has been required for fly ash and silica fume until relevant European standards are issued	
Sweden	Requirements for ground granulated slag to be used in concrete are included in SS 13 70 03 Concrete — Application of EN 206-1 in Sweden	By hEN 15167
Switzerland	None	
United Kingdom	BS 3892-1: Pulverised-fuel ash — Part 1: Specification of pulverised-fuel ash for use with Portland cement	Yes, hEN 450
	BS 3892-2: Pulverized-fuel ash — Part 2: Specification for pulverized-fuel ash to be used as a Type I addition	No
	BS 6699: Ground granulated blastfurnace slag for use with Portland cement	Yes, by hEN 15167
	BS 7979: Specification for limestone fines for use with Portland cement	No

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Table 3.3 — National aggregates — Including recycled aggregates — Standards

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Austria	EN 13139: Aggregates for mortar: F1 < 4 mm	
Belgium	None	
Czech Republic	No provisions	
Denmark	Recycled aggregates are allowed and the requirements are described in DS 2426 (see Table 1)	A future version of EN 12620
Finland	Blast furnace slag and ferrochrome slag as artificial aggregates are covered by Table 1 and by Betonikiviainekset (Concrete aggregates), Finnish Concrete Association, Guidance document under revision	Yes No
France	None	
Germany	DIN 4226-100: Gesteinskörnungen für Beton und Mörtel — Teil 100: Rezyklierte Gesteinskörnungen (Aggregates for concrete and mortar — Part 100: Recycled aggregates) NOTE Application of recycled aggregates is specified in a separate guideline of the DAfStb based on DIN 1045-2 and DIN EN 206-1. DIN V 20000-103: Anwendung von Bauprodukten in Bauwerken — Teil 103: Gesteinskörnungen nach DIN EN 12620:2003-04 (Use of building products in construction works — Part 103: Aggregates according ton DIN EN 12620:2003-04) NOTE This standard contains mainly the specifications for the national application of aggregates; e. g. selection of classes given in DIN EN 12620. DIN V 20000-104: Anwendung von Bauprodukten in Bauwerken — Teil 104: Leichte Gesteinskörnungen nach DIN EN 13055-1:2002-08 (Use of building products in construction works — Part 104: Lightweight aggregates according to DIN EN 13055-1:2002-08) NOTE This standard contains specification for the national application of light weight aggregates. Hüttenbims nach DIN 4301 (Porous blast furnace slag)	Amendments to EN 12620 to incorporate clauses for recycled aggregates are under preparation No (will be part of DIN 1045-2 in the future) No (will be part of DIN 1045-2 in the future) No
Ireland	None	
Italy	UNI 8520–1: Aggregati per calcestruzzo — Designazione e criteri di conformità Istruzioni complementari per l'applicazione della EN 12620:2002 UNI 8520–2: Aggregati per calcestruzzo — Requisiti Istruzioni complementari per l'applicazione della EN 12620:2002	[Texts are being published]
Luxembourg	CDC–GRA: Cahier des charges granulats et sables (CDC-GRA: Specifications for aggregates and sands)	

Table 3.3 (*continued*)

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Netherlands	NEN 3543:2005: Nederlandse aanvulling op NEN-EN 13055-1:Lichte toeslagmaterialen — Lichte toeslagmaterialen voor beton, mortel en injectiemortel (Dutch supplement to NEN-EN 13055-1: Lightweight aggregates — Lightweight aggregates for concrete, mortar and grout) NEN 3833:2005: Nederlandse aanvulling op NEN-EN 13139: Toeslagmaterialen voor mortel (Dutch supplement to NEN-EN 13139: Aggregates for mortar) NEN 5905:2005: Nederlandse aanvulling op NEN-EN 12620: Toeslagmaterialen voor beton (Dutch supplement to NEN-EN 12620: Aggregates for concrete) CUR Recommendation 5, 1984: Metselwerkpuingranulaat als toeslagmateriaal voor beton (Crushed clay brick masonry aggregates for concrete) (see NOTE 1) CUR Recommendation 80, 2001: Beton met menggranulaten als grof toelagmateriaal (Concrete with recycled concrete or recycled masonry as coarse aggregate, see NOTE 1) NOTE 1 CUR Recommendations are not NEN standards	
Norway	Guidelines from the concrete society for recycled aggregates NBP 26	
Portugal	LNEC E 467:2005: Guia para a utilização de agregados em betões de ligantes hidráulicos (LNEC E 467:2005: Guide for the use of aggregates in concrete) LNEC E 471:2006: Guia para a utilização de agregados reciclados grossos em betões (LNEC E 471:2006: Guide for the use of coarse recycled aggregates in concrete)	Listing the requirements to be regulated
Slovakia	None	
Slovenia	None	
Sweden	Recycled aggregates allowed. Requirements found in BA 99 (The National Board of Housing, Building and Planning´s handbook of recycled materials)	
Switzerland	None. A separate document will be elaborated	
United Kingdom	(Further requirements for lightweight aggregates, RA and RCA are given in our complementary concrete standard, BS 8500-2 (see Table 1 for details))	

Table 3.4 — National admixtures standards

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Austria	None	
Belgium	None	
Czech Republic	None	
Denmark	None	
Finland	Certified product declaration	Yes
France	None	
Germany	DIN V 18998: Beurteilung des Korrosionsverhalten von Zusatzmitteln nach Normen der Reihe DIN EN 934 (Assessment of Corrosion Behaviour of Admixtures According to EN 934) DIN V 20000-100: Anwendung von Bauprodukten in Bauwerken — Teil 100: Betonzusatzmittel nach DIN EN 934-2:2002-02 (Application of building products in structures — Part 100: Concrete admixtures according to DIN EN 934-2:2002-02) (NOTE This standard contains specifications for the national application of concrete admixtures)	Partly integrated in EN 934-1 No (will be part of DIN 1045-2 in the future)
Ireland	None	
Italy	UNI 10765:1999: Additivi per impasti cementiti — Additivi multifunzionali per calcestruzzo — definizioni, requisiti e criteri di conformità (Admixtures for concrete — Multifunctional admixtures for concrete — Definition, requirements and conformity criteria)	
Luxembourg	None	
Netherlands	None	
Norway	None	
Portugal	None	
Slovakia	None	
Slovenia	None	
Sweden	None	
Switzerland	None	
United Kingdom	BS 8443: Specification for establishing the suitability of special purpose concrete admixtures	Publication expected in late 2005

Table 3.5 — National standards for others constituents, e.g. fibres

CEN Member Countries	Reference and title	Due to be replaced by an EN/ETA
Austria	No standard; other national guidelines	
Belgium	None	
Czech Republic	None	
Denmark	Fibres — Requirements for fibres are described in: DS 2426 (see Table 1 for details)	
Finland	None	
France	None	
Germany	Steel fibres and polymer fibres (NTA = National Technical Approval)	EN 14889-1 und -2
	DIN 1100: Hartstoffe für zementgebundene Hartstoffestriche — Anforderungen und Prüfverfahren (Hard aggregates for cement-bound floor screeds — Requirements and test methods) (NOTE Aggregates acc. to DIN 1100 have to be used for concrete in the exposure class XM3 acc. to DIN 1045-2)	—
Ireland	None	
Italy	UNI 11037: Fibre di acciaio da impiegare nel confezionamento di conglomerato cementizio rinforzato (Steel fibre to be used in the preparation of reinforced concrete conglomerate)	
Luxembourg	None	
Netherlands	None	
Norway	None	
Portugal	None	
Slovakia	None	
Slovenia	None	
Sweden	None	
Switzerland	None	
United Kingdom	None	

5 Limiting values

Table 4.1 contains the number of CEN Member Countries recommending requirements for aggregate categories for normal-weight aggregate concrete used in general construction. Annex A contains the details of these requirements. Table 4.1 shows the selected requirements for aggregates vary significantly and reflect local experience and what is locally available.

NOTE 1 It is inevitable that when a constituent material standard is a list of what is available somewhere in Europe, the national complementary requirements will select categories that reflect their experience.

NOTE 2 As EN 12620 reflects the needs somewhere in Europe, EN 206-1 should not attempt to set tighter classes as a general requirement for concrete. Leave this to complementary national provisions.

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Table 4.1 — Number of CEN Member Countries with requirements for national minimum aggregate categories for normal weight aggregate concrete used in general construction

Annex A contains the details of the CEN Member Country requirements			
Aggregate categories	**Number of CEN Member Countries with:**		
	Requirements	**Conditional requirements**	**No requirements**
Coarse aggregate grading categories	5	3	9
Graded coarse aggregate categories	3	3	11
All-in aggregate	3	3	9
Flakiness Index categories	7	2	8
Shape Index categories	3	3	11
Shell content categories	5	4	8
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	8	3	6
Fines content categories	8	3	6
Los Angeles categories	4	5	8
Resistance to impact categories	1	2	14
Resistance to wear categories	3	2	12
Resistance to polishing categories	3	3	11
Resistance to surface abrasion (AAV) categories	0	2	15
Resistance to abrasion by studded tyres	0	3	14
Freeze-thaw resistance categories	5	9	3
Magnesium sulfate categories	1	7	9
Acid-soluble sulfate categories	7	3	7
Drying shrinkage not greater than 0,075 %	2	6	8
Lightweight organic contaminators	5	5	7

While EN 206-1, Annex F gives some recommended limiting values for CEM I concrete with each of the exposure classes, in reality limiting values for durability are given in the national requirements. It should be noted that CEN Member Countries use different exposure classes for similar concrete elements and similar environments, see national examples in Table 2.2 and Table 2.4. In addition the effect of 'grouping' exposure classes may result in the rounding up of requirements. This Part of the CEN Report provides a comparison of these limiting values based on exposure class and detailed information is given in Annex B. Figures 1 to 17 give the national requirements/recommendations for maximum w/c ratio, minimum cement content and minimum compressive strength class in exposure classes XC1 to XA3. Annex B contains more detailed information including permitted cement types. However, this information is for comparison purposes and for specification purposes the national provisions should be used.

These figures show a wide range of requirements for the concrete composition in the different European countries even for the same exposure class. The data show that there is no agreed relationship between

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compressive strength class, maximum w/c ratio and minimum cement content. Often the values with regard to the compressive strength class, the maximum water cement ratio and the minimum cement content do not correspond with the recommended values given in EN 206-1, Table F.1. In France, different requirements are used for precast and in-situ concrete. The values given in this Technical Report are for in-situ concrete.

An overview of the requirements is presented in Table 4.2 in terms of the minimum and maximum value, the most frequently used value with respect to the minimum concrete cover, (i.e. the nominal cover less the allowance for deviation), the minimum compressive strength class, the maximum water cement ratio and the minimum cement content. The most frequently used value (m. f. v.) is the value selected by more CEN Member Countries than any other value and it should not be interpreted as meaning that most CEN Member Countries use this value.

Table 4.2 — Observations with regard to the national recommendations for exposure classes for an intended working life of at least 50 years in terms of the minimum and maximum value and the most frequently used value with regard to the minimal concrete cover, the compressive strength class, the maximum water cement ratio and the minimum cement content

Exposure class	Minimum cover, mm		Minimum compressive strength class			Maximum w/c ratio			Minimum cement content, kg/m^3		
	min	max	min	max	m. f. u.	min	max	m. f. u.	min	max	m. f. u.
XC1	10	20	NR	C25/30	C 20/25	0,60	NR	0,65	NR	300	260
XC2	15	35	NR	C28/35	C25/30	0,55	NR	0,60	150	300	280
XC3	10	35	NR	C32/40	NR, C25/30	0,45	NR	0,55	150	340	280
XC4	15	40	NR	C32/40	NR	0,45	NR	0,50	150	340	300
XD1	25	40	NR	C40/50	C30/37	0,45	0,60	0,55	150	360	300
XD2	25	55	NR	C40/50	C30/37	0,40	0,55	0,50, 0,55	150	360	300
XD3	33	55	NR	C50/60	C35/45	0,40	0,45	0,45	150	400	320
XS1	25	40	NR	C40/50	C30/37	0,45	0,55	0,50, 0,45	150	360	300
XS2	25	45	NR	C40/50	C35/45	0,40	0,55	0,45	150	360	320, 360
XS3	30	50	NR	C50/60	C35/45	0,35	0,45	0,45	150	400	320
XF1	-	-	NR	C32/40	NR	0,55	0,60	0,60	NR	300	300
XF2	-	-	NR	C35/45	NR	0,45	NR	0,55	NR	340	300
XF3	-	-	NR	C40/50	NR	0,45	0,60	0,50	NR	340	300, 320
XF4			NR	C40/50	NR	0,40	NR	0,45	NR	400	340
XA1	-	-	NR	C35/45	NR	0,40	0,60	0,55	150	380	300
XA2	-	-	NR	C40/50	C35/45	0,40	0,50	0,50	150	380	320
XA3	-	-	NR	C40/50	NR, C35/45, C40/50	0,35	0,45	0,45	150	400	360

m. f. u. most frequently used value

Table 4.3 compared the most frequently used values with the recommended values given in EN 206-1, Table F.1. These data show that in the majority of cases (~ 82 %) the most frequently used values with regard to the maximum water cement ratio and the minimum cement content correspond with the recommended values given in EN 206-1, Table F.1.

Most CEN Member Countries set a value for the compressive strength class. In nine cases (~ 53 %) the most frequently used values with regard to the compressive strength class corresponds with the recommended values given in EN 206-1, Table F.1.

Table 4.3 — Comparison of the most frequently used values with regard to the compressive strength class, the maximum water cement ratio and the minimum cement content with the recommended values given in EN 206-1, Table F.1

Exposure class	Compressive strength class				Maximum w/c ratio			MCC		
	EN 206-1	m. f. u.			EN 206-1	m. f. u.		EN 206-1	m. f. u.	
XC1	C20/25	C 20/25			0,65	0,65		260	260	
XC2	C25/30	C25/30			0,60	0,60		280	280	
XC3	C30/37	NR	C25/30	C30/37	0,55	0,55		280	280	
XC4	C30/37	C30/37			0,50	0,50		300	300	
XD1	C30/37	C30/37			0,55	0,55		300	300	
XD2	C30/37	C 30/37			0,55	0,50		300	300	
XD3	C35/45	C35/45			0,45	0,45		320	320	
XS1	C30/37	C30/37			0,50	0,50	0,45	300	300	
XS2	C35/45	C35/45			0,45	0,45		320	340	
XS3	C35/45	C35/45			0,45	0,45		320	320	360
XF1 [a]	C30/37	NR			0,55	0,60		300	300	
XF2 [b]	C25/30	NR			0,55	0,55		300	300	
XF3 [c]	C30/37	NR	C30/37		0,50	0,50		320	300	320
XF4 [d]	C30/37	NR			0,45	0,45		340	340	
XA1	C30/37	NR			0,55	0,55		300	300	
XA2	C30/37	C35/45			0,50	0,50		320	320	
XA3	C35/45	NR			0,45	0,45		360	360	

[a] EN 206-1: No Air entrainment required; No Air entrainment required in 16 of 17 countries.

[b] EN 206-1: Air entrainment required; 12 countries: Air entrainment required; 3 countries: No air entrainment required; 2 countries: Solutions with and without AEA available

[c] EN 206-1: Air entrainment required; 10 countries: Air entrainment required; 3 countries: No air entrainment required; 3 countries: Solutions with and without AEA available

[d] EN 206-1: Air entrainment required;12 countries: Air entrainment required; 2 countries: No air entrainment required; 2 countries: Solutions with and without AEA available

	Most frequently used values correspond with the recommended values given in EN 206-1, Table F.1.
	Most frequently used values do not correspond with the recommended values given in EN 206-1, Table F.1.

In five cases (XC1, XC2, XC4, XD1 and XD3) the most frequently used values with regard to the compressive strength class, the maximum water cement ratio and the minimum cement content correspond with the recommended values given in EN 206-1, Table F.1 for all three categories.

Denmark, which has the lowest minimum cement contents, has an additional requirement for minimum fines content. In the case of Denmark, the minimum cement content cannot be reduced when Type II additions are used.

When assessing the implications of these data, both the type of element and the selected exposure class need to be taken into account, e.g. for example, indoor concrete may be classed as X0 or XC1, see Clause 2.

There is no consistent view on the concrete quality required to resist a given exposure class with a given minimum cover and intended working life.

NOTE Relatively small changes in requirements may have significant impacts on the competitiveness of concrete solutions and there will be strong resistance to proposals that take the worse values and potential liability issues if CEN/TC 104/SC 1 were to select values that were not worse case.

Annex B includes information on permitted cement types. With the exception of one CEN Member Country, they all provide guidance for the use of cements with several main constituents (blended cements) besides Portland cement (CEM I).

Annex B shows, sometimes, substantial differences in the types of cement permitted in the national application documents for the same exposure class. This reflects not only the traditionally different factors of the market and building practice but also different philosophies in setting regulations. For example, specifications are given in the German application standard DIN 1045-2 for the application of all 27 basic types of cement and also for a number of CEM II-M cements. Other national annexes to EN 206-1 seem to regulate the application of only a few types of cement that traditionally play a part in the particular national market.

In a few cases for a given exposure class, the use of some blended cements is linked to a higher/lower cement content and a lower/higher water cement ratio than CEM I concrete for a certain exposure class. See for example the entry for Portugal in Table B.2 and the UK in Table B.11.

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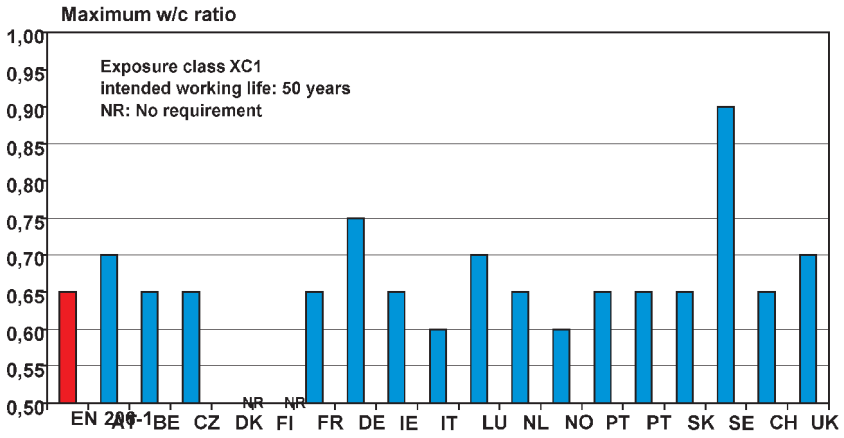

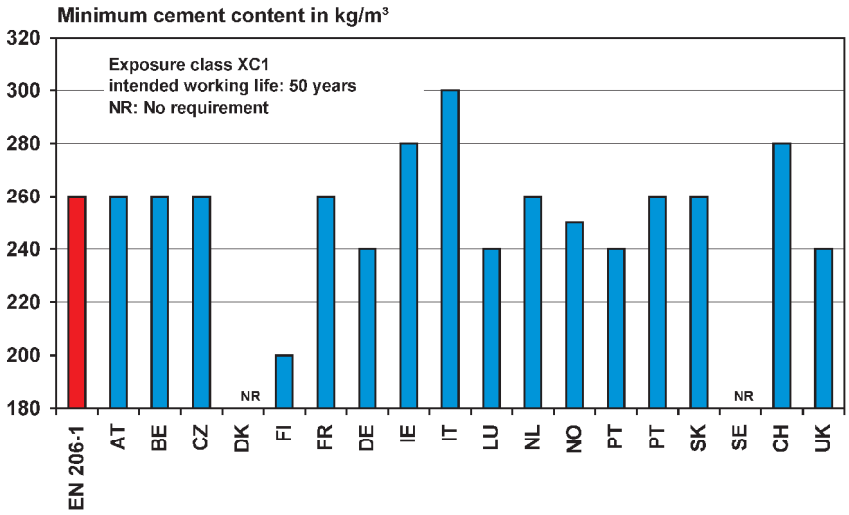

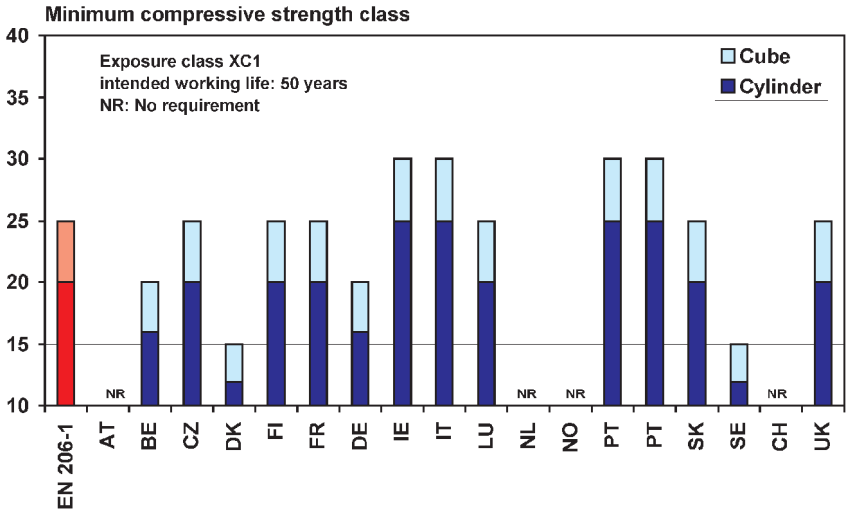

Figure 1 — Comparison of National Provisions to EN 206-1 – Exposure Class XC1

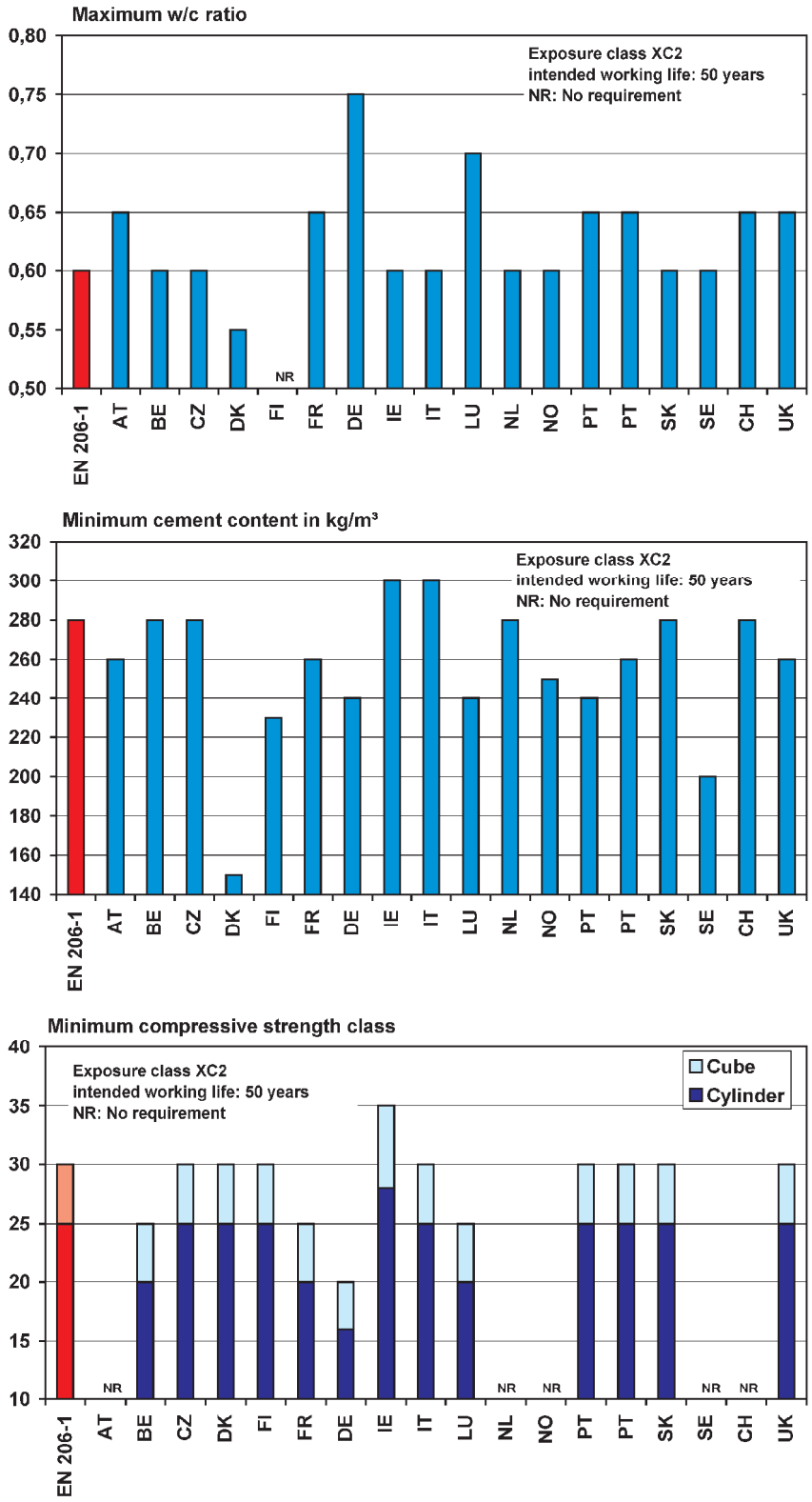

Figure 2 — Comparison of National Provisions to EN 206-1 – Exposure Class XC2

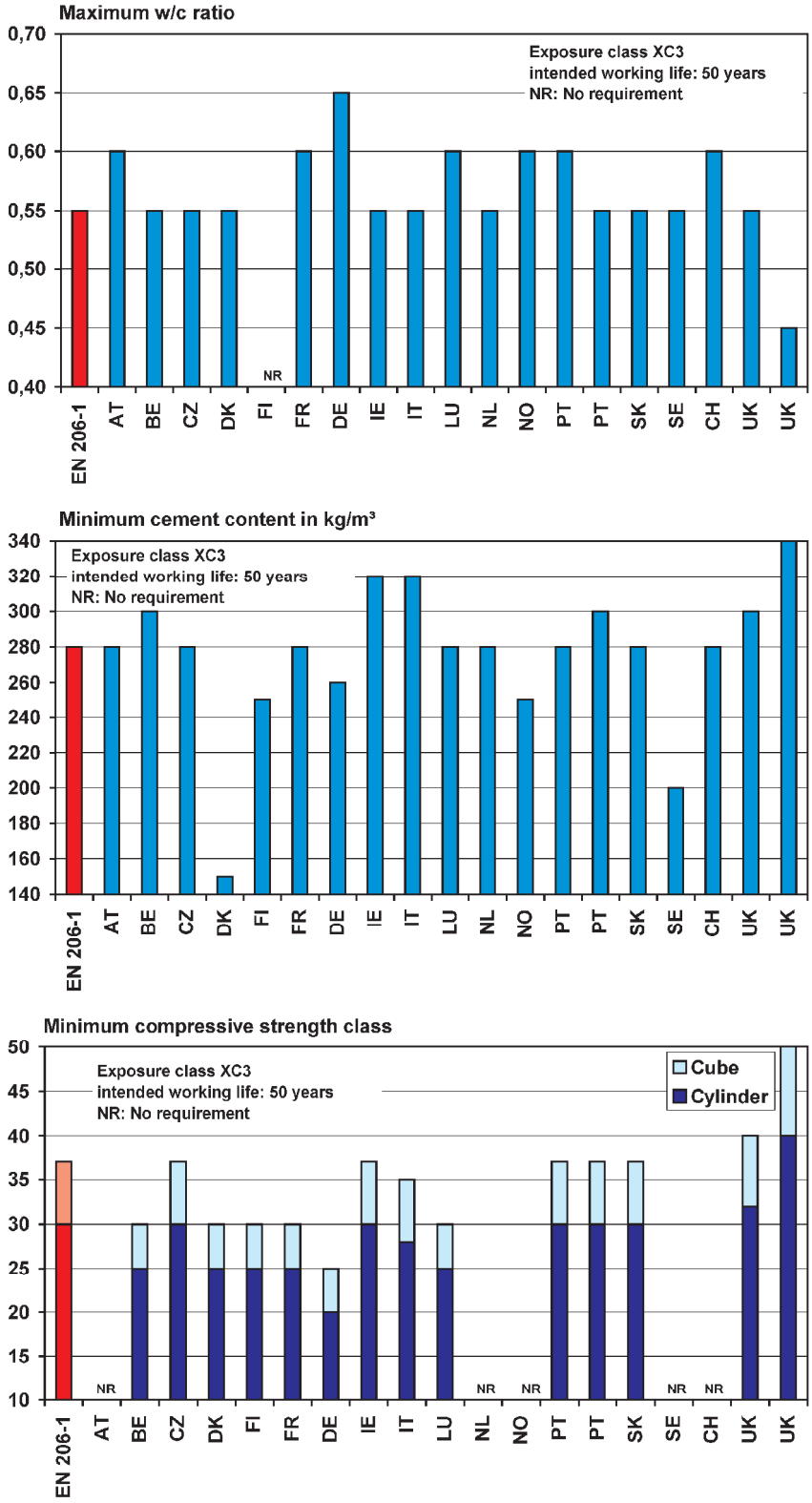

Figure 3 — Comparison of National Provisions to EN 206-1 – Exposure Class XC3

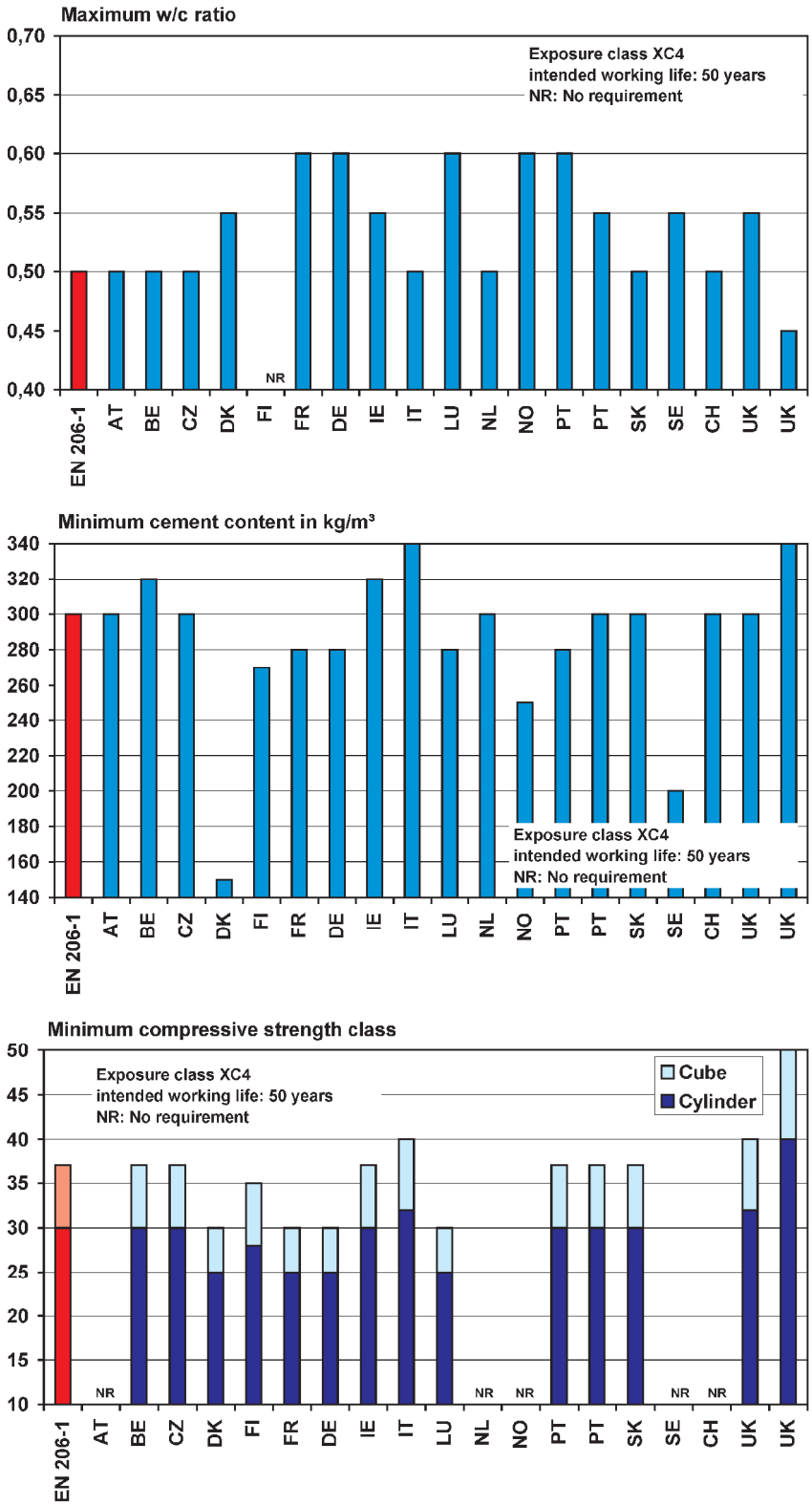

Figure 4 — Comparison of National Provisions to EN 206-1 – Exposure Class XC4

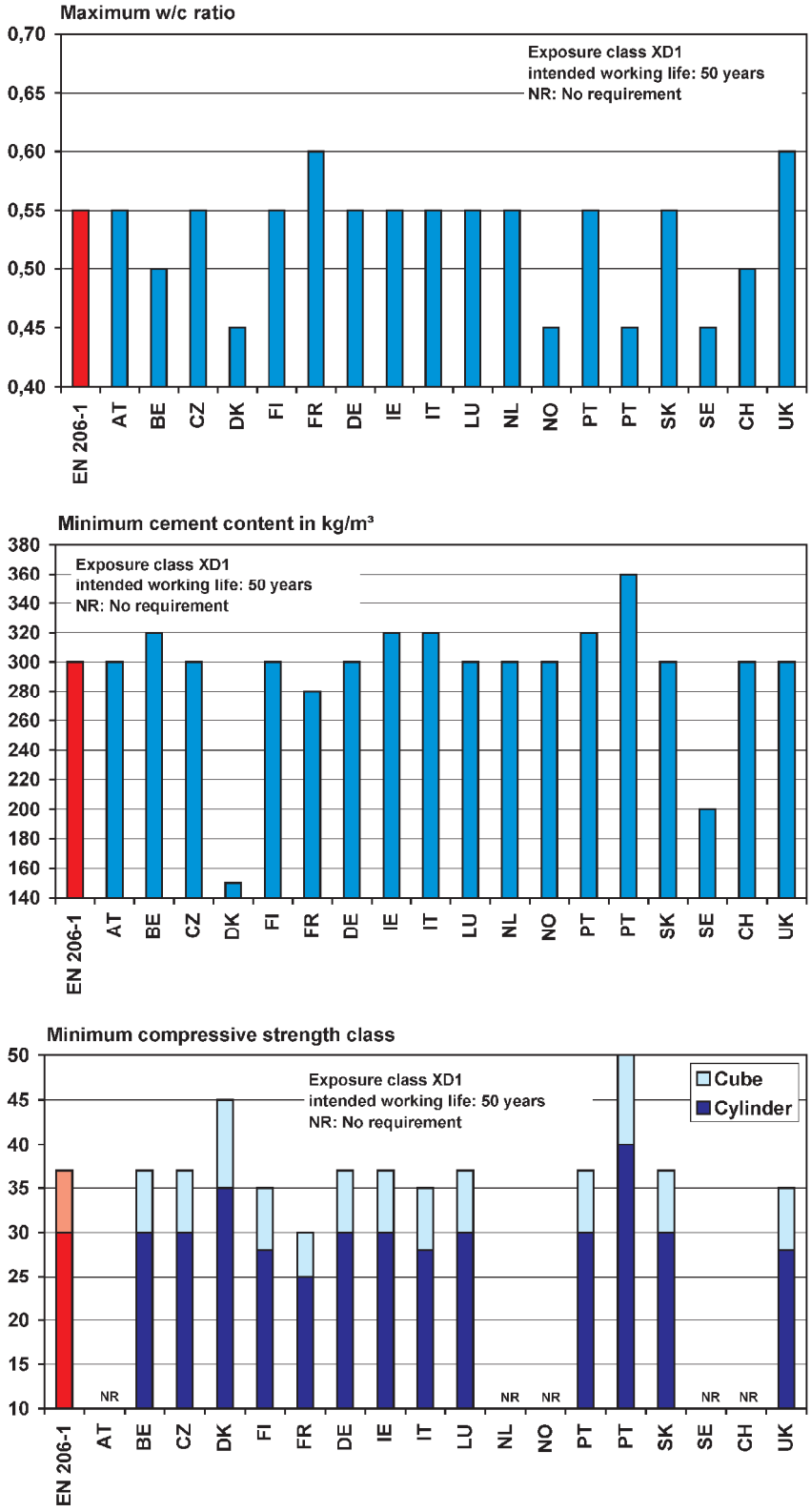

Figure 5 — Comparison of National Provisions to EN 206-1 – Exposure Class XD1

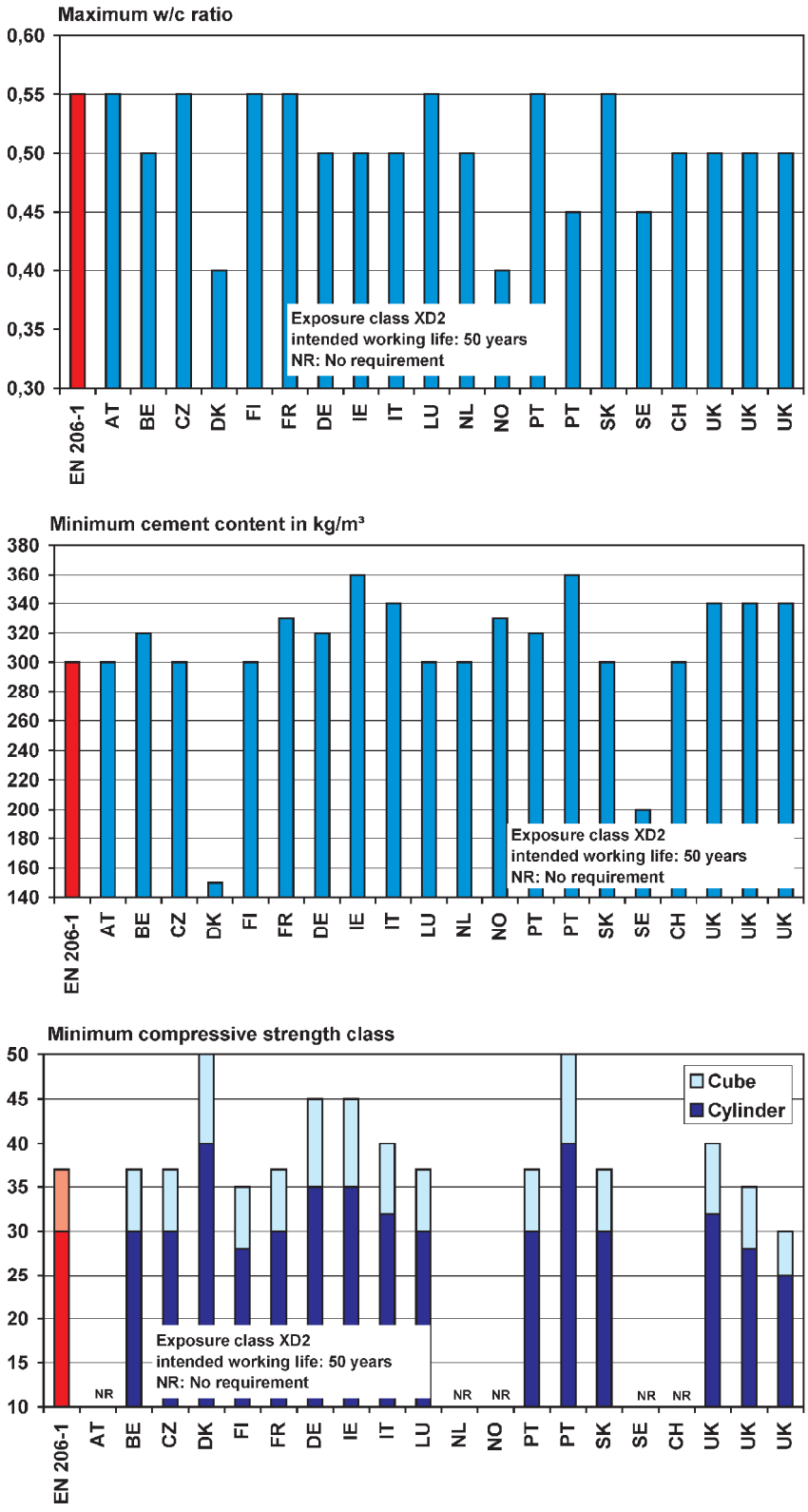

Figure 6 — Comparison of National Provisions to EN 206-1 – Exposure Class XD2

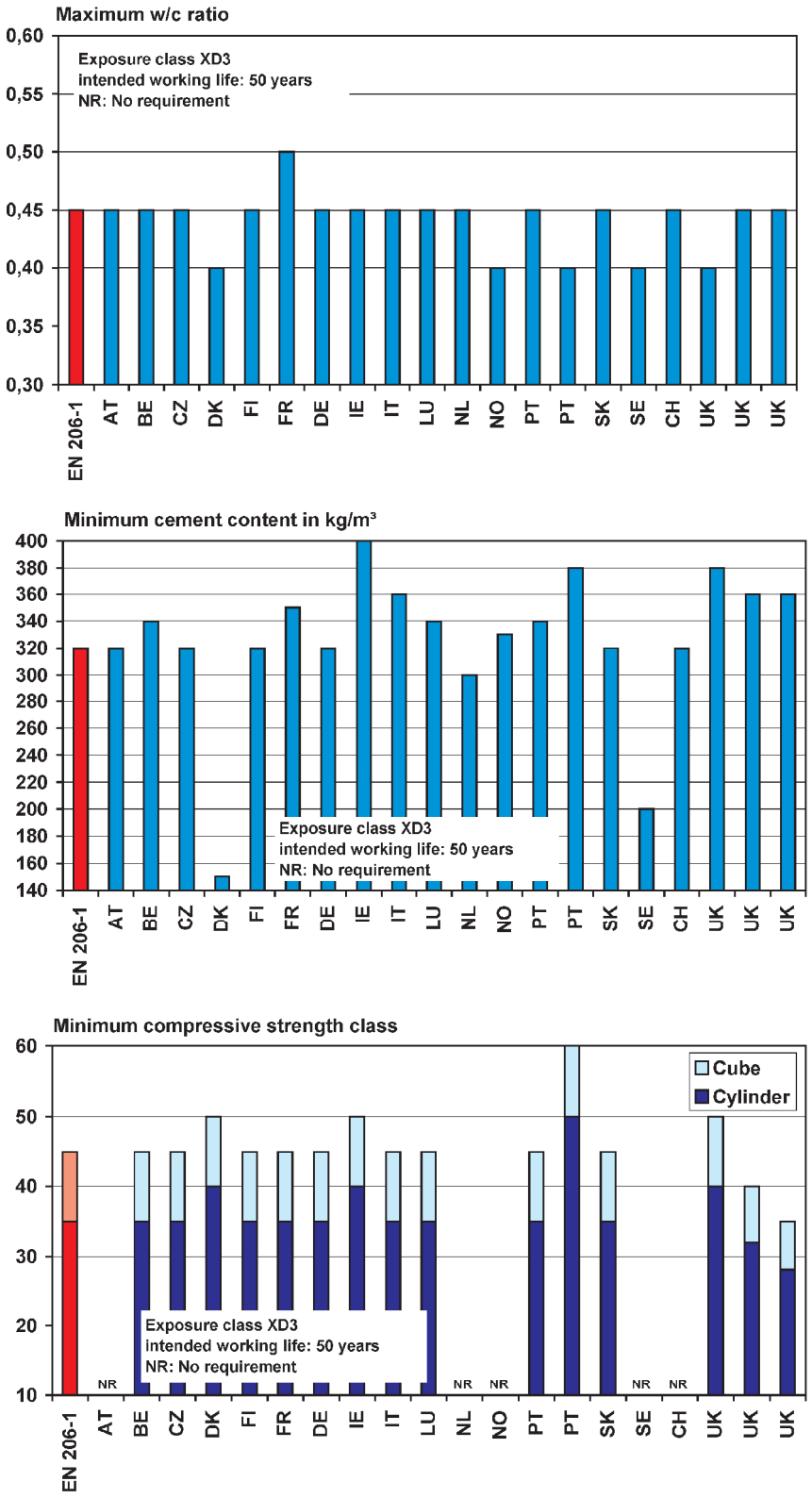

Figure 7 — Comparison of National Provisions to EN 206-1 – Exposure Class XD3

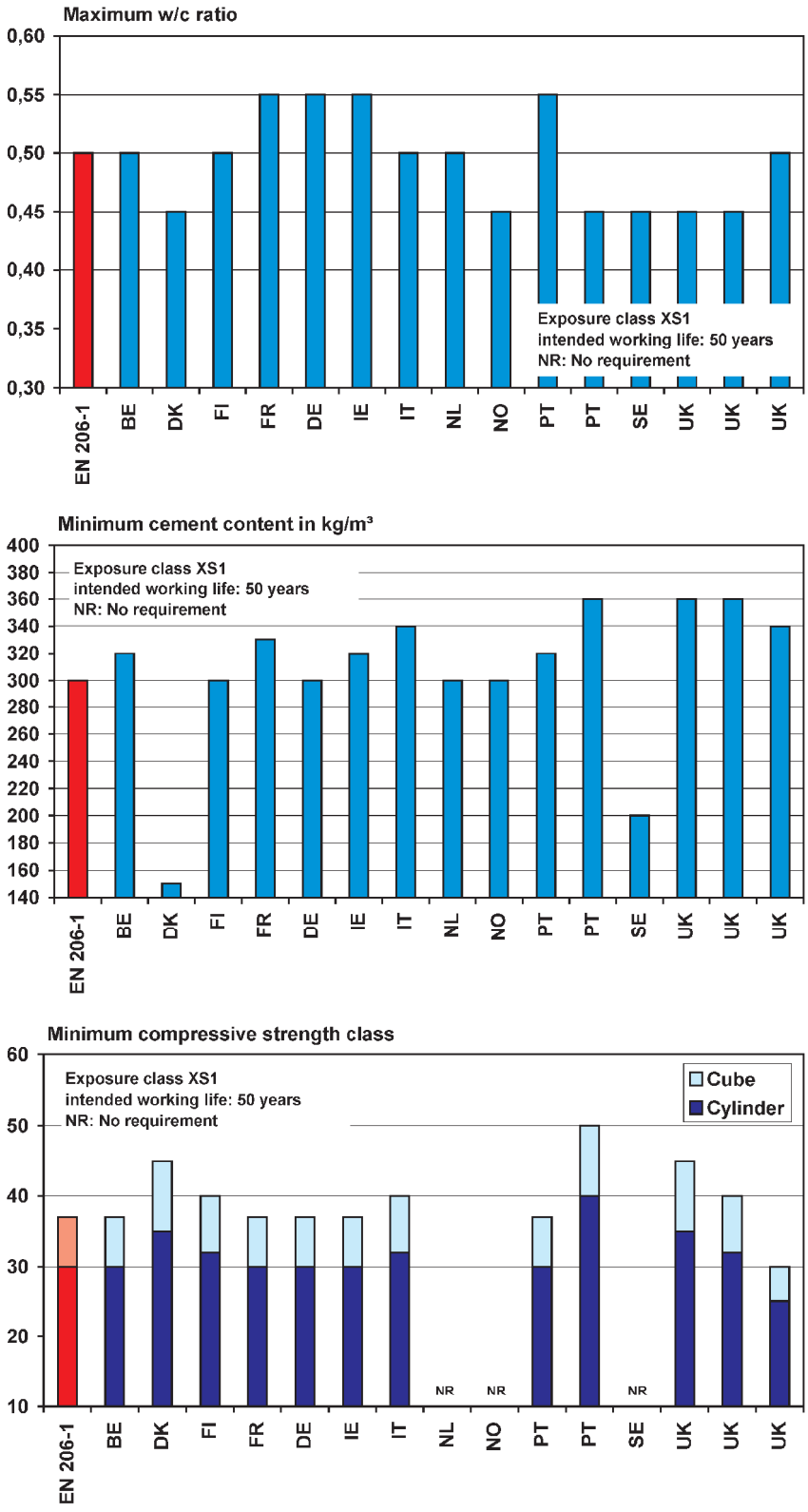

Figure 8 — Comparison of National Provisions to EN 206-1 – Exposure Class XS1

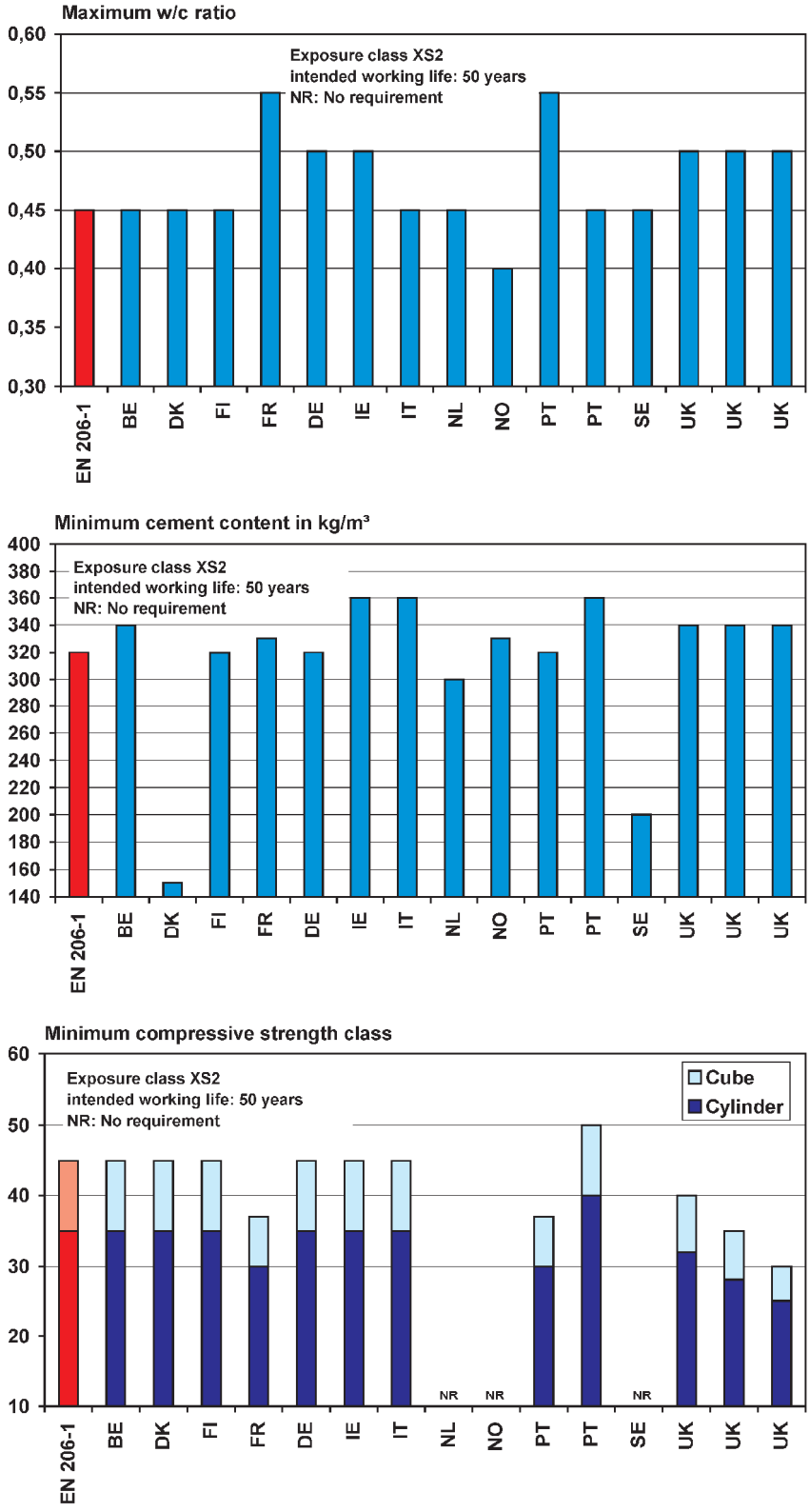

Figure 9 — Comparison of National Provisions to EN 206-1 – Exposure Class XS2

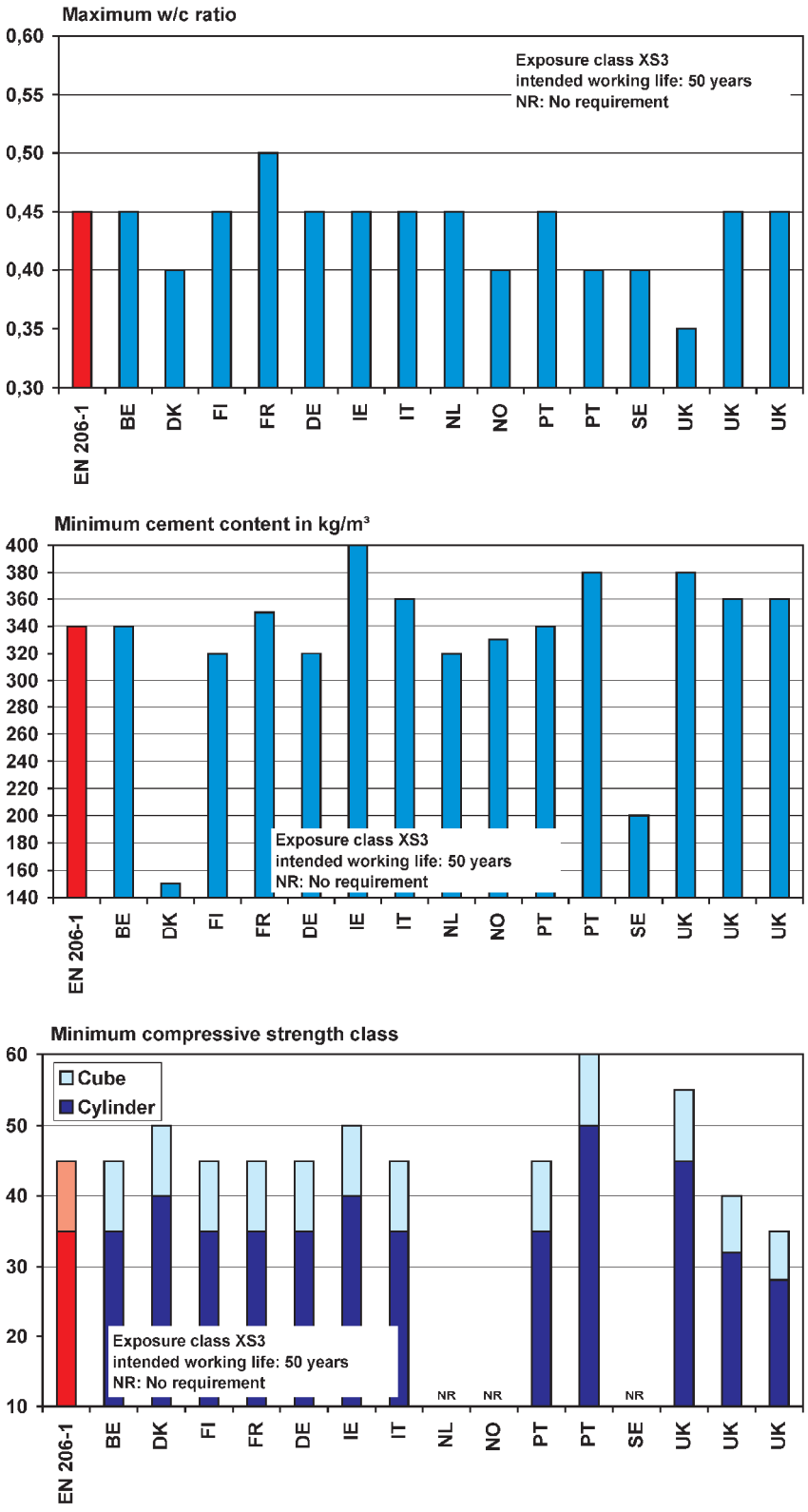

Figure 10 — Comparison of National Provisions to EN 206-1 – Exposure Class XS3

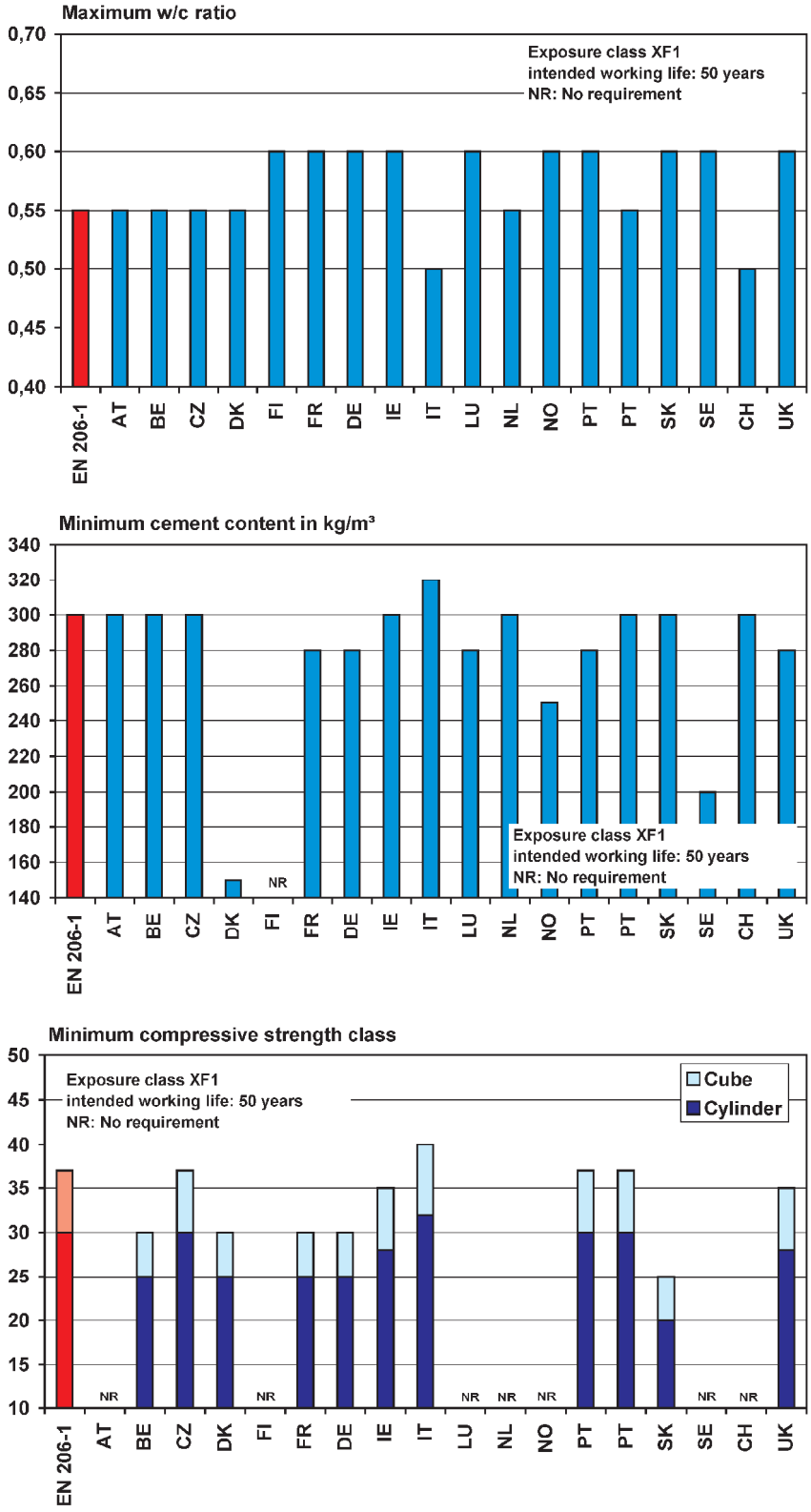

Figure 11 — Comparison of National Provisions to EN 206-1 – Exposure Class XF1

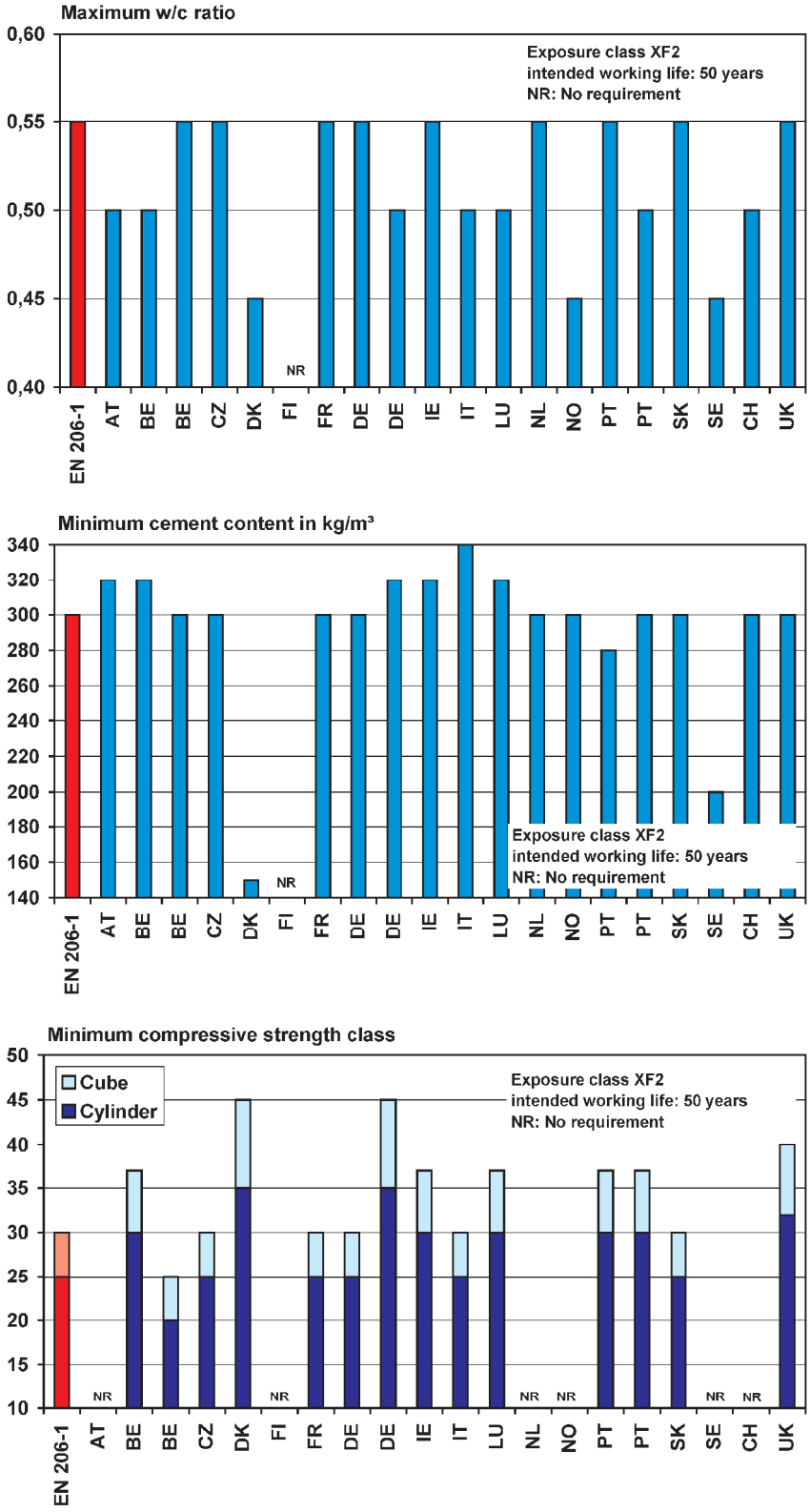

Figure 12 — Comparison of National Provisions to EN 206-1 – Exposure Class XF2

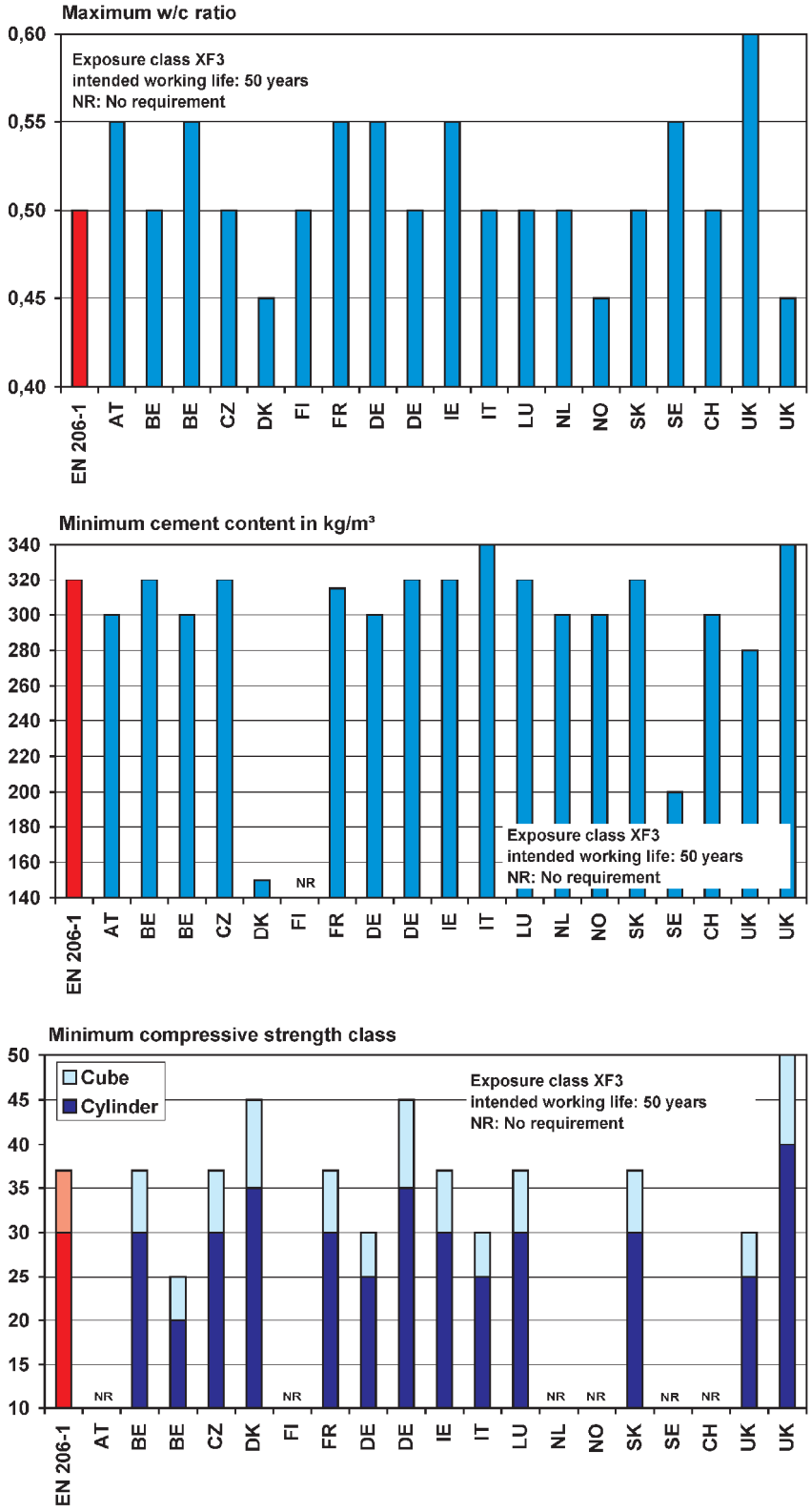

Figure 13 — Comparison of National Provisions to EN 206-1 – Exposure Class XF3

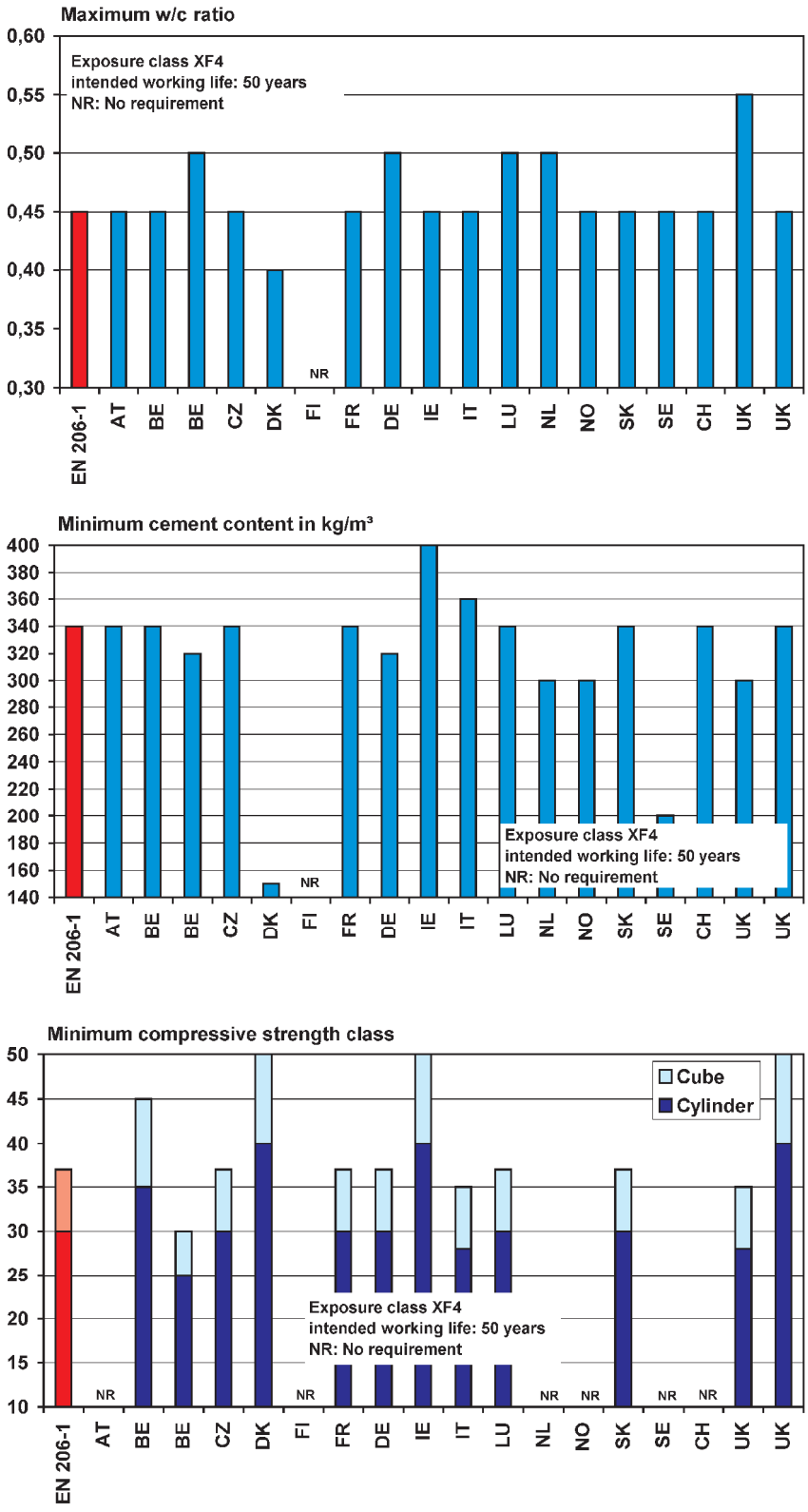

Figure 14 — Comparison of National Provisions to EN 206-1 – Exposure Class XF4

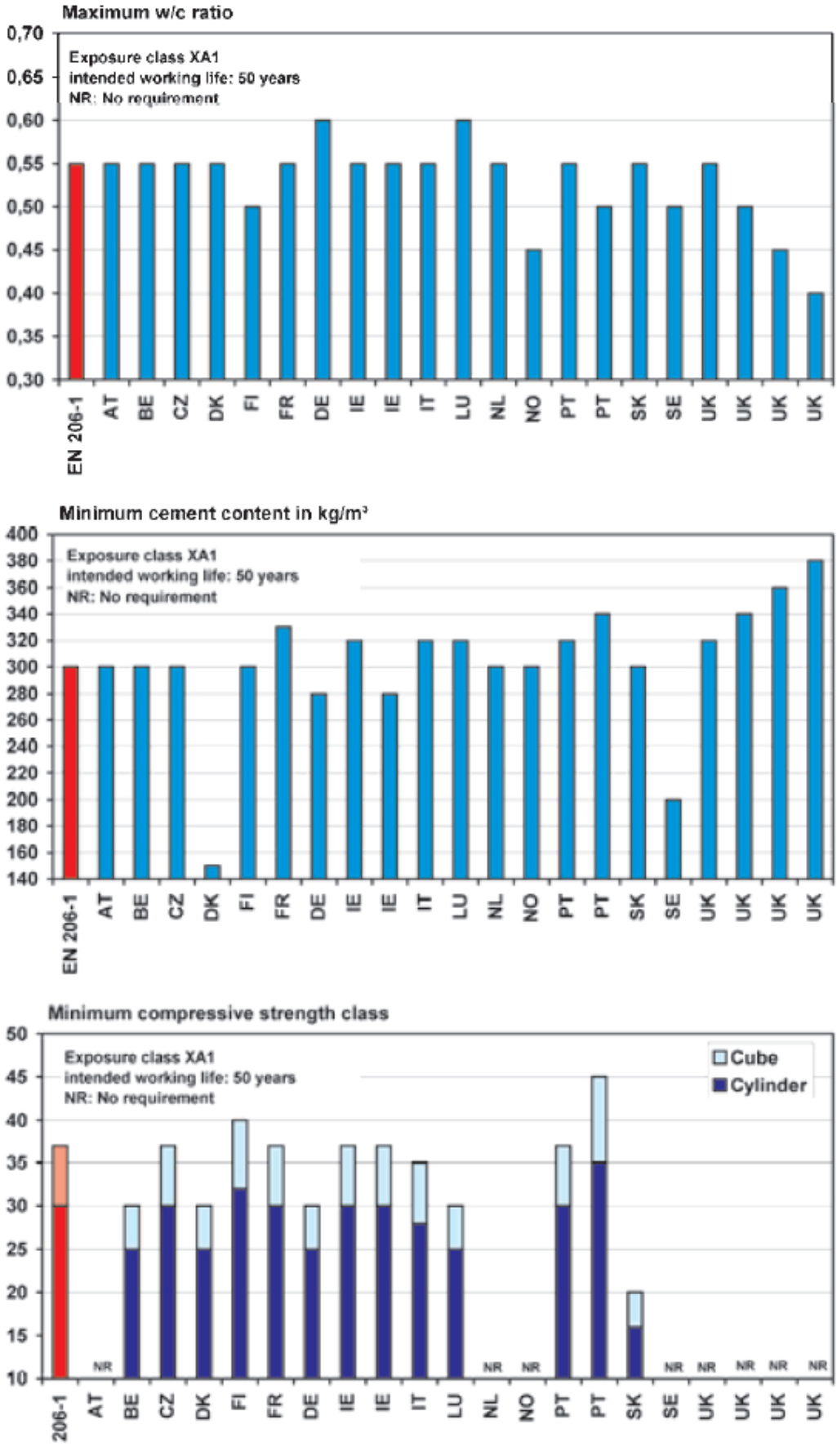

Figure 15 — Comparison of National Provisions to EN 206-1 – Exposure Class XA1

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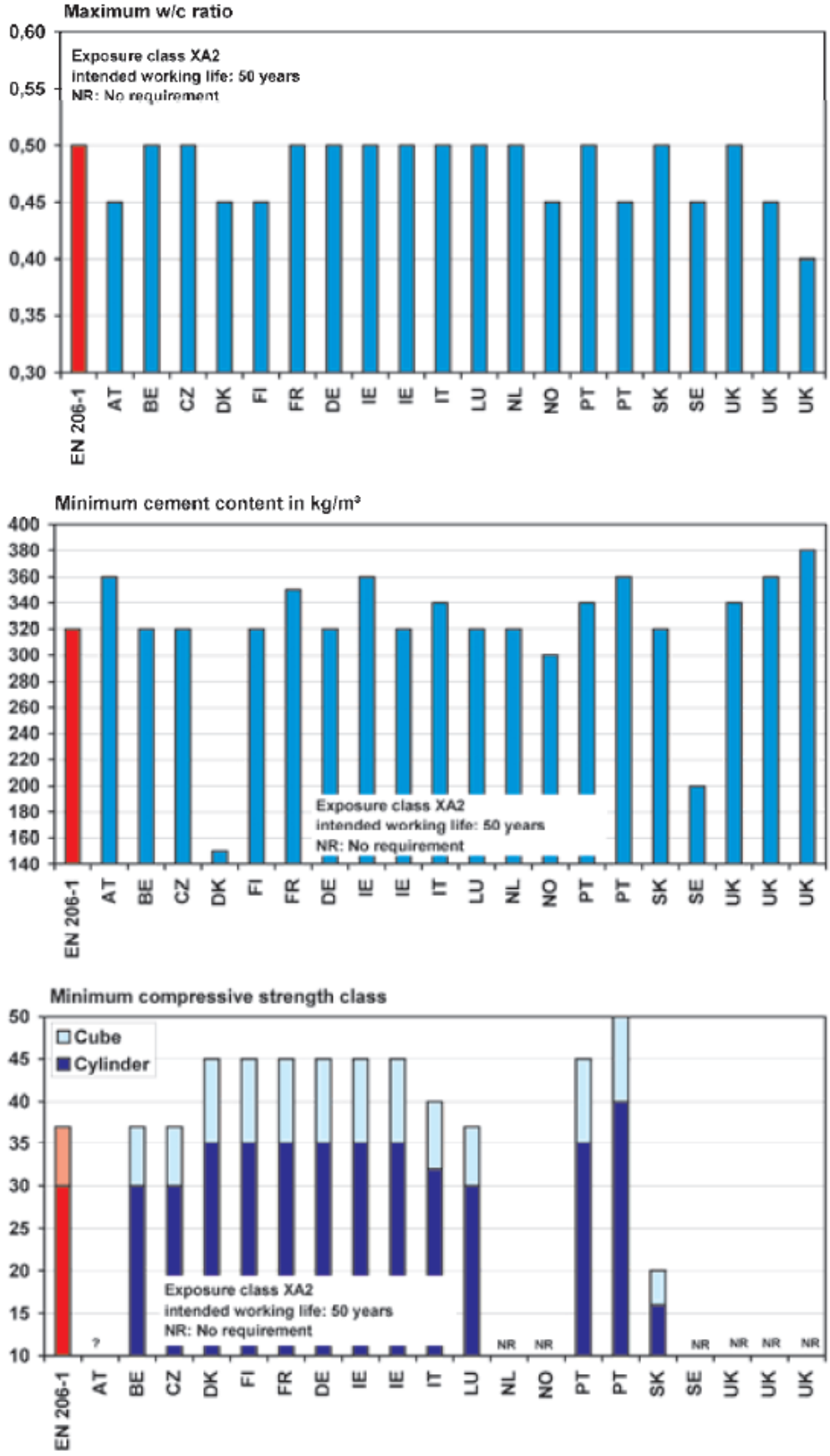

Figure 16 — Comparison of National Provisions to EN 206-1 – Exposure Class XA2

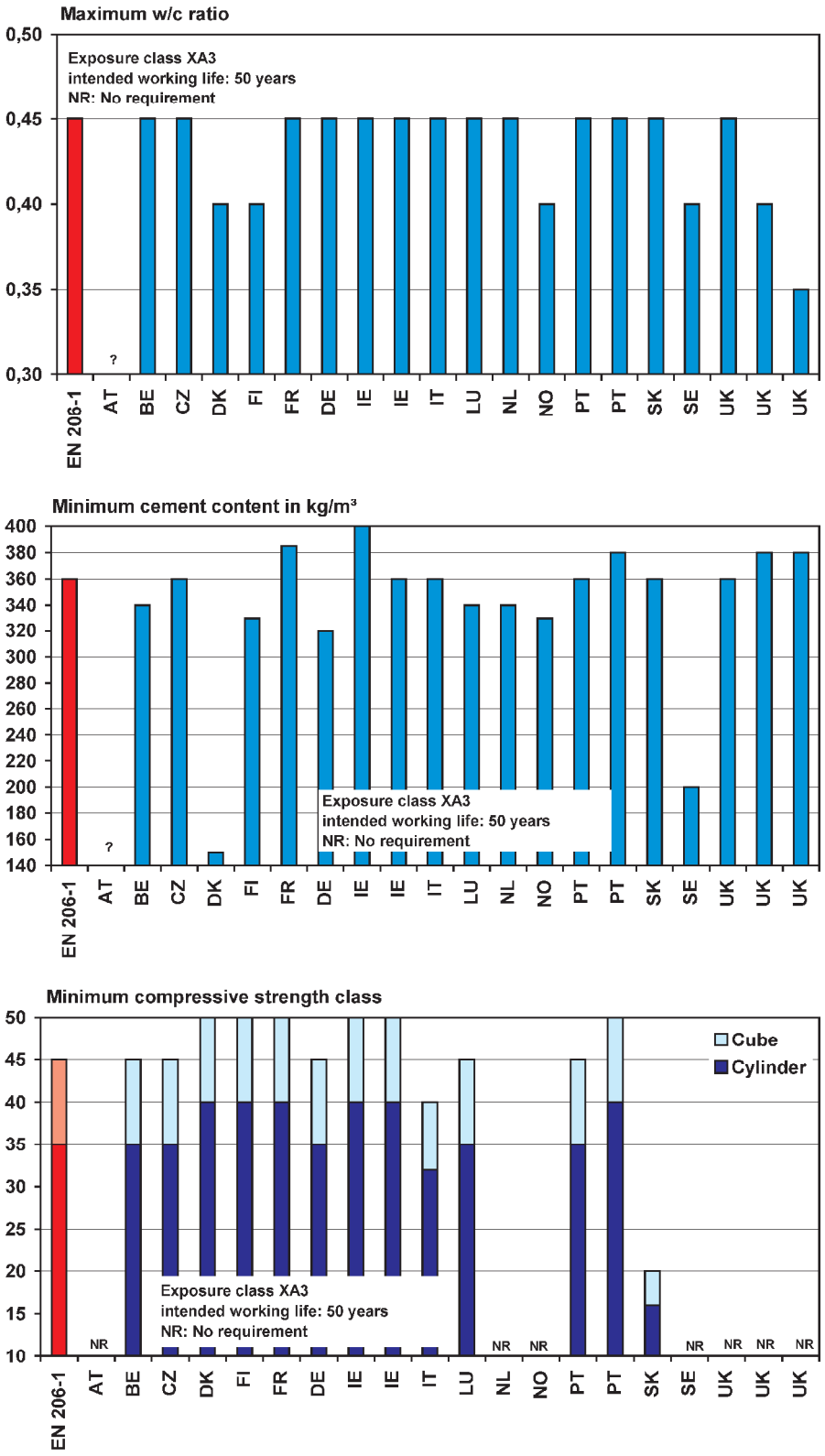

Figure 17 — Comparison of National Provisions to EN 206-1 – Exposure Class XA3

6 Methods for minimising the risk of damaging ASR

EN 206-1:2000, 5.2.3.4 leaves provisions to resist alkali-silica reaction to national rules. This Part of the survey only asked some general questions about these national requirements to resist alkali-aggregate reaction.

NOTE There is a European project called 'PARTNERS' on ASR and they will have collected more detailed information.

Table 5.1 gives the location of the national requirements. Table 5.2 asks whether aggregates are classified into different categories with respect to ASR. A 'No' response may be an indication that the range of aggregate types is too small to make any practical difference.

Table 5.3 lists the methods used to resist ASR. The approaches to minimising the risk of damaging ASR tend to be similar. The (incomplete) detail that was supplied with some of the responses has not been included in this summary, as it could be completely misleading. Two CEN Member Countries that have the same maximum alkali content may have significantly different requirements due to the way in which the alkali content is calculated, e.g. based on the total alkali content of the cement or based on the alkali content of the clinker.

NOTE The method of calculating the maximum alkali content is not agreed and will be difficult to agree as it would include a factor related to the acceptable level of safety, which is a nationally determined parameter.

Where a CEN Member Country has a particularly reactive aggregate, lower maximum alkali contents are required.

Table 5.4 gives some more information on the performance methods currently in use in Europe.

There are other forms of alkali-aggregate reaction and Table 5.5 shows that only one CEN Member Country has provisions to resist these other forms of AAR.

The information obtained by this survey is not intended to provide the basis for approximating requirement.

NOTE Other projects have studied this area in much more detail.

Considering the benefits of European harmonization, it seems useful if CEN/TC 51, CEN/TC 104 and CEN/TC 154 were to co-operate in order to determine how the alkali content of constituents is to be measured and declared.

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Table 5.1 — Location of national requirements

CEN Member Countries	Location of national requirements
Austria	ONR B 3100: Beurteilung von Gesteinskörnungen für Beton auf Alkali-Reaktivität Beurteilung von Gesteinskörnungen für Beton auf Alkali-Reaktivität (Assessment of concrete aggregates for alkali-reactivity in accordance with RILEM regulations)
Belgium	To prevent the alkali-silica reaction, at least one of the following measures has to be applied: — Limitation of the total alkali content of the concrete — Use of a low-alkali cement conform to NBN B 12-109 — Choose aggregates which are not potentially reactive Take measures to restrict the water saturation of the concrete
Czech Republic	CSN EN 206-1: Zmena Z2 (paragraph NA.3)
Denmark	See Table 1.1
Finland	None
France	Guidelines: Recommandations pour la prévention des désordres dus à l'alcali-réaction, LCPC, juin 1994 (Recommendations for the prevention of damage by the alkali-aggregate reaction) – (available in English))
Germany	DAfStb-Richtlinie: Vorbeugende Maßnahmen gegen schädigende Alkalireaktion im Beton (Alkali-Richtlinie) (DAfStb-Guideline: Preventive measures against deleterious alkali-reaction in concrete (Alkali-Guideline) Ergänzend: Vorläufige Empfehlung des DAfStb zur Vermeidung möglicher schädigender Alkalireaktionen bei Verwendung von Kies-Splitt und Kies-Edelsplitt des Oberrheins als Betonzuschlag (Supplementary: Provisional recommendation by the DAfStb for the prevention of harmful alkali reactions likely to occur when using chippings or high-grade chippings from the Upper Rhine Valley as concrete aggregate)
Ireland	Alkali-Silica Reaction in Concrete, published by The Institution of Engineers of Ireland and The Irish Concrete Society, 2003. (IEI/ICS ASR Report)
Italy	UNI 8981- 2 Rev. 2006: Durability of concrete works and precast elements — Criteria for the avoidance of alkali-silica reaction (pop-out)
Luxembourg	DNA EN 206
Netherlands	NEN 8005:2004 states in a note that if CUR Recommendation 89 (2002) *Measures to prevent concrete damage because of ASR* is adhered to, the requirement in 5.2.3.4 (…, actions shall be taken to prevent deleterious alkali-silica reaction using procedures of established suitability) in EN 206-1 has been fulfilled
Norway	Norwegian Concrete Association NBP 21
Portugal	LNEC E 461:2004: Metodologia para prevenir reacções expansivas internas (Methodology for avoiding internal expansive reactions)
Slovakia	STN 73 1210, clause 5.2 — More details on testing are provided in standard ST 72 1179
Slovenia	None
Sweden	See Table 1.1 (SS 13 70 03)
Switzerland	SN EN 206-1:2000: National Annex (Table 1.1, Ref. [1]). Amendments will be elaborated
United Kingdom	BS 8500-2 (see Table 1.1). More detailed guidance is provided in BRE Digest 330: Alkali-silica reaction in concrete

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Table 5.2 — Aggregate reactivity

CEN Member Countries	Is there a national classification of aggregate reactivity?
Austria	Yes by ONR 23100
Belgium	No
Czech Republic	CSN EN 206-1: Zmena Z2 (paragraph NA.3); testing standard – CSN 72 1179
Denmark	Yes by petrographic analysis and performance tests given in DS 2426
Finland	No
France	Yes FD P 18-542: (Criteria for the classification of aggregates) + XP P 18-594 (Performance tests, petrographic analysis, chemical tests)
Germany	Yes, depending on type of the reactive aggregate by concrete test or petrographic analysis described in the Alkali-Guideline mentioned in table 5.1
Ireland	Yes; IEI/ICS ASR Report
Italy	By petrographic analysis and performance tests given in UNI 8520-22
Luxembourg	No
Netherlands	No
Norway	Reactive/none-reactive — Norwegian Concrete Association NBP 21
Portugal	Yes, given in LNEC E 461:2004: Metodologia para prevenir reacções expansivas internas (Methodology for avoiding internal expansive reactions)
Slovakia	Yes, given in STN 721179 where the testing method can be found, and in STN 731210 where the classification for alkali-silica reaction is shown
Slovenia	None (ASTM standards are used in practice)
Sweden	No
Switzerland	No, in preparation
United Kingdom	Yes, given in BRE Digest 330: Alkali-silica reaction in concrete

Table 5.3 — Methods permitted to minimise damaging ASR

CEN Member Countries	Low alkali cement	Maximum alkali content	Performance method
Austria	No	No	No
Belgium	Yes (NBN B 12-109)	Not in a standard, frequently specified in the general tenders for roads and bridges	Not in a standard, frequently specified in the general tenders for roads and bridges
Czech Republic	CSN EN 206-1 Zmena Z2 (paragraph NA.3) – only some recommendation		
Denmark	Yes	Yes	Yes
Finland	No	No	No
France	No	Yes; value depends upon cement type and aggregate reactivity	Yes
Germany	Yes, rules for application of low-alkali cements are included in the Alkali-Guideline mentioned in table 5.1. Low alkali cements are defined in DIN 1164-10 (cf. Table 3.1)	No	No
Ireland	Yes	Yes; value varies with aggregate reactivity	Yes; Testing, History of use, or moisture control allowed
Italy	No	Yes	No
Luxembourg	No	Yes	No
Netherlands		CUR Recommendation 89 (see table 5.1) includes appropriate methods	
Norway	Yes	Yes	(test method under development)
Portugal	Yes, using silica fume, fly ash or slag in defined contents for reactive class II (LNEC E 461)	Yes	Yes, in the Specification LNEC E 461 (referred in table 1.1), for reactive classes II and III
Slovakia	For CEM I $Na_2O + 0{,}658\ K_2O \leq 0{,}6\ \%$ For others it must be $\leq 0{,}8\ \%$	No	Yes
Slovenia	Evaluation of reactivity of aggregates is in process		
Sweden	Yes		
Switzerland	None, in preparation	None, in preparation	None, in preparation
United Kingdom	Yes for normal reactivity aggregates	Yes for normal and high reactivity aggregates	Yes for highly reactive aggregates

Table 5.4 — Performance method

CEN Member Countries	Summary of performance method
Austria	Verringerte Dehnung (Cement with Reduced strain) according ÖNORM B 3327-1
Belgium	Modified Oberholster : < 0,1 % after 20 days RILEM – AAR 2 : < 0,04 % after 6 months Danish method : < 0,1 % after 25 weeks
Czech Republic	Chemical and mortar test
Denmark	Methods for aggregate with micro porous flint: — TK 84 Chemical shrinkage (fine aggregate) or — TI-B 51 Mortar bar expansion (fine aggregate) or — TI-B 52 Content of reactive grains (fine aggregate) — TI-B 75 Critical absorption of 10 % flint (coarse aggregate) and — DS 405.4 Content of light weight aggregate (coarse aggregate) Method for coarse aggregate from the North Sea: — DafStb – Richtlinje Vorbeugende Maßnahmen gegen städigende Alkalireaktion im Beton Method for other aggregate: — ASTM C 1260 Potential alkali reactivity — Accelerated mortar bar expansion (fine and coarse aggregate)
Finland	None
France	NF P 18-454: (Performance test on concrete) and FD P 18-456 (Criteria to assess the reactivity of the concrete tested in accordance with NF P 18-454)
Germany	None
Ireland	Reference made to test methods described in IEI/ICS ASR Report. These may assist in making judgements but are not regarded as necessarily definitive
Italy	None
Luxembourg	None
Netherlands	None
Norway	Under development
Portugal	It is used, fundamentally, the ASTM C 1260-1 for evaluating the reactivity of mixtures of aggregates and RILEM AAR-3 and AAR-4 for evaluating the reactivity of the concrete composition
Slovakia	— to use the cement with the alkali content as mentioned in Table 5.3.1 — to substitute the initial aggregates with another one — to lower the saturation of the concrete or to prevent it from the humidity penetration
Slovenia	ASTM standards are used in practice
Sweden	None
Switzerland	None, in preparation
United Kingdom	Described in *Testing protocol for greywacke aggregates* (ISBN 0 7210 1543 3) Uses BS 812-123 test and expansion at 2 years to determine the alkali content to give 0,08 % expansion. The limit for concrete using this aggregate is then set at 1.50 kg/m^3 Na_2O_{eq} less than the determined alkali content

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Table 5.5 — Requirements for other forms of alkali aggregate reaction

CEN Member Countries	Type of reaction and where requirements are specified
Austria	ONR 3100
Belgium	None
Czech Republic	None
Denmark	None
Finland	None
France	None
Germany	None
Ireland	None
Italy	None
Luxembourg	None
Netherlands	None
Norway	None
Portugal	None
Slovakia	Yes, the method as well as the classification for alkali-carbon reaction is given in STN 72 1160
Slovenia	None
Sweden	None
Switzerland	None
United Kingdom	None

7 Use of additions

The way in which additions are used in Europe varies significantly and it was not possible to agree the k-value concept in EN 206-1 without permitting CEN Member Countries the option of varying the k-values for w/c ratio, the rules with respect to minimum cement content and permitting CEN Member Countries to use other concepts. In addition, it was not possible at that time to agree k-values for cement types other than CEM I. This Part of the survey established the ways in which additions are used in CEN Member Countries.

Table 6.1 shows the number of CEN Member countries that took up the option in EN 450:1995 of having a higher class for loss of ignition (LOI). At the time of the survey, EN 450:1995 was in the process of being replaced by EN 450-1 which has three LOI classes and so the survey tried to establish which classes would be permitted. In four CEN Member Countries the decision on whether to permit the use of class C had still to be decided.

Nine of the 17 CEN Member Countries that answered the questionnaire permit the LOI class ≤ 7 % according to EN 450:1995 or intend to allow the LOI category B (2,0 % to 7,0 %) according to hEN 450-1:2005. In three CEN Member Countries this is qualified with respect to freeze-thaw conditions. In some CEN Member Countries the permission to use categories B (2,0 % to 7,0 %) and C (4,0 % to 9,0 %) is still under discussion.

Table 6.3 shows that Germany, Netherlands and Switzerland (under preparation) have national provisions (national regulations) for the environmental compatibility of fly ash.

Table 6.4 shows a majority of CEN Member Countries apply the rules of EN 206-1 (k-value, minimum cement content) for CEM I cement with fly ash or silica fume. The k-values for fly ash in combination with CEM I vary

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between 0,2 and 0,6. Some CEN Member Countries (DE, CZ) set fixed values for minimum cement content when using fly ash as Type II addition. With the exception of Germany and Switzerland, CEN Member Countries apply a k-value of 2,0 for silica fume in some or all exposure classes.

Table 6.5 shows the k-value concept for fly ash has been generally applied to cement types other than CEM I using k-values in the range of 0,2 and 0,5. Some CEN Member Countries relate the k-value to the strength class of the cement.

Table 6.6 shows six CEN Member Countries use the k-value concept with silica fume and cement types other than CEM I. The application of the concept is, in the majority of the cases, restricted to CEM II (both A and B) cements.

Table 6.7 shows six CEN Member Countries apply the k-value concept for ground granulated blastfurnace slag (ggbs). The k-values vary between 0,6 and 1,0.

NOTE CEN/TC 104/SC1 has already identified for the 2010 revision of EN 206-1 that rules for the use of ggbs need to be included.

In EN 206-1, the k-value for silica fume depends upon the exposure class and maximum w/c ratio. Table 6.8 establishes national practice where EN 206-1 requires for a w/c ration $\geq 0{,}50$ a k-value of 1,0 for the XC exposure and 2,0 for the XD and XS exposures. Denmark, Norway and Sweden showed that the condition does not apply as they always have a maximum w/c ratio requirement not greater than 0,45 for the XD and XS exposures. The other answers indicate that EN 206-1 should be amended to make its intention clear.

Generally Table 6.9 shows that no other concepts for the use of additions are applied in the CEN Member Countries. The United Kingdom, Portugal and Ireland have a system for combinations of CEM I or CEM II with either ggbs, fly ash or limestone that uses early and 28 day strength requirements. Finland applies durability design rules for freeze-thaw resistance and carbonation.

Some CEN Member Countries (CH and DE) apply the combined k-value concept when fly ash and silica fume are mixed as Type II additions.

EN 206-1 does not define precisely how equivalent performance should be determined, although some general guidance is provided in EN 206-1, annex E.

Table 6.10 shows the extent to which the method is used and the way in which it is applied. Concepts are under preparation in a few CEN Member Countries (i.e. Netherlands, Portugal, Norway and Switzerland) or adopted (Finland). For certain durability criteria, i.e. freeze thaw resistance, chloride migration coefficients or carbonation guidelines are being developed.

NOTE Before the EN 206-1, 2010 revision is completed, CEN is expected to have published a relative carbonation test and tests for the migration of chlorides.

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Table 6.1 — EN 450:1995 – Permitted LOI categories

CEN Member Countries	≤ 5 %	≤ 7 %
Austria	Yes	No
Belgium	Yes	Yes, but then total fly ash content < 25 % cement content (in XF classes)
Czech Republic	Yes	No
Denmark	Yes	No
Finland	Yes	Yes, but not in XF
France	Yes	Yes, but not in XF4
Germany	Yes	No
Ireland	Yes	Effectively yes as Part 1 ash in BS 3892 is permitted
Italy	Yes	Yes
Luxembourg	Yes	Yes
Netherlands	Yes	No
Norway	Yes	---
Portugal	Yes	Yes
Slovakia	Yes	Yes
Slovenia	Yes	Yes
Sweden	Yes	No
Switzerland	Yes	No
United Kingdom	Yes	Yes

Table 6.2 — hEN 450-1:2005 – LOI classes that will be permitted

CEN Member Countries	Category A (≤ 5 %)	Category B (2,0 % to 7,0 %)	Category C (4,0 % to 9,0%)
Austria	Yes	No	No
Belgium	Yes	Yes (but in XF classes fly ash content < 25 % cement content)	No
Czech Republic	Yes	Yes	Yes
Denmark	Yes	No	No
Finland	Yes	Not in XF	No
France	Yes	Yes, but not in XF4	Will be discussed
Germany	Yes	No	No
Ireland	Yes	Yes? – but to be formally discussed/decided	To be formally discussed/decided
Italy	Yes	Yes	To be discussed
Luxembourg	Yes	To be discussed	To be discussed
Netherlands	Yes	No	No
Norway	Yes	---	---
Portugal	Yes	Yes	Yes
Slovakia	Yes	Yes – should be discussed. It is used at the black coal combustion	No, but can be discussed
Slovenia	Yes	Yes	Yes
Sweden	Yes	?	?
Switzerland	Yes	No	No
United Kingdom	Yes	Yes	No

Table 6.3 — National provisions (i.e. regulations) for the environmental compatibility of co combustion fly ashes

CEN Member Countries	National provisions
Austria	None
Belgium	None
Czech Republic	None
Denmark	None
Finland	None
France	None. Found not necessary because of the limited co-combustion percentage permitted in EN 450-1
Germany	The environmental compatibility is verified for the co-combustion of communal sewage sludge with some requirements specified on the communal sewage sludge. For all other co-combustion fly ashes according to EN 450-1 the environmental compatibility has to be verified by a national or European technical approval that includes e.g. determination of trace elements, and, where necessary, leaching tests on concrete specimens
Ireland	None
Italy	No
Luxembourg	No
Netherlands	Bouwstoffenbesluit (Building Materials Decree)
Norway	---
Portugal	No
Slovakia	We have no experience with this so far. The notice 559/2005 that is in accordance with the EU notice is valid for us
Slovenia	No
Sweden	No
Switzerland	In preparation. Will be given in the National Annex to SN EN 450-1
United Kingdom	None. Research at the University of Dundee has shown that these fly ashes are as safe as traditional fly ashes

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Table 6.4 — Rules for the *k*-value concept used with CEM I cement

CEN Member Countries	Fly-ash to EN 450		Silica fume to prEN 13263	
	***k*-value**	**Rule for minimum cement content (MCC)**	***k*-value**	**Rule for MCC**
Austria	EN 206-1	Yes	EN 206-1	Yes
Belgium	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Czech Republic	0,2	CSN EN 206-1 Zmena Z2: Content of (cement + k*fly ash) mustn't be less than values in table F.1 CSN EN 206-1	EN 206-1	EN 206-1
Denmark	0,5	No reduction in MCC	2,0	No reduction in MCC
Finland	EN 206-1	EN 206-1	2,0	EN 206-1
France	0,4 to 0,6	See NOTE	1,0 or 2,0	See NOTE
Germany	0,4 (except XF2 and XF4: k = 0); 0,7 for underwater concrete and concrete for bored piles according to DIN EN 1536 (NOTE Maximum fly ash content, that may be taken into account ≤ 33 mass-% of cement content)	cf. Table 4.2 (Germany), Min. CC when using type II additions	1,0 (except XF2 and XF4: k = 0) (NOTE Maximum silica fume content ≤ 11 mass-%)	cf. Table 4.2 (Germany), Min. CC when using type II additions
Ireland	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Italy	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Luxembourg	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Netherlands	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Norway	0,2/0,4	Reduction in CC by subtraction of k*m (CC + k*m) > MCC	1,0/2,0	Reduction in CC by subtraction of k*m (CC + k*m) > MCC
Portugal	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Slovakia	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Slovenia	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Sweden	EN 206-1	EN 206-1	EN 206-1	EN 206-1
Switzerland	EN 206-1		k = 1,0	
United Kingdom	EN 206-1	EN 206-1	EN 206-1	EN 206-1

NOTE Accompanying the French response to Table 6.4: Additions authorized in France and particular capacities for the *k*-value concept.

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Additional information provided by AFNOR

The following are extracts from the French National Annex to EN 206-1.

NA 5.1.6 Additions

Besides additions quoted in 5.1.6, general capacity in the use for concretes in France as addition of type II is also established for the following normalized additions:

— Silica fumes, corresponding to NF P 18-502 standard (NA 7);

— Ground granulated blastfurnace slag (class B), corresponding to NF P 18-506 standard.

Besides additions quoted in 5.1.6, general capacity in the use for concretes in France as addition of type I is also established for the following normalized additions:

— Limestone additions, corresponding to NF P 18-508 standard;

— Siliceous additions corresponding to NF P 18-509 standard.

NA 5.2.5.2.1 Generally

The concept of coefficient k and of equivalent cement authorizes the consideration of type II additions and of certain type I additions:

— by replacing the term “water/cement ratio” by that of “water/(cement + $k \times$ addition) ratio”, the water being by definition the effective water (see EN 206 and NA 3.1.30);

— by replacing requirement of minimum cement content by the same requirement applied to the equivalent cement content.

Equivalent cement content is constituted with cement of type CEM I 42,5 N or CEM I 42,5 R or CEM I 52,5 N or CEM I 52,5 R and one of normalized additions mentioned below with the exception of the other cements or the other additions.

To take into account respective contributions of constituents toward durability, the quantity of equivalent cement is defined with the formula:

equivalent cement = $C + kA$

Where

C is the quantity of cement by cubic metre of concrete (in kg/m^3);

A is the quantity of addition by cubic metre of concrete considered in the equivalent cement content (in kg/m^3) and maximum value of which is defined by $A/(A + C)$ ratio clarified in the NA F.1 table for the various exposure classes. If a bigger quantity of addition is used, excess must not be taken into account either for the calculation of the water/(cement + $k \times$ addition) ratio, or for the minimum equivalent cement content;

k is the coefficient applied to the considered addition (see NA 5.2.5.2.2)

General capacity in the use for concretes in France is established for the following normalized additions for the partial replacement of the cement and for the determination of the minimum equivalent cement content:

— fly ashes for concrete corresponding to the NF EN 450 standard, then to NF EN 450-1 standard;

— silica fumes, corresponding to the NF P 18-502 standard, then to NF IN 13263-1 standard;

— ground granulated blastfurnace slag (class B), corresponding to NF P 18-506 standard;

— limestone additions, corresponding to NF P 18-508 standard;

— siliceous additions category A corresponding to NF P 18-509 standard.

NA 5.2.5.2.2 Concept of *k*-value to take additions into account

General capacity in the use for concretes of which the place of use is France, is established for the following values of the coefficient k given in NA.3 table

NA.3 Table — Values for the coefficient k

Name of the addition	k-value	Supplementary conditions to be filled
Fly ashes	0,60 0,50 0,40	If $i_{28} \geq 0{,}83$ and $i_{90} \geq 0{,}95$
Silica fumes	2,00 1,00	If, for XA exposure classes, $W/C \leq 0{,}45$ and $C \geq 280$ kg/m^3 In the other cases or on particular prescription
Ground granulated blastfurnace slag (class B)	0,90	$h_{3/7} \geq 0{,}70$ $h_{3/28} \geq 0{,}85$
Type I Additions		
Limestone additions	0,25	$i_{28} \geq 0{,}71$
Siliceous additions (class A)	0,25	$i_{28} \geq 0{,}71$
All additions		
For the quantities of additions exceeding values indicated in table NA.F.1 or in table NA.F.2 and for the other cements or the other additions that those mentioned in NA.5.2.5.2.1.	0,00	
NOTE i_{28}, i_{90}, $h_{3/7}$ and $h_{3/28}$ are determined according to the standards of the considered addition.		

Maximum values for A/(A + C) ratio (Extracts from NA.F.1 and NA.F.2 tables)

	X0, XC1, XC2 XC3, XC4, XF1 XF2, XF3, XD1	XS1, XS2, XS3, XD2, XD3	XF4	XA1, XA2	XA3
Fly ashes	0,30	0,15	0,15	0,30	0,00
Silica fumes	0,10	0,10	0,10	0,10	0,10
Ground granulated blastfurnace slag	0,30	0,15	0,15	0,30	0,00
Limestone additions	0,25	0,05	0,05	0,00	0,00
Siliceous additions	0,20	0,15	0,05	0,00	0,00

Table 6.5 — Use of *k*-value concept with fly ash conforming to EN 450 and cement types other than CEM I

CEN Member Countries	Cement type	*k*-value	Rule for MCC
Austria	CEM II/A CEM II/B	0,4 0,4	
Belgium	CEM III/A CEM II, CEM III B and C and CEM V	0,2 0	Fly ash/cement ≤ 0,25 Fly ash use forbidden except in class X0
Czech Republic	CEM II/A-S, CEM II/B-S, CEM III A	0,2	CSN EN 206-1: Zmena Z2: Content of (cement + *k**fly ash) mustn't be less than values in table F.1 CSN EN 206-1
Denmark	CEM II/A — L or LL	0,5	No reduction in MCC
Finland	All allowed cement types	0,4	EN 206-1, additions included in the cement are taken into account as type II addition in the concrete
Germany	CEM II/A-S or CEM II/B-S; CEM II/A-T or CEM II/B-T; CEM II/A-LL; CEM II/A-P; CEM II/A-V; CEM II/A-M with main constituents S, D, P, V, T, LL acc. to Table F.3.2 (cf. Annex to Table 4.2 (Germany)); CEM II/B-M (S-D, S-T, D-T) acc. to Table F.3.2 (cf. Annex to Table 4.2 Germany); CEM III/A; CEM III/B with ≤ 70 mass-% ggbs	0,4 0,7 for underwater concrete and concrete for bored piles according to DIN EN 1536 (NOTE Depending on the type of cement the maximum fly ash content, that may be taken into account shall be not greater than 15 (with main const. D), 25 (with main const. P, V) or 33 (all others) mass-%)	cf. Table 4.2 (Germany), Min. CC when using type II additions
Italy	CEM I (32.5 N,R) CEM I (42.5 N,R) CEM IIA, (32.5, 42.5 [N,R]) CEM IIIA, (32.5, 42.5 [N,R]) CEM IVA, (32.5, 42.5 [N,R]) CEM VA, (32.5, 42.5 [N,R])	0,2 0,4 0,2 0,2 0,2 0,2	As per EN 206-1
Luxembourg	CEM II/A-S;/B-S 32.5 CEM II/A-S;/B-S 42.5;52.5 CEM II/A-LL 32,5;42,5N CEM II/A-LL 42,5R;52,5 CEM III/A 32,5;42,5N CEM III/A 42,5R;52,5 Other cements	0,2 0,4 0,2 0,4 0,2 0,4 0,0	As in EN 206-1
Netherlands	CEM IIIA CEM IIIB Blended cements	0,2 0,2 by ratio	
Slovakia	CEM II /A-S, CEM II /B-S, CEM III A	0,2	As in EN 206-1
Sweden	CEM II	0,2 or 0,4	As in EN 206-1, provided the added amount of fly ash per cement clinker is max 0,33. (The lowest permitted clinker content of the cement type shall be anticipated)

Table 6.6 — Use of *k*-value concept with silica fume conforming to prEN 13263 and cement types other than CEM I

CEN Member Countries	Cement type	*k*-value	Rule for MCC
Austria	CEM II/A CEM II/B	EN 206-1	
Denmark	CEM II/A-L or LL CEM II-V	2,0	No reduction in MCC
Finland	All allowed cement types	2,0 (w/c ≤ 0,45) 1,0 (w/c > 0,45)	EN 206-1, Additions included in the cement are taken into account as type II addition in the concrete
Germany	CEM II/A-S or CEM II/B-S CEM II/A-T or CEM II/B-T CEM II/A-LL; CEM II/A-P or CEM II/B-P CEM II/A-V CEM II/A-M with main constituents S, P, V, T, LL acc. to Table F.3.2 (cf. Annex to Table 4.2 (Germany)) CEM II/B-M (S-T, S-V) acc. to Table F.3.2 (cf. Annex to Table 4.2) CEM III/A CEM III/B	1,0 (NOTE Maximum silica fume content ≤ 11 mass-%)	cf. Table 4.2 (Germany), Min. CC when using type II additions
Norway	II/A-L, II/A-S, II/B-S, II/A-D, II/A-V, II/B-V, III/A dependant on exposure class	1,0 and 2,0	Reduction in CC by subtraction of *k**m (CC + *k* *m) > MCC
Sweden	CEM II	1,0 or 2,0	As in EN 206-1, provided the added amount of silica fume per cement clinker is max 0,11. (The lowest permitted clinker content of the cement type shall be anticipated)

Table 6.7 — Use of *k*-value concept with additions other than fly ash and silica fume

CEN Member Countries	Cement type	*k*-value	Rule for MCC
Austria (**GGBS**) Additons according ÖNORM B 3309 (fly ash, GGBS, combi products)	CEM I CEM II	0,8 0,8	Yes
Belgium (**GGBS**)	CEM I	0,9	GGBS/cement ≤ 0,45 GGBS/cement ≤ 0,20 for classes XF, XC3 and XC 4
Finland	All allowed cement types	0,8 1,0 in XA classes	EN 206-1, Additions included in the cement are taken into account as type II addition in the concrete
France	CEM I	GGBS: 0,9 Siliceous additions: 0,25 Calcareous additions: 0,25	See NOTE of the response to Table 6.2.1
Germany	CEM I CEM II/A-LL Same rules as for fly ash according to EN 450 (cf. tables 6.2.1 and 6.2.2)	tempered phonolite filler according to a NTA approval (k = 0,6) Fly ash from lignite (CaO-content slightly above 10 mass-%, reactive SiO_2 about 20 mass %) according to a NTA: same rules as for fly ash according to EN 450 (cf. tables 6.2.1 and 6.2.2)	270 Same rules as for fly ash according to EN 450 (cf. tables 6.2.1 and 6.2.2)
Norway For slag	II/A-L, II/A-S, II/B-S, II/A-D, II/A-V, II/B-V, III/A dependant on exposure class	Basic values K = 0,6	Reduction in CC by subtraction of k*m (CC + k*m) > MCC
Sweden	CEM I, CEM II	0,6	Ground granulated slag according to requirements in SS 13 70 03 Concrete – Application of EN 206-1 in Sweden. The amount of slag per cement shall be max 1,0. Addition to CEM II permitted provided the amount of slag per cement clinker is max 1,0. (The lowest permitted clinker content of the cement type shall be anticipated)

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Table 6.8 — k-value for silica fume used in combined XD or XS exposures with the associated XC exposure when the w/c ratio > 0,45

CEN Member Countries	XD and XC	XS and XC
Austria	EN 206-1	Not relevant
Belgium	No guidance is provided on what to do.	
Czech Republic	No guidance is provided on what to do.	
Denmark	XD requires w/c ≤ 0,45	XS requires w/c ≤ 0,45
Finland	1,0	1,0
France	1,0	1,0
Germany	1,0	1,0
Ireland	No guidance given	No guidance given
Italy	No guidance given	No guidance given
Luxembourg	1,0	1,0
Netherlands	No guidance is provided	No guidance is provided
Norway	XD always ≤ 0,45	XD always ≤ 0,45
Portugal	-	-
Slovakia	No guidance is provided on what to do	
Slovenia	No guidance is provided on what to do	
Sweden	XD requires w/c ≤ 0,45	XS requires w/c ≤ 0,45
Switzerland	1,0	
United Kingdom	No guidance is provided on what to do	

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Table 6.9 — Use of other concepts

CEN Member Countries	Concept *Include name of concept, where rules are specified, summary of concept*
Austria	No
Belgium	No
Czech Republic	No
Denmark	Sewage sludge ash may be used for X0 and XC1, which are without w/c ratio requirements, therefore the k-value concept is not applicable
Finland	Yes, durability design rules for freeze-thaw resistance and carbonation by50 Betoninormit 2004, Suomen Betoniyhdistys by50 Concrete Code, Finnish Concrete Association
France	No
Germany	No
Ireland	No specific guidance included. However, in practice, use of additions 'at the concrete mixer' is regarded in a similar way to that of the UK
Italy	No
Luxembourg	No
Netherlands	No
Norway	We use the k-concept also for slag
Portugal	Portugal since 1993 has a position similar to UK, although not testing particular mixtures of cements with additions because a minimum concrete compressive strength is required. Portugal also allows the use of cement CEM II/A 42,5 (or of higher strength class). The binder must always have the composition of the equivalent cement
Slovakia	No
Slovenia	No
Sweden	No
Switzerland	When fly ash and silica fume are combined, the following applies: — fly ash ≤ (0,66 × cement – 3 × silica fume) in mass percent — silica fume /cement ≤ 0,11 in mass percent
United Kingdom	There is a verification system for combinations of CEM I with either ggbs, pfa or limestone that uses early and 28 day strength requirements. These combinations are then effectively treated in the same way as its equivalent factory-made cement, i.e. same maximum w/c ratio and same minimum cement (combination) content apply. The requirements are given in BS 8500-2: Concrete — Complementary British Standard to BS EN 206-1, Part 2: Specification for constituent materials and concrete and require testing to determine the range of composition after taking into account variability that satisfy early and 28-day strength criteria to give strength classes 32.5, 42.5 and 52.5 as appropriate. The requirements for this are set out in Annex A of BS 8500-2 and an example of a suitable system is given in Annex D.

Table 6.10 — Equivalent performance concept

CEN Member Countries	Use of concept	Method used for the determination of equivalent performance
Austria	No	No
Belgium	No	
Czech Republic	No	No
Denmark	No	No
Finland	Yes	Not in line with Annex E but durability design for carbonation and frost resistance by Betoninormit 2004, Suomen Betoniyhdistys by Concrete Code, Finnish Concrete Association
France	Not yet	No, but under consideration
Germany	Yes	Concrete not meeting the requirements of DIN 206-1 and DIN 1045-2 are subject to a National or European Technical Approval (e. g. for mass or high performance concrete with lower minimum cement content as specified in DIN 1045-2/A1:2005-01, tables F.2.1 and F.2.2 or DAfStb-Guideline for massive structures) Depending on the use of the concrete the scope in the NTA/ETA is restricted to specific applications (e. g. mass concrete for foundation members) For the specific concrete a test programme is developed within the procedure of technical approval, consisting mainly of fresh and hardened concrete tests (e. g. consistency, strength development, freeze-thaw resistance, depth of carbonation etc.). The composition of the concrete (water/cement ratio, cement content, constituent materials) is fixed strictly with only small deviations allowed
Ireland	No	-
Italy	No	No
Luxembourg	No	None
Netherlands	Not yet	
Norway	Not yet	
Portugal	Not yet (it is a recent disposition, see below[a] its main lines)	
Slovakia	Not yet	
Slovenia	No	
Sweden	No	
Switzerland	Yes	(Compressive strength), Durability criteria, i.e. freeze-thaw resistance, chloride migration coefficient (chloride resistance), water absorption coefficient. The guidelines are in preparation (Table 1, Ref. [3])
United Kingdom	No	Comment: As any advantage of going the performance route has been removed by not permitting the maximum w/c ratio or minimum cement content to be changed, the system is not being used in practice

[a] 1. The properties accelerated carbonation and oxygen permeability (XC classes) chloride diffusion coefficient and capillary absorption (XS and XD classes) and compressive strength (all classes) are determined on:

— A composition (reference composition, RC) conforming to the prescriptive requirements (maximum w/c, minimum C and strength class) for 50 years service life and for the exposure class in question, stated in the Tables of LNEC E464 that substitute Table F of EN 206-1 and with the reference cement stated in these Tables;

— The composition (SC) which performance is intended to study;

2. The results obtained with the RC are compared with those of the SC and conclusions on the equivalence of the performance as regards carbon dioxide or chloride penetrations into concrete are extracted.

3. Conclusions can also be extracted on the equivalence of the dosage of the specific binder and of the w/c ratio used in the SC, relatively to the correspondent pair of values used in the RC.

In this case, and if the results allow to conclude that the SC is equivalent to the RC, the concrete producer is authorized to use the new minimum value of C and the new maximum value of W/C as new limits for the composition satisfying the requirements for that exposure class, unless the constituents of the binder change with regard to not only their origins but also their relevant characteristics.

8 Intermediate compressive strength classes

In EN 206-1, 4.3.1 NOTE, there is a permission to use intermediate compressive strength classes. The survey sought information on CEN Member Countries that needed the use of intermediate strength classes (see Table 7.1) and the reasons why these classes were needed (see Table 7.2).

It should be noted that CEN Member Countries have been using EN 206-1 with national structural design codes. When the European structural design codes become more established, the need for these intermediate classes may change.

Table 7.1 — Use of intermediate compressive strength classes

CEN Member Countries	Do you have intermediate compressive strength classes?
Austria	No
Belgium	No
Czech Republic	No
Denmark	No
Finland	Yes
France	No
Germany	No
Ireland	Yes
Italy	Yes
Luxembourg	No
Netherlands	Yes
Norway	No, and we do not use a number of them. We use the cylinder strength only to reference strength classes and a B instead of C for that reason i.e. B35 is a C35/45
Portugal	No
Slovakia	Not yet, but we would like to have them in future
Slovenia	No
Sweden	Yes
Switzerland	No
United Kingdom	Yes

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Table 7.2 — Reasons why intermediate compressive strength classes are needed

Compressive strength class	Used by CEN Member Countries	Reason why class is needed
C 6/8	UK	Used in designated concrete GENO
C 28/35	NL	Maintains former strength classes B35 (steps of 5 N/mm^2 cube)
	UK	Needed to give one step in strength with one step in w/c ratio Maintains former strength class C35 (steps of 5 N/mm^2 cube)
	FI	Maintains former strength class K35 (steps of 5 N/mm^2 cube)
	IE	Maintains use of a common structural concrete specified and maintains natural step in W/C ratios
	SE	Classes adapted to Swedish dimensioning practise. Figures after /-sign in increments of 5 MPa.
	I	To maintain former cube strength class 35 (In use)
C 32/40	UK	Needed to give one step in strength with one step in w/c ratio Maintains former strength class C40 (steps of 5 N/mm^2 cube)
	FI	Maintains former strength class K40 (steps of 5 N/mm^2 cube)
	IE	Maintains use of a common concretes specified, particularly concrete specified for specific agricultural use.
	I	To maintain former strength class 40 (In use)
C53/65	NL	Maintains former strength classes B 65 (steps of 5 N/mm^2 cube)
C57/70 C65/80 C75/90 C85/100	FI	Maintains former strength classes K70, K80, K90, K100 (steps of 5 N/mm^2 cube)
C32/40	SK	It has been used in the road constructions for a long time

9 Conformity and certification

A significant number of CEN Member Countries have regulatory requirements for accredited third party certification. In these cases, with the exception of Sweden, the regulations apply to ready mixed concrete and site mixed concrete in the same way. In Sweden a certification of site mixed concrete is only obligatory if a subcontractor produces the concrete. In most cases EN 206-1, annex C is applied.

Views differ on whether CEN Member Countries should be permitted to use alternative conformity rules, but EN 206-1:2000, 8.1 does permit the specifier to require higher minimum testing rates and extending this to a CEN Member is not seen as a deviation from the rules.

NOTE EN 206-1, clause 8 does not follow the CEN *Product standards and conformity assessment guideline,* approved by Resolution BT68/2000.

The data in Table 8.3 show no clear pattern. Some CEN Member Countries do not require identity testing when the concrete is covered by third party certification (Netherlands) and others only require it for critical elements (Norway) or for large public structures (France), but Germany requires both certification and identity testing for C30/37 concrete and above or for special exposure classes.

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A significant number of CEN members use the concept of concrete families. In most cases the scope of concrete families is limited to that given in EN 206-1, Annex K. In France the scope is widened, in Germany it is more restricted than given in EN 206-1, Annex K. United Kingdom has no limitation other than to verify that the relationships are valid.

No information is given about the national systems for accreditation of certification bodies.

Table 8.1 — Conformity and certification

CEN Member Countries	Alternative conformity rules	Identity testing required by local regulations	Regulatory requirement for accredited third party certification of product control	Where accredited third party certification is required by regulations, do the regulations apply to:	
				Ready-mixed concrete?	Site-mixed concrete?
Austria	Extended	Extended	Extended	Yes	Yes
Belgium	Yes	No	No	No	No
Czech Republic	No	No	Yes	Yes	Yes
Denmark	Yes	No	Yes but not for concrete with reduced control	Yes	Yes
Finland	No	No	Yes	Yes	Yes
France	No	No*	No*	No*	No
Germany	Yes	Yes	Yes	Yes	Yes
Ireland	No	No	Not at present	-	-
Italy	No	No	No	No	No
Luxembourg	No	Yes	Yes	Yes	Yes
Netherlands	Yes	No	No	—	—
Norway		Yes, in Execution Class: Extended control	Yes	Yes	Yes
Portugal	No	Yes**	Yes**		
Slovakia	Yes	Not always, only if it is required by the control site plan	Yes	Yes	No
Slovenia	No	No	There is no formal requirement for the accreditation of 3rd party, however, it is applied in practice	Yes	Yes
Sweden	No	No	Yes	Yes	Yes, if the concrete is produced by a subcontractor. No if the concrete is produced by the user
Switzerland	No	No	No	No	No
United Kingdom	No	No	No	—	—

* Regulation de facto by application of Fascicule 65A (for public works) or of NF P 18-201 (for private works)

** The Portuguese Standards NP EN 206-1 and NP ENV 13670-1 will be mandatory in 2007 (substituting NP ENV 206 still a regulatory document on concrete in Portugal). These identity testing and certification are proposed to be mandatory for inspection classes 2 and 3 of the NP ENV 13670-1.

Table 8.2 — Alternative conformity rules used by CEN Member Countries

CEN Member Countries	Standard and brief description of the rules
Belgium	According to the Belgian Committee for Certification of Concrete the sampling frequency as described in Table 13 of EN 206-1 for the conformity control is so low that is takes too long to get sufficient insight in the question whether concrete meets the requirements of EN 206-1 or not and for the statistical representativity. Therefore the frequency of EN 206-1 is kept for classes up to C30/37 but increased for classes above 1/100 m^3 for classes between C 35/45 and C50/60 and 1/75 m^3 for classes over C 50/60)
Denmark	DS 2426 (see Table 1 for details) For compressive strength we have alternative conformity rules based on mean value and coefficient of variation
Germany	DIN 1045-2: Tragwerke aus Beton, Stahlbeton und Spannbeton — Teil 2: Beton: Festlegung, Eigenschaften, Herstellung und Konformität — Anwendungsregeln zu DIN EN 206-1 (DIN 1045-2: Concrete, reinforced and prestressed concrete structures — Part 2: Concrete — Specification, properties, production and conformity — Application rules for DIN EN 206-1) There are different sampling rates for high strength concrete and light weight concrete Sampling rates are doubled. Special conformity criteria for high strength concrete. A minimum value for the standard deviation is assumed as: — 3 N/mm^2 for normal concrete — 5 N/mm^2 for high strength concrete Any individual test result (criterion 2) for high strength concrete shall be $\geq f_{ck} - 5$ for initial production and $\geq 0{,}9\, f_{ck}$ for continuous production. The mean value of 3 test results for initial production shall be $\geq f_{ck} + 5$ Table 15 Confirmation criterion for family members (Criterion 3) is supplemented for 6 to 14 test results and more than 15 test results: 6 to 14: Mean value $\geq f_{ck} + 3{,}0$ ≥ 15: Mean value $\geq f_{ck} + 1{,}48\, \sigma$ If conformity of concrete compressive strength is assessed for overlapping consecutive test results this has to be decided before starting the production. Notice has to be given to the third party certification body Additional notes for the actions in the case of non-conformity of the product: Rebound hammer and testing of cores
Netherlands	According to the Dutch Committee for Standardisation the sampling frequency as described in table 13 of EN 206-1 for the conformity control is so low that is takes to long to get sufficient insight in the question whether concrete meets the requirements of EN 206-1 or not. Therefore it is recommended to maintain different frequencies for the following criteria: — consistency — density (mortar) — air content — water/cement ratio, water/binder ratio — chlorides — density (concrete) — compressive strength — tensile splitting strength

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Table 8.2 (*continued*)

CEN Member Countries	Standard and brief description of the rules
Slovakia	STN EN 206 – 1/Z1: Clause 8.2.1.1 is supplemented with the sentence: The relationships shall be reviewed on the basis of the original compressive strength test data at every assessment period, at least once a month, if the concrete is produced. (In Slovakia these families of the concrete are not used). There are almost exceptionally used criteria for the initial production in the Slovak Rep. as shown in the paragraph 8 of the Clause 8.2.1.1. To obtain at least 35 results is rather difficult. The production is usually interrupted during the winter period - from December to March. Clause 8.2.1.2 is supplemented by the sentence: In the case of the light-weight concrete the samples must be taken at the place where the concrete is being used. Table 13 is supplemented as follows: For the concretes with the strength class ≥ C55/67 and all the light-weight strength concrete classes is for the initial production valid 1/100 m^3 or 1/production week. For the continuous production of the same concretes is valid 1/200 m^3 or 1/production week. The question is what should be understood under the term *production week* (is it 7 days of a week or 7 days of production). Table 13, note a) is supplemented as follows: At the assessment of conformity of the family concretes it is necessary to take the samples equally from every individual composition represented by the ratio of the produced amount to the total amount. This procedure is necessary for the control of the relationship between each individual concrete composition of the family and the reference concrete. Table 13, note a) is further supplemented as follows: If, at the initial production, the amount does not exceed 25 m^3/production week, then it is sufficient to produce one sample only. Clause 8.2.1.3 will be completed as follows: It will be decided upon the overlapping or non-overlapping consecutive test results in the beginning. This must be announced to the third party. (In Slovakia there are mostly used the non-overlapping consecutive test results). A note is added to the Table 15: When there are more than 6 test results, these are divided into the groups of 6 non-overlapping consecutive test results. Table 17 is supplemented with the note: For other characteristics (e.g. saturation, freeze/thaw resistance, resistance to water penetration) the minimum rate of sampling will be agreed on between a specifier and a producer.

Table 8.3 — CEN Member Countries with regulatory requirements for identity testing

CEN Member Countries	Give brief description of requirements and where they are specified
Austria	EN 206-1, Annex B: extended. See attached file
France	Regulation de facto Public works Marchés publics de travaux — Cahier des clauses techniques générales — Fascicule N°65A: Exécution des ouvrages en béton armé ou en béton précontraint par post-tension, Ministère de l'Equipement, août 2000 Private works NR P 18-201: Travaux de bâtiments — Exécution des ouvrages en béton — Cahier des clauses techniques
Germany	DIN 1045-3, Tragwerke aus Beton, Stahlbeton und Spannbeton — Teil 3: Bauausführung (DIN 1045-3, Concrete, reinforced and prestressed concrete structures — Part 3: Execution of structures) The execution standard defines so called inspection classes. With inspection class 2 (for example compressive strength ≥ C30/37) identity testing is obligatory. Table B.1 of EN 206-1 is supplemented for 7 to 34 test results and ≥ 35 test results. A minimum standard deviation of — 3 N/mm^2 for normal concrete and — 5 N/mm^2 for high strength concrete is assumed for more than 35 test results Any individual test result (Criterion 2) for high strength concrete shall be ≥ 0,9 f_{ck}
Luxembourg	DNA EN 206 Annexe M: Contrôle et analyse sur chantier du béton frais et durci (DNA EN 206 Annex M: Control and analysis of fresh and hardened concrete on site) Definition of supervision classes, internal and external control, frequency of testing, profile of the staff
Norway	NS 3465: Execution of concrete structures, once per 200 m^3 or day for works in execution class 'Extended Control'.
Slovakia	It is usually the control-testing plan for each site, but it is not included in the law
Table 8.3 does not give the true extent to which identity testing is still being used, as it is a regulation de facto in a number of CEN Member Countries for government work.	

Table 8.4 — CEN Member Countries with regulatory requirements for accredited third party certification of production control

CEN Member Countries	Who imposed this requirement e.g. government, state, local authorities, and where is it specified? (Title in national language and English) Does it apply to both ready-mixed and site-made concrete?
Austria	Government (OIB)
Czech Republic	According to law 22/1997 Sb. and government decree 163/2005
Denmark	It is required by the government by a reference in the Building Regulation to DS 2426, where the requirement is stated For both ready-mixed and site-mixed concrete certification is required except for concrete for structures with reduced control and strength class ≤ C25/30
Finland	Required by the government by a reference in the Building Regulation to: Suomen rakentamismääräyskokoelma, B4 Betonirakenteet, National Building Code of Finland, B4 Concrete structures Applies to all concrete (ready-mixed, site-made, precast) fot loadbearing structures in Structural Classes 1 and 2 (strength class higher than C16/20).
Germany	Clause 10.2 of EN 206-1 is obligatory in DIN 1045-2 to both ready-mixed and site-made concrete. It is required by the 'official' implementation of EN 206-1. It is required by the building authorities. In addition to the assessment, surveillance and certification of production control the concrete is certified in DIN 1045-2.
Luxembourg	Required by the local authorities for all concrete structures specified according DNA EN 206 Stated in CDC-BET Cahier des charges concernant les travaux de bétonnage (CDC-BET Specifications for placing concrete)
Norway	Norwegian building authorities
Slovakia	It is required by the government and stated in the law 90/1990. It is valid only for ready-mixed concrete. For site-made concrete it is valid only in the case if it is bought by somebody else than the producer
Slovenia	See 8.1.1
Sweden	The National Board of Housing, Building and Planning and the National Road Authorities. Se 8.1.1 above

Table 8.5 — Location of the requirements for accredited third party certification even when they are voluntary

CEN Member Countries	
Austria	We use EN 206-1, annex C with small amendments in ÖNORM B 4710-1
Belgium	General requirement for all voluntary certification bodies in Belgium (Internal rules of IBN/BIN)
Czech Republic	We use EN 206-1
Denmark	We use EN 206-1, annex C with small amendments in DS 2426
Finland	Suomen rakentamismääräyskokoelma, B4 Betonirakenteet, National Building Code of Finland, B4 Concrete structures, clause 1.1
France	NF Béton prêt à l'emploi (ready mixed concrete) certification mark reference rules
Germany	EN 206-1, Annex C is used. Amendments for testing of plausibility of production control data is specified by DIN 1045-2, Annex C. Annex C applies to mobile plants too. Additional requirements for the certification body: The certification body shall apply a documented system to assess the cases of non-conformity established during the course of routine and extraordinary inspections. This system shall take into account the gravity of deviations, their accumulation and their distribution as a function of time.
Ireland	NSAI Certification body operate a product certification scheme based largely on Annex C, EN 206-1. See their website for further details (NSAI.ie)
Italy	No national scheme
Luxembourg	EN 206-1, Annex C
Netherlands	Beoordelingrichtlijn BRL 1801 — Concrete (Assessment Guideline 1801 — Concrete) (see NOTE 1) NOTE 1 A 'BRL' is not a NEN standard
Norway	Required by the authorities, performed in accordance with NS-EN 206
Portugal	None
Slovakia	We use EN 206-1, Annex C with small amendments. Concrete in Slovakia belongs to the System 2+. The initial test and the control done by the third party is required every 12 months
Slovenia	Governmental regulation endorsing SIST EN 206-1
Sweden	EN 206-1 annex C with accredited certification bodies amendments
Switzerland	According to the National Preface of SN EN 206-1:2000 conformity evaluation and certification of production control by a accredited third party is mandatory, based on Annex C of EN 206-1
United Kingdom	QSRMC: Quality and Product Conformity Regulations BSI Kitemark: Product Certification Scheme protocol PC515: Ready Mixed Concrete

Table 8.6 — Use of concrete families

CEN Member Countries	Use of family concept in practice	Do you limit the scope of concrete families to that given in EN 206-1, annex K?
Austria	Yes	Yes, practically not in use
Belgium	Yes	Yes
Czech Republic	No	No
Denmark	Yes	Guidance is given in line with EN 206-1, Annex K, but the rules are not exactly the same
Finland	Yes	Guidance is given in the line with Annex K but the rules are not exactly the same
France	Yes	Annex K has been modified and is normative in the French national annex to NF EN 206-1. The scope is widened
Germany	Yes	Yes Minimum of 2 concrete families for strength classes between C8/10 and C50/60
Ireland	Yes	No. General guidance is given in an Irish Concrete Federation document, issued as advice to concrete producers. Annex K was used as general guidance but not compulsory
Italy	No	
Luxembourg	Not yet	
Netherlands	Not yet	
Norway	Yes, but use varies	
Portugal	Yes	Yes
Slovakia	No, but discussion on this would be very suitable	
Slovenia	Yes	Yes
Sweden	Yes	Yes
Switzerland	Not yet. Later on yes.	Under discussion. Probably yes
United Kingdom	Widely	No

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10 National provisions related to additional or different requirements

In EN 206-1, clause 1 there is a list of concretes or techniques that may need additional or different requirements. Table 9.1 shows the level to which national requirements are given to cover these additional and different requirements. More details of these requirements and their location are given in Tables 9.2 to 9.7. In addition to the topics listed in EN 206-1, CEN Member Countries were asked to identify other topics that needed additional or different national requirements and these are listed in Table 9.8.

These Tables show that a number of CEN Member Countries have rules for the use of recycled aggregates.

NOTE It is premature for CEN/TC 104/SC 1 to consider rules for the use of recycled aggregates until they are adequately covered in EN 12620.

In general, special technologies are not standardized in CEN Member countries but covered by other documents. A few CEN Member Countries have rules for steel fibre concretes.

NOTE There has been little support in CEN/TC 104/SC 1 for a standard on fibre concrete.

EN 206-1, clause 1 also contains a list of concretes to which it does not apply. Table 9.9 identifies where there are national requirements for these concretes. There are no standards for areas defined as being outside the scope of EN 206-1, but France is working on a standard to cover some of these areas.

When developing the revision of EN 206-1, it is important for CEN/TC 104/SC 1 to know if there were common topics presently outside the scope of EN 206-1 that are covered by national requirements. Table 9.10 contains a long list of these national requirements. A significant proportion of the additional requirements relate to durability. Some CEN Member Countries, typically those that require relatively low minimum cement contents (see Clause 4, Tables 4.3 to 4.18), have a requirement for minimum filler content.

Several CEN Member Countries introduce the concept of control classes (as used in the execution standard).

Several CEN Member Countries put normative limits on concrete families.

With the recent publication of European Guidelines on self-compacting concrete and the interest in this characteristic of concrete, the survey identified the level of support for expanding EN 206-1 to cover self-compacting concrete (Table 9.11). There is a clear majority hoping that the revision of EN 206-1 will cover self-compacting concrete, but note the comment from Norway in Table 9.11.

Table 9.1 — Additional or different requirements

CEN Member Countries	Concrete using other constituent materials	Special technologies excluding sprayed concrete	Concrete for disposal of liquids and gaseous wastes	Concrete for vessels for storage of polluting substances	Concrete for massive structures	Dry-mixed concrete	Other
Austria	No	Yes	No	No	Yes	No	Look at: http://www.concrete-austria.com
Belgium	No	No	No	No	No	No	No
Czech Republic	No				Additional requirements in CSN P ENV 13670-1 Zmena Z1, paragraph NA.13		
Denmark	Yes	Yes for SCC	No	No	No	No	No
Finland	No	No	No	No	No	No	No
France	No	Yes for SCC and HPFRC	No	No	No	No	No
Germany	Yes	Yes	No	(Yes) only as secondary barrier	Yes	Yes	Yes (steel fibre reinforced concrete (under preparation))
Ireland	Yes	No	No	No	No	No	No
Italy	Yes	Yes for SCC	No	No	No	No	No
Luxembourg	Yes	Yes	Yes	No	No	No	No
Netherlands	Yes	Yes	Yes	No	No	No	No
Norway	No	No	No	No	No	No	No
Portugal	No	No	No	No	No	No	No
Slovakia	No	No	No, but we would appreciate it	No, but we would appreciate it	Yes	No	Water-proof concrete and concrete resistant to abrasion
Slovenia	No	No	No	No	No	No	No
Sweden	Yes	Yes	No	No	No	No	No
Switzerland	No	No	No	No	No	No	Steel fibre concrete
United Kingdom	Yes	No	No	No	No	Yes	No

Table 9.2 — Concrete using other constituent materials

CEN Member Countries	Location where rules for use is given and a brief description of the rules
Denmark	DS 2426 contains requirements for the use of fibres and sewage sludge incineration ash
Germany	DAfStb-Richtlinie Beton nach DIN EN 206-1 und DIN 1045-2 mit rezyklierten Gesteinskörnungen nach DIN 4226-100 (DAfStb-Guideline Concrete According to DIN EN 206-1 and DIN 1045-2 with Recycled Aggregates According to DIN 4226-100) The Guideline limits the use of recycled aggregate up to a maximum amount of 45 vol-% of the total aggregate content depending on type of aggregate and exposure class (type of aggregate is given in DIN 4226-100: type 1: ≥ 90 mass-% recycled concrete, ≤ 10 mass-% non porous clay brick and sand lime brick; type 2: ≥ 70 mass-% recycled concrete, ≤ 30 mass-% non porous brick and sandlime stone)
Ireland	No specific rules given for use of GGBS or Pfa (Part 1) — Generally UK guidance followed. (This is under review at present)
Italy	UNI 11039–1: Calcestruzzo rinforzato con fibre di acciaio — Definizioni, classificazione e designazione (Steel fibre reiforced concrete — Definitions, classification and designation) UNI 11039–2: Calcestruzzo rinforzato con fibre di acciaio — Metodo di prova per la determinazione della resistenza di prima fessurazione e degli indici di duttilità (Steel fibre reinforced concrete — Test method for determination of first crack and ductility indexes)
Luxembourg	Concrete with recycled aggregates: DAfStb — Richtlinie für Beton mit rezykliertem Zuschlag (German Board for Steel reinforced Concrete — Guideline for concrete with recycled aggregates)
Netherlands	Assessment Guideline for Certification BRL 1802 (1996): Certificate for the combination of cement and fly-ash as binder in concrete (see NOTE 1) This BRL concern the use a specific concrete with a well defined combination of fly-ash and cement in one or more environmental classes. Typical for these specifications is the fact that the minimum cement content is lower and/or the maximum water/cement ratio is higher in relation to the current standards. In relation to all other materials in concrete (aggregates, admixtures, water) the current standard is valid unabridged BRL 1804 (2202): Filler aggregate for use as addition in concrete and mortar (see NOTE 1) This BRL concerns the quality of fine stony additions for use as filler material in concrete and mortar BRL 5061 (2001): Certification for steel fibres for use in concrete and mortars This BRL gives requirements for steel fibres and the way the quality of these fibres has to be controlled (see NOTE 1) BRL 9325 (2006): Ground granulated blastfurnace slag and Portland cement for use in concrete (see NOTE 1) This BRL concerns the quality of the raw material ggbs BRL 9340 (2004, with Amendment 2005): Ground granulated blastfurnace slag and Portland cement for use in concrete (see NOTE 1) This BRL concerns the use in a specific concrete with a well defined combination of ggbs and cement in one or more environmental classes NOTE 1 A 'BRL' is not a NEN standard.
Norway	Rules given in national annex to NS-EN 206-1 for use of ground granulated blastfurnace slag
Portugal	Pozzolans may be used as a type II addition on the formulation of mixtures of cement and additions, see Table 6.4.1
Sweden	SS 137003 allows the use of ground granulated blastfurnace slag
United Kingdom	BS 8500-2 for ground granulated blastfurnace slag, limestone addition and recycled aggregates

Table 9.3 — Special technologies excluding sprayed concrete, as this will be covered by ENs

CEN Member Countries	Location where rules for use is given
Austria	ÖVBB guidelines see http://www.concrete-austria.com
Belgium	None in NBN B 15-001, but technical approval required for steel fibre reinforced concrete
Denmark	DS 2426 contains test methods for SCC
Germany	DAfStb-Richtlinie Selbstverdichtender Beton (DAfStb-Guideline Self-Compacting Concrete) The SCC-Guideline contains in addition to DIN EN 206-1 and DIN 1045-2 requirements on fresh and hardened concrete properties (e. g. target values and maximum allowed deviations for slump-flow and V-funnel flow time, segregation sensitivity, total entrained air for AEC in exposure classes XF2, XF3 and XF4) and quality control (constituent materials, fresh and hardened concrete properties) DAfStb-Richtlinie mit verlängerter Verarbeitbarkeitszeit (Verzögerter Beton) (DAfStb-Guideline Retarded Concrete) The Guideline contains procedures for suitability testing, for production, placing and curing of retarded concrete in addition to DIN EN 206-1 and DIN 1045-2 DAfStb-Heft 337, Verhalten von Beton bei hohen Gebrauchstemperaturen (DAfStb-Publication 337, Behaviour of concrete exposed to high service temperatures ≤ 250 °C) The publication contains details about the change of concrete properties under higher temperatures FGSV-Merkblatt für Herstellung und Verarbeitung von Luftporenbeton (FGSV-Guideline on the production and placing of air entrained concrete), issued by Forschungsgesellschaft für Straßen- und Verkehrswesen e. V. (Road and Transportation Research Association)
Italy	UNI 11039 1: Calcestruzzo rinforzato con fibre di acciaio — Definizioni, classificazione e designazione UNI 11039 2: Calcestruzzo rinforzato con fibre di acciaio — Metodo di prova per la determinazione della resistenza di prima fessurazione e degli indici di duttilità. UNI 11040: Calcestruzzo autocompattante — Specifiche, caratteristiche e controlli (Self compacting concrete — Specification, characteristics and cheking) (UNI 11041, 11042, 11043, 11044, 11045 Test methods for SCC) Linee Guida del Ministero dei Lavori Pubblici: Calcestruzzo preconfezionato, Calcestruzzo strutturale ad alta resistenza, Calcestruzzo strutturale
Luxembourg	In preparation: guideline for SCC
Netherlands	CUR Recommendation 18, 1990, Under-water-concrete (see NOTE 1) This recommendation gives definitions, requirements and rules for the production and control of under water concrete. CUR Recommendation 35, 1994, Determination of the flexural strength, the bending toughness and the equivalent flexural strength of steel fibre reinforced concrete (see NOTE 1) This recommendation describes the test methods. BRL 5060, 2004, Certification for steel fibre reinforced concrete (see NOTE 2) This BRL gives requirements for steel fibre reinforced concrete and the way the quality of this concrete has to be controlled. CUR Recommendation 97, 2004, High strength concrete (see NOTE 1) Recommendation 97 gives provisions and requirements for high strength concrete (B65 to B105) in addition to existing technical and technological standards. CUR Recommendation 93, 2002, Self compacting concrete (see NOTE 1) Recommendation 93 gives provisions and requirements for self compacting concrete in addition to existing technical and technological standards. CUR-Recommendation 100, 2004: Exposed concrete (see NOTE 1) This recommendation is used for concrete (made on site or prefabricated) with special aesthetical requirements. These requirements add to existing standards, especially the standard for the execution of concrete works (NEN 6722). A gray-scale is included in this recommendation. NOTE 1 CUR Recommendations are not NEN standards. NOTE 2 A ‘BRL’ is not a NEN standard.
Sweden	The National Road Administration has requirements for under water concrete (BRO 2004)
United Kingdom	None in BS 8500, but guidance is provided in various other publications

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Table 9.4 — Concrete for disposal of liquid and gaseous wastes

CEN Member Countries	Location where guidance/requirements is given
Germany	None (cf. 9.5)
Luxembourg	Concrete for water endangering liquid substances: DAfStb — Richtlinie Betonbau beim Umgang mit wassergefärdenden Stoffen (German Board for Steel reinforced Concrete — Guideline, concrete or water endangering liquid substances)
Netherlands	In The Netherlands a set of provisions to prevent the pollution of soils must be applied. Below the provisions are given for concrete, divided into several sections Test methods CUR-Recommendation 63, 1998: Determination of the penetration of liquids in concrete by capillarity (not being used for certified ready-mixed concrete in accordance with BRL 1801) NEN-EN 12390-8 (used for certified ready-mixed concrete in accordance with BRL 1801) Design and construction CUR-Recommendation 65, 2005, 2nd edition: Design and construction and repair of liquid tight concrete structures BRL 2316, 1994: Precast concrete elements impermeable for fuels and lubricants BRL 2319, 1994: Construction of soil protective facilities with prefabricated elements BRL 2362, 2000, 2nd edition: Construction of soil protective concrete floors and pavements BRL 2370, 1999: Placing concrete in soil protective facilities BRL 2371, 1998: Making existing concrete soil protective facilities Inspection CUR Recommendation 44, 2002, 3rd edition: Criteria for the assessment of soil protective facilities NOTE 1 CUR Recommendations are not NEN standards NOTE 2 A 'BRL' is not a NEN standard

Table 9.5 — Concrete for vessels for storage of polluting substances

CEN Member Countries	Location where guidance/requirements is given
Germany	DAfStb-Richtlinie: Betonbau beim Umgang mit wassergefährdenden Stoffen (DAfStb-Guideline: Concrete Structures in Contact with Water Pollutants) In Germany the consciousness of environmental issues are expressed among others in the law for groundwater protection. Facilities for storing, decanting, manufacturing, handling and using water-hazardous materials must be constructed, erected and operated in such a way, that no water contamination need to be feared. This principle of care in § 19g of the German Water Resources Act (WHG) has meant, that special requirements have had to be imposed on reinforced and pre-stressed concrete structures and components intended to act as secondary barriers preventing the penetration of water-hazardous materials to the groundwater after failure of the primary safety system. When designing components for this purpose, it is necessary to ensure, that the penetration front of the medium demonstrably fails to reach the side of the component opposite to the wetted side, allowing a margin for safety given in the Guideline. In the Guideline regulations for these types of secondary barriers are given (design, concrete technology, execution, inspection, repair, maintenance)

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Table 9.6 — Concrete for massive structures

CEN Member Countries	Location where guidance/requirements is given
Austria	Yes, see http://www.concrete-austria.com
Czech Republic	Additional requirements in CSN P ENV 13670-1 Zmena Z1, paragraph NA.13
Germany	DAfStb-Richtlinie: Massige Bauteile aus Beton (DAfStb-Guidelin: Concrete for Massive Structures)
Ireland	None in National Standards; other recognised technical advice is generally followed in practice (e.g. CIRIA Reports, etc.)
Slovakia	Yes, STN 731210: The requirement for the development of hydration warmth
United Kingdom	None in the standard, but guidance given elsewhere, e.g. CIRIA Report 135 and Concrete Society Digest No 2

Table 9.7 — Dry mixed concrete

CEN Member Countries	Location where guidance/requirements is given
Germany	DAfStb-Richtlinie Herstellung und Verwendung von Trockenbeton und Trockenmörtel (DAfStb-Guideline: Production and Application of Dry-Mixed Concrete and Dry-Mixed Mortar)
United Kingdom	BS 5838 –1: Specification for dry packaged cementitious mixes — Part 1: Prepacked concrete mixes

Table 9.8 — Other

CEN Member Countries	Subject and location where guidance/requirements is given
Austria	Yes, see http://www.concrete-austria.com
Germany	Steel fibre reinforced concrete DAfStb-Richtlinie: Stahlfaserbeton (in Vorbereitung) (DAfStb-Guideline: Steel Fibre Reinforced Concrete (under preparation))
Norway	Guidance for underwater concreting given in Norwegian Concrete Association NPB number 5
Slovakia	STN 731210: Water-proof concrete and concrete resistant to abrasion
Switzerland	SIA 162/6: Stahlfaserbeton, 1999 (Steel fibre concrete, 1999)

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Table 9.9 — Areas that are listed in EN 206-1 as being outside the scope of EN 206-1 but covered by national requirements

CEN Member Countries	Aerated concrete	Foamed concrete	Concrete with an open structure (no-fines concrete)	Concrete with a density less than 800 kg/m^3	Refractory concrete
Austria	No	No	No	No	ÖVBB guideline for tunnels see http://www.concrete-austria.com
Belgium	No	No	No	No	No
Czech Republic	No	No	No	No	No
Denmark	No	No	No	No	No
Finland	No	No	No	No	No
France	No	No	No	No	No
Germany	No	No	No	No	No
Ireland	No	No	No	No	No
Italy	No	No	No	No	No
Luxembourg	No	No	No	No	No
Netherlands	No	Yes[a]	No	No	No
Norway	No	No	No	No	No
Portugal	No	No	No	No	No
Slovakia	Yes	No	Yes	No	No[c]
Slovenia	No	No	No	No	No
Sweden	No	No	No	No	No
Switzerland	No	No	No	No	No
United Kingdom	No[b]	No[b]	No[b]	No[b]	No[b]

Notes

[a] CUR Recommendation 59, 1998
Vervaardiging en beproeving van schuimbeton
Production and testing of foamed concrete
This recommendation applies to foamed concrete for structures and elements.

NOTE CUR Recommendations are not NEN-standards.

[b] While no guidance is provided, BS 8500/EN 206-1 could be used to specify these concretes

[c] STN 73 6124: voidage must be over 20 %

Table 9.10 — Other areas outside the scope of EN 206-1 but covered by national requirements

CEN Member Countries	Location of national provisions List of topics covered
Austria	ÖNORM B 4710-1, chapter 14 following ENV 13670-1
Belgium	Definition of environmental classes grouping exposure classes in function of the effective use of the concrete (presented as an alternative to the use of the exposure classes) (see footnote b in table 2.3.1) Extension of the use of the k-factor to cements other than CEM I Inclusion of GGBS as addition typ II Requirements for the accuracy of weighing equipment Recommendations about the selection of cement types and classes (informative) Correspondence between the exposure classes in EN 13369 and in EN 206-1
Czech Republic	None
Denmark	The areas treated in DS 2426 (see Table 1.1 for details) are: — Concrete are divided into control classes (tightened, normal, reduced) — Requirements for maximum filler content in concrete — Environmental classes – the exposure classes of EN 206-1 is grouped into 4 exposure classes Passive (P), Moderate (M), Aggressive (A) and extra aggressive (EA). — Requirements for the use of sewage sludge incineration ash — Specific requirements for aggregate (e.g. AAR and frost) are described — Requirements for dry content in recycled water — Requirements for alkali content of concrete — Concrete in exposure class XF shall be pre-tested with regard to frost resistance requirements — Test methods for self-compacting concrete — Specific requirements for delivery of concrete (time from mixing to construction) — Requirements for the accuracy of weighing equipment — Requirements for a mixing report — Annex K is normative in Denmark supplied with additional requirements. — Rules for fibres — Requirements to a concrete declaration — Supplying requirements for concrete with closed structure — Rules for recalculation of strength results from different terms than the prescribed (28 days)
Finland	Suomen rakentamismääräyskokoelma, B4 Betonirakenteet (National Building Code of Finland, B4 Concrete structures) Structural classes 1, 2 and 3 including rules related to design and execution. Important structures and concrete strength C35/45 or higher belong to class 1. minor structures and concrete strength C16/20 or lower belong to class 3 Qualification of designer and supervisor in Structural classes 1 and 2 Frost resistance requirements including initial testing and repeated testing by50 Betoninormit 2004, Suomen Betoniyhdistys by50 Concrete Code, Finnish Concrete Association Durability design rules
France	None

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Table 9.10 (*continued*)

CEN Member Countries	Location of national provisions List of topics covered
Germany	Given in DIN 1045-2 (see also Clause 4 for details): — Table 1 – national examples for exposition classes — Tables 5 to 6 description of consistence is added — Resistance to ASR according to a DAfStb-Guideline — Rules for standardized prescribed concrete (minimum cement content etc.) — Modified k-value concept for additions (including requirements on mixtures of cement and fly ash to produce a concrete with high sulphate resistance up 1 500 mg/l sulphate in ground water) — Limits for the maximum amount of admixtures in normal strength and high strength concrete — Replacement of table 10 (maximum chloride content) — Limits for fresh concrete temperature — Requirements for maximum fines content in concrete (≤ 0,125 mm) in expositions classes XF and XM — Requirements on artificial air content for concrete in exposure classes XF2, XF3 or XF4 — Requirements for underwater concrete — Requirement for concrete exposed to water-contaminating substances (reference is made to the DAfStb-Guideline, cf. table 9.1.5) — Concrete exposed to high service temperatures (reference is made to the DAfStb-publication 337) — Conversion factors calculating the wet-cube compressive strength from the dry-cube compressive strength for normal strength and high strength concrete — Additional information when delivering concrete — Some additional requirements for conformity control and conformity criteria (e.g. for high strength concrete) — Some additional requirements for production control — Identity testing for compressive strength according to annex B in DIN EN 206-1 is replaced by tests of the compressive strength on the site with specified acceptance criteria according to DIN 1045-3, Annex A.2 — Some amendments for annex C — Normative tables in Annex F (cf. clause 4) — Additional provisions for high-strength concrete in Annex H — Annex K is normative with additional requirements — An informative annex L is added with grading curves for the aggregate <u>Additional regulations in:</u> ZTV-ING: Zusätzliche Technische Vertragsbedingungen und Richtlinien für Ingenieurbauten; (Additional Technical Contract Conditions and Guidelines for Enineering Structures) ZTV-ING: Contains in addition to DIN EN 206-1 and DIN 1045-2 requirements for concrete engineering structures in connection with roads (bridges, tunnels, etc.) ZTV-W 215: Zusätzliche Technische Vertragsbedingungen — Wasserbau (ZTV-W) für Wasserbauwerke aus Beton und Stahlbeton; (Additional Technical Contract Conditions — Hydraulic Engineering (ZTV-W) for Water Engineering Structures made of Concrete) ZTV-W 215: Contains in addition to DIN EN 206-1 and DIN 1045-2 requirements for concrete engineering structures in the field of hydraulic engineering (weirs, sluices, etc.)

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Table 9.10 (*continued*)

CEN Member Countries	Location of national provisions List of topics covered
Ireland	Guidance given on the following in National Annex (other than previously mentioned): — Maximum chloride contents — Limiting values/cover — Maximum temperature of fresh concrete — Standardised prescribed mixes — Delivery ticket for readymixed concrete — Transport of (fresh) concrete — Conformity properties other than strength (reactive alkali content) — Identity testing for slump and air content — Forms for specifying or ordering concrete mixes
Italy	Test methods for self-compacting concrete Linee guida del Ministero dei LLPP
Luxembourg	Areas treated in DNA EN 206: — Reference to CDC-BET, specifications for placing concrete — Reference to German guideline for recycled water, recycled aggregates, retarded concrete, concrete for water endangering liquid substances — Specific test methods for frost and de-icing agents exposed concrete (XF4) → RILEM CDC 2 — Requirements for concrete declaration — Requirements for mixing report — Specific requirements for delivery of concrete (time from mixing to construction) — Modified annexes B, D, F — Complementary annexes L (grain-size distribution curves), M (identification and on site testing rules), N (recommendations for the specification using concrete categories) <u>Areas treated in CDC-BET:</u> — steel reinforcing works, nominal concrete covers — guidance for placing and compacting concrete — guidance for hot and cold weather concreting — guidance for concreting massive structures — rules for the curing of concrete — complementary rules for the frequency of different concrete testing's — guidance for the specification and evaluation of fair-faced concrete
Netherlands	None
Norway	A number of items are covered in publications from the Norwegian Concrete Association, such as underwater concreting, sprayed concrete, light weight concrete, recycled aggregates

Table 9.10 (*continued*)

CEN Member Countries	Location of national provisions List of topics covered
Portugal	Given in the 3 LNEC Specifications quoted in Table 1.1, namely: In LNEC E 461: Classifying the reactivity of aggregates (see 5.2) Defining 3 levels of prevention according to 3 categories of the risk for the structures and to 3 increasing exposures to the humidity and establishing accordingly 4 preventive measures for the last 2 high levels If none of these measures were applied, it will be evaluated the susceptibility of mixtures of aggregates or compositions of concrete to the alkali-silica reaction, using ASTM C 1260-01 test method for aggregate mixtures and RILEM AAR-3 or AAR-4 test methods for the concrete composition A similar methodology is established for the internal sulphate reactions In LNEC E 464: Defining the suitability of mixtures of cements and additions as concrete constituents Increasing the informative examples of exposure classes of Table 1 of EN 206-1 Establishing the prescriptions on concrete composition and strength classes for a design working life of 50 and 100 years and some other common prescriptions on cements and mixtures Establishing the combination of exposure classes Establishing the general framework of the guarantee of the design working life to introduce the „performance-related design methods with respect to durability" of the EN 206-1, developed in LNEC E 465 Establishing the suitability of the equivalent performance concept, the properties to be determined and the analysis of the results In LNEC E 465: Highlighting the main principles and application rules related to the durability of reinforced concrete stated in the EN 1990 Remembering the general methodology of a durability design, establishing the minimum reliability indexes for each of 3 reliability classes and the serviceability limit state, establishing that this corresponds to the crack initiation due to the corrosion of the steel Applying the probabilistic method presented in the RILEM Report 14 (1996) to the Tuuti model of the deterioration of the reinforced concrete Establishing performance models for the initiation period under carbonation and chlorides and a model for the propagation period that permits to esteem minimum deterministic propagation periods satisfying the serviceability limit state Presenting, as examples and for each exposure class, values of the performance properties of these models, function of the minimum covers for durability, the reliability classes of concrete structures and the design working life
Slovakia	STN 731210: Concrete resistant to abrasion Clause 7.3: We suggest to add maximum transport time stated by the producer Clause 7.6: Concrete transport section has been extended; please contact us for any further details Annex A: the initial test is supplemented with the testing of cement and aggregate of which the samples of concrete were taken. This should be done so that the characteristics of these two could be compared during the initial test as well as in the future

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Table 9.10 (*continued*)

CEN Member Countries	Location of national provisions List of topics covered
Slovenia	SIST 1026: — basic requirements for performance-based design — additional exposure classes for abrasion resistance of concrete surface — additions have to be verified for intended use by initial testing (9.5 and Annex A of EN 206-1) — recommended gradation for aggregates — suitability of recycled aggregates has to be proved by initial testing — recommendations of fine particle content (depending on cement content) — additional requirements for underwater concrete — additional sampling/testing frequency for high-strength and lightweight concrete — additional conformity criteria for high-strength concrete — test methods for : surface scaling resistance, internal freeze-thaw resistance, abrasion resistance
Sweden	Standardized prescribed concrete SS 137003 The frost resistance of concrete in exposure class XF4 shall be tested according to SS 137244
Switzerland	None
United Kingdom	Given in BS 8500 Designated concrete Standardized prescribed concrete Proprietary concrete Brownfield sites and mobile groundwater Guidance on the concrete aspects of hot and cold weather concreting Guidance on AAR and DEF (briefly) Identity testing for slump, flow and air content Specification for and use of RCA and RA Some additional requirements for production control Transport of concrete Test method for determining the composition of RCA and RA Determination of the alkali content of constituent materials

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Table 9.11 — Self compacting concrete

CEN Member Countries	Would you like to see EN 206-1 cover SCC?	Where there is a national specification for SCC, the title in national language and its English translation
Austria	No	ÖNORM B 4710-1, class F72
Belgium	Not yet	No[a]
Czech Republic	Yes	No
Denmark	Yes	Already use flow classes from EN 206-1 with modified test methods. The modifications to the test methods are given in DS 2426
Finland	Yes	No
France	Yes	New AFGC (Association française de genie civil/French association for civil engineering) Guidelines should soon be produced
Germany	(Yes) question should be extended to other types of concrete (e. g. massive structures, steel fibre reinforced concrete)	DAfStb-Richtlinie Selbstverdichtender Beton (DAfStb-Guideline Self-Compacting Concrete)
Ireland	Yes	No
Italy	Yes	UNI 11040 (2003): Calcestruzzo auto-compattante — Specifiche, caratteristiche e controlli (Self compacting concrete — Specification, characteristics and checking)
Luxembourg	Yes	In preparation
Netherlands	Yes	CUR Recommendation 93, 2002: Self-compacting concrete; BRL 1801, KIWA-Criteria 73 (Conformity-criteria) NOTE 1 CUR Recommendations are not NEN standards. NOTE 2 A 'BRL' is not a NEN standard. NOTE 3 KIWA-Criteria are not NEN standards.
Norway	Yes (with some concerns, the self compaction part of it is EN 13670 not EN 206-1, but the concrete is)	No, only a guideline
Portugal	Yes	No
Slovakia	Yes	If not possible, we would very much appreciate an independent standard on self-compacting concrete
Slovenia	Yes if well defined test methods and criteria are available	No
Sweden	Yes	No
Switzerland	Yes	No
United Kingdom	Yes	No[a]

[a] BE and UK support the use of the European Guidelines

11 Production control

A significant number of CEN Member Countries modified the rules given in EN 206-1, 9.2 to 9.9. Main topics are requirements for the education and experience of the personnel and the batching of the constituents.

NOTE When EN 206-1 was being drafted, it was recognised that there were clear national differences in the requirements for the experience and education of personnel and it was not possible to agree common requirements.

Tables 10.1 and 10.2 show the difference in the way standards are applied within different legal systems.

The information given in Part 8: *Conformity and Certification* and Part 10: *Production Control* shows that EN 206-1, clauses 8 and 9 should be reviewed in conjunction.

There seems to be no clear understanding of Resolution 313. The text should be reviewed together with EN 206-1, clauses 8 and 9 so that a resolution is no longer necessary.

Table 10.1 — Local production control 'rules of application'

CEN Member Countries	National regulations that modify any of the rules of application given in EN 206-1, 9.2 to 9.9?
Austria	Yes, additional requirements in ÖNORM B 4710-1, chapter 9.2 to 9.9
Belgium	None
Czech Republic	None
Denmark	Yes, in DS 2426
Finland	9.6.1 There are national qualification requirements for the personnel 9.8 Admixtures can be added also agitating equipment like in truck mixers
France	Minor adaptations have been introduced in NF EN 206-1
Germany	Yes Clause 9.3: Recorded data and other documents Records from production control shall be retained for at least 5 years Clause 9.5: Concrete composition and initial testing Limits for the necessity of initial testing are specified Within a specific range in concrete composition no initial testing is required (cement and fly ash ± 15 kg/m^3, admixtures between 0 and maximum specified in DIN 1045-2, clause 5.2.6) Clause 9.6: Personnel, equipment and installation The production control shall be managed by a specialist with wide experience of advanced concrete technology and production (e.g. a concrete engineer). Education requirements are given in a special guideline. The producer shall ensure that management and all personnel involved in concrete production, transport and production control receive further training at intervals of not more than three years in the production. Table 21: Tolerances for the batching process of constituent material Tolerance of ± 3 % of required quantity for all constituent materials Clause 9.8: Mixing of concrete Only high range water reducing admixtures are allowed to be added to a truck mixer. The note is converted to normative text. Clause 9.9: Production control procedures EN 206-1, Annex H for high strength concrete is normative with additional specifications Table 22: Control of constituent materials Test frequencies for the testing of recycling water are specified. These are missing in EN 1008: Mixing water for concrete
Ireland	No. Guidance given on interpretation and use in Irish Concrete Federation publication for advice to members

Table 10.1 (*continued*)

CEN Member Countries	National regulations that modify any of the rules of application given in EN 206-1, 9.2 to 9.9?
Italy	None
Luxembourg	None
Netherlands	Yes. NEN 8005:2004 includes normative text to 9.6.2.2 (Batching equipment), and a NOTE to 9.6.1 (Personnel) and 9.7 (Batching of constituent materials) as well
Norway	Yes (9.3 five years), (9.6.1 Competence requirements for personnel)
Portugal	None
Slovakia	Yes, considering the recorded data and other documents as well as the composition and initial testing of the concrete
Slovenia	Yes, in non-mandatory SIST 1026
Sweden	Yes, the education and experience of the personnel are specified
Switzerland	None
United Kingdom	None

Table 10.2 — Implementation of Resolution 313

CEN Member Countries	How has resolution 313 been implemented?
Austria	No response
Belgium	Was already meant so in the previous certification scheme
Czech Republic	In government decree 163/2005 in accordance with EN 206-1
Denmark	Conformity is required to be according to DS EN 206-1 and DS 2426
Finland	Rules in case of non-compliance of concrete structures (including concrete) are given in National Building Code of Finland, B4 Concrete structures, clause 6.6. Certification Body has also rules for non-compliance, depending on the severity. These rules existed already before EN 206-1. The consequences will be investigated. Conformity to EN 206-1 is not a key issue as such
France	At present, resolution 313 is implemented only for concrete under 3rd party certification
Germany	No implementation Non-conformity means non-compliance with clause 8. This is clarified in EN 206-1, clause 8.4 *Actions in the case of non-conformity of the product* together with the national application document DIN 1045-2
Ireland	Conformity to I.S. EN 206-1 is stated on delivery documentation. Clarification given in resolution 313 will be useful if an interpretation is required in case of dispute
Italy	Not yet
Luxembourg	Not yet
Netherlands	Implemented in the Assessment guideline for Certification of concrete (BRL 1801)
Norway	No response
Portugal	The Portuguese Standards NP EN 206-1 and NP ENV 13670-1 will be mandatory in 2007 (substituting NP ENV 206, still a regulatory document on concrete in Portugal). These identity testing and certification are proposed to be mandatory for inspection classes 2 and 3 of the NP ENV 13670-1
Slovakia	Concrete in Slovakia belongs, according to the notice, into the system 2+, that means we need an initial type testing, factory production control by the third party every 12 months and planned tests. We require the initial type testing to be done for each kind of concrete according to Annex A EN 206 -1. For the planned tests according to Table 13 EN 206-1 we require the criteria given in Clause 8 to be fulfilled. Factory production control we require the Annex C with some amendments to be fulfilled
Sweden	No. In Sweden EN 206-1 already is understood to be in line with Resolution 313
Switzerland	There was no doubt about the interpretation of the term conformity to EN 206-1 and it corresponds to the resolution 313 of CEN/TC 104/SC 1 in Prague and no further clarification was seen to be necessary
United Kingdom	It has been included in the normative part of BS 8500-2. Specifiers specify conformity to BS 8500-2 only as BS 8500-2 requires conformity to EN 206-1 as clarified by Resolution 313. It was done this way to avoid potential legal problems associated with specifying concrete conforming EN 206-1

Annex A

National minimum aggregate categories for normal weight aggregate concrete used in general construction

Table A.1 — Requirements in AUSTRIA

Location of requirements: ÖNORM B 4710-1: Beton — Teil 1: Festlegung, Herstellung, Verwendung und Konformitätsnachweis (Regeln zur Umsetzung der ÖNORM EN 206-1) (Concrete — Part 1: Specification, production, use and verification of conformity) (Rules for the implementation of ÖNORM EN 206-1)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	Yes [a]
Graded coarse aggregate categories	Table 3	Yes [a]
All-in aggregate	4.3.5	Yes [a]
Flakiness Index categories	Table 8	No
Shape Index categories	Table 9	Yes [a]
Shell content categories	Table 10	Yes [a]
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	Yes [a]
Fines content categories	Table 11	Yes [a]
Los Angeles categories	Table 12	Yes [a]
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	Yes [a]
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	Yes [a]
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	Yes [a]
Drying shrinkage not greater than 0,075 %	5.7.2	Yes [a]
Lightweight organic contaminators	6.4.1 and annex G.4	NR
[a] Depends upon exposure class, see Table NAD 6 (end of Annex A)		

Table A.2 — Requirements in BELGIUM

Location of requirements: NBN B 15-001: Supplément à la NBN EN 206-1 — Béton — Spécification, performances, production et conformité NBN B 15-001: Aanvulling op NBN EN 206-1 — Beton — Eisen, gedraging, vervaardiging en conformiteit (Supplement to NBN EN 206-1:Concrete — Specification, performance, production and conformity)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	[a]
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	NR

[a] Freeze-thaw resistance to be declared for all XF classes

Table A.3 — Requirements in CZECH REPUBLIC

Location of requirements: CSN EN 206-1 Zmena Z2		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	NR
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	For high strength concrete and special concrete a.g. concrete for roads ≤ 0,25 % by mass (fine aggregate) ≤ 0,05 % by mass (coarse aggregate)

Table A.4 — Requirements in FINLAND

Location of requirements: *by43* Betonikiviainekset (Concrete aggregates), Finnish Concrete Association, Guidance document under revision		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR [a]
Graded coarse aggregate categories	Table 3	NR [a]
All-in aggregate	4.3.5	NR [a]
Flakiness Index categories	Table 8	NR [a]
Shape Index categories	Table 9	NR [a]
Shell content categories	Table 10	NR [a]
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR [a]
Fines content categories	Table 11	NR [a]
Los Angeles categories	Table 12	NR [a]
Resistance to impact categories	Table 13	NR [a]
Resistance to wear categories	Table 14	NR [a]
Resistance to polishing categories	Table 15	NR [a]
Resistance to surface abrasion (AAV) categories	Table 16	NR [a]
Resistance to abrasion by studded tyres	Table 17	NR [a]
Freeze-thaw resistance categories	Table 18	NR [a]
Magnesium sulfate categories	Table 19	NR [a]
Acid-soluble sulfate categories	Table 20	NR [a]
Drying shrinkage not greater than 0,075 %	5.7.2	NR [a]
Lightweight organic contaminators	6.4.1 and annex G.4	NR [a]

[a] Recommendations depending on the use will be given in *by43*

Table A.5 — Requirements in FRANCE

Location of requirements: National annex included in the NF EN 206-1 standard		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	G_c 80/20
Graded coarse aggregate categories	Table 3	G_T 17,5
All-in aggregate	4.3.5	Not possible
Flakiness Index categories	Table 8	FI_{50}
Shape Index categories	Table 9	NR
Shell content categories	Table 10	SC_{10}
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	$f_{1,5}$ f_{NR} f_{NR} f_{22}
Fines content categories	Table 11	f_{22}
Los Angeles categories	Table 12	LA_{50}
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	$M_{DE}25$
Resistance to polishing categories	Table 15	PSV_{50}
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	F declared
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	$AS_{0,8}$
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	Declared value

Table A.6 — Requirements in GERMANY

Location of requirements: DIN V 20000-103, Anwendung von Bauprodukten in Bauwerken — Teil 103: Gesteinskörnungen nach DIN EN 12620 (DIN V 20000-103, Use of Building Products in Construction Works — Part 103: Aggregates according ton DIN EN 12620)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	$G_c85/20$
Graded coarse aggregate categories	Table 3	NR due to $G_c85/20$
Fine aggregate	-	Tolerances acc. to table 4
All-in aggregate	Clause 4.3.5	G_A90 acc. to table 2
Flakiness Index categories	Table 8	FI_{50}
Shape Index categories	Table 9	SI_{55}
Shell content categories	Table 10	SC_{10}
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	$f_{1,5}$, f_3, f_3, f_3
Los Angeles categories	Table 12	LA_{NR}
Resistance to impact categories	Table 13	SZ_{NR}
Resistance to wear categories	Table 14	$M_{DE}NR$
Resistance to polishing categories	Table 15	PSV_{NR}
Resistance to surface abrasion (AAV) categories	Table 16	AAV_{NR}
Resistance to abrasion by studded tyres	Table 17	A_NNR
Freeze-thaw resistance categories	Table 18	F_4
Magnesium sulfate categories	Table 19	MS_{NR}
Acid-soluble sulfate categories	Table 20	$AS_{0,8}$ and AS_1
Drying shrinkage not greater than 0,075 %	5.7.2	when required
Light weight organic contaminators	6.4.1 and annex G.4	≤ 0,5 % by mass (fine aggregate) ≤ 0,1 by mass (coarse aggregate)
Attestation of conformity system	Table ZA.2a	2+

Table A.7 — Requirements in IRELAND

Location of requirements: NSAI — S.R. 16:2004		
Aggregate categories	**EN 12620 table**	**Requirement * (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR**
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	LA_{40}
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR**
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR**
Freeze-thaw resistance categories	Table 18	NR
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	
Lightweight organic contaminators	6.4.1 and annex G.4	NR

* Although national minimum values are not specified as such, the levels are selected in accordance with end use, as in NSAI Standard Recommendations S.R. 16:2004 “Guidance on the use of I.S. EN 12620:2002”

** Not used

Table A.8 — Requirements in ITALY

Location of requirements: UNI 8520-1: Agreggates for Concrete — Additional provision for the application of EN 12620 — Part 1: Designation and Conformity Criteria UNI 8520-2: Agreggates for Concrete — Additional provision for the application of EN 12620 — Part 2: Requirements		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR, however, FI_{35} is recommended
Shape Index categories	Table 9	NR, however, SI_{40} is recommended
Shell content categories	Table 10	NPD
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	Coarse A., not crushed ≤ $f_{1,5}$ Coarse A, crushed ≤ f_4 Fine A, not crushed ≤ f_3 Fine A, crushed from quarried material ≤ f_{10} Fine A. crushed from rocks ≤ f_{16} Natural graded mix 0/8 ≤ f_3 Not crushed aggregate mix ≤ f_3 Crushed aggregate mix ≤ f_{11}
Los Angeles categories	Table 12	For concrete ≥ C50/60 ≤ LA_{30} is recommended
Resistance to impact categories	Table 13	NPD
Resistance to wear categories	Table 14	NPD
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NPD
Freeze-thaw resistance categories	Table 18	For exposure class XF(1-4) ≤ F_2
Magnesium sulfate categories	Table 19	For exposure class XF(1-4) ≤ MS_{25}
Acid-soluble sulfate categories	Table 20	Coarse aggregates ≤ $AS_{0,2}$ Fine aggregates ≤ $AS_{0,8}$
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	Ordinary concrete: fine aggregates = 0,5 % coarse aggregate = 0,1 % Architectural concrete: fine aggregates = 0,25 % coarse aggregates = 0,05 %

Table A.9 — Requirements in LUXEMBOURG

Location of requirements: CDC–GRA: Cahier des charges granulats et sables (CDC-GRA Specifications for aggregates and sands)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	FI_{35}
Shape Index categories	Table 9	SI_{55}
Shell content categories	Table 10	SC_{10}
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	$f_{1,5}$, NR, NR, f_3
Los Angeles categories	Table 12	LA_{40}
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	M_{DE} declared
Resistance to polishing categories	Table 15	PSV_{NR}
Resistance to surface abrasion (AAV) categories	Table 16	AAV_{NR}
Resistance to abrasion by studded tyres	Table 17	A_NNR
Freeze-thaw resistance categories	Table 18	XF1: F_4, $XF_2 + XF_3$: F_2
Magnesium sulfate categories	Table 19	XF4: MS_{18}
Acid-soluble sulfate categories	Table 20	$AS_{0,2}$ and AS_1
Drying shrinkage not greater than 0,075 %	5.7.2	When required
Lightweight organic contaminators	6.4.1 and annex G.4	When required

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Table A.10 — Requirements in THE NETHERLANDS

Location of requirements:

NEN 3543:2005: Nederlandse aanvulling op NEN-EN 13055-1: Lichte toeslagmaterialen — Lichte toeslagmaterialen voor beton, mortel en injectiemortel
(Dutch supplement to NEN-EN 13055-1: Lightweight aggregates — Lightweight aggregates for concrete, mortar and grout)

NEN 3833:2005: Nederlandse aanvulling op NEN-EN 13139: Toeslagmaterialen voor mortel
(Dutch supplement to NEN-EN 13139: Aggregates for mortar)

NEN 5905:2005: Nederlandse aanvulling op NEN-EN 12620: Toeslagmaterialen voor beton
(Dutch supplement to NEN-EN 12620: Aggregates for concrete)

In NEN 5905 national provisions are given. In some cases categories are required. If so, NEN 5905 indicates with a general remark that 'If other categories are used, the suitability for the application has to be demonstrated'.

CUR Recommendation 5, 1984 (see NOTE)

Metselwerkpuingranulaat als toeslagmateriaal voor beton (Crushed clay brick masonry aggregates for concrete)

NOTE CUR Recommendations are not NEN standards

Aggregate categories	EN 12620 clause/table	Requirement (use NR if no national requirement)
Recycled aggregates	3.5	Composition requirements: - Crushed concrete[e]: > 90 % (m/m) concrete – Mixture of bricks and concrete[e]: > 50 % (m/m) concrete[e]
Aggregate grading	4.3.1	Producers declared value
Coarse aggregate grading categories	Table 2	NR[a b]
Graded coarse aggregate categories	Table 3	NR[a]
All-in aggregate	4.3.5	NR[a]
Flakiness Index categories	Table 8	Producers declared value
Shape Index categories	Table 9	NR[a]
Shell content categories	Table 10	For coarse aggregates: SC_{10}
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR[a]
Fines content categories	Table 11	NR[a]
Fines quality	4.7	Sand-equivalent (SE): > 60 Methylene blue test (MB): next to NEN-EN 933-9, assess-ment according to NEN 5941 is recommended because of lack of experience with test methods described in EN 12620
Los Angeles categories	Table 12	$\geq LA_{30}$
Resistance to impact categories	Table 13	NR[a]
Resistance to wear categories	Table 14	NR[a]
Resistance to polishing categories	Table 15	NR[a]
Resistance to surface abrasion (AAV) categories	Table 16	NR[a]
Resistance to abrasion by studded tyres	Table 17	NR[a]
Particle density and water absorption	5.5	Producers declared values

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Table A.10 (*continued*)

Aggregate categories	EN 12620 clause/table	Requirement (use NR if no national requirement)
Freeze-thaw resistance categories	Table 18	NR[a]
Magnesium sulfate categories	Table 19	NR[a]
Alkali-silica reaction	5.7.3	See Table 5.1 of this CEN TR
Chlorides	6.2	Producers declared value
Acid-soluble sulfate categories	Table 20	Producers declared value[c]
Total sulfur	6.3.2	Producers declared value
Constituents which alter the rate of setting and hardening of concrete	6.4.1 and Annex G.4	NR[a,d]
Carbonate content of fine aggregates for concrete pavement surface courses	6.5	Next to NEN-EN 196-21:1993[f], assessment according to NEN 5922 is recommended because of lack of experience with test methods described in EN 12620

[a] Depends upon type of aggregate and use.

[b] Percentage passing by mass: for D allowed to 100 % if requirements of NEN-EN 12620, table 2, comment c are fulfilled.

[c] $AS_{0,2}$ and $AS_{0,8}$ are useful.

[d] If aggregates are used in 'visual' concrete the presence of light weight contaminators or soluble iron components has to be determined according to EN 1744-1, clause 14.

[e] All particles with an apparent particle density (ρ_a) ≥ 2,10 Mg/m^3.

[f] Although EN 196-21:1989 is replaced with EN 196-2:2005, NEN 5905:2005 refers to NEN-EN 96-21:1993 (See 'Location of requirements' given above).

Table A.11 — Requirements in NORWAY

Location of requirements: NS-EN 12620: National Annex and NS-EN 206-1: National Annex		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	Requirements of 4.3 apply
Graded coarse aggregate categories	Table 3	do
All-in aggregate	4.3.5	do
Flakiness Index categories	Table 8	To be declared according to T8
Shape Index categories	Table 9	NR
Shell content categories	Table 10	< 10 %
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	To be declared according to T11
Fines content categories	Table 11	To be declared according to T11
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	F_1, and alternative method
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	To be declared according to T20
Drying shrinkage not greater than 0.075%	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	6.4.1 apply

Table A.12 — Requirements in PORTUGAL

Location of requirements: LNEC E 467: Guia para a utilização de agregados em betões de ligantes hidráulicos (LNEC E 467: Guide for the use of aggregates in concrete)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	$\leq FI_{50}$
Shape Index categories	Table 9	NR
Shell content categories	Table 10	$\leq SC_{10}$
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	$\leq f_4$, $\leq f_{16}$, $\leq f_{11}$,$\leq f_{22}$
Los Angeles categories	Table 12	$\leq LA_{50}$
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	M_{DE} (≤ 35)
Resistance to polishing categories	Table 15	$\geq PSV_{44}$
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	$\leq F_4$
Magnesium sulfate categories	Table 19	$\leq MS_{35}$
Acid-soluble sulfate categories	Table 20	$\leq AS_{0,2}$ $\leq AS_1$ (slags)
Drying shrinkage not greater than 0,075 %	5.7.2	All aggregates, except fillers
Lightweight organic contaminators	6.4.1 and annex G.4	Annex G.4 is mandatory
NOTE There are other requirements in LNEC E 467.		

Table A.13 — Requirements in SLOVAKIA

Location of requirements: STN EN 206-1/Zmena 1: Concrete — Part 1: specification, performance, production and conformity supplements EN 206-1 with the national provisions STN 731210: Water-proof concrete and concrete types of the specific characteristics (Resistance to abrasion, Concrete for the massive constructions — low hydrating warmth)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	No, but we suggest LA_{30} to be used for the concrete resistant to abrasion
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	F2 for XF1 F1 for XF3
Magnesium sulfate categories	Table 19	MS_{25} for XF2 MS_{18} for XF4
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	NR

Table A.14 — Requirements in SLOVENIA

Location of requirements: SIST 1026: Beton — 1.del: Specifikacija, lastnosti, proizvodnja in skladnost — Pravila za uporabo SIST EN 206-1 (SIST 1026: Concrete — Part 1: Specification, performance, production and conformity — Rules for the implementation of SIST EN 206-1)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	NR
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	NR

Table A.15 — Requirements in SWEDEN

Location of requirements: SS 13 70 03: Betong — Användning av EN 206-1 I Sverige (Concrete — Application of EN 206-1 in Sweden)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	Declared
Graded coarse aggregate categories	Table 3	Declared
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR. If the aggregate comes from the sea then SC_{10}
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	Declared
Fines content categories	Table 11	If fines > 3 % of natural graded 0/8 a test is required
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	If specified
Freeze-thaw resistance categories	Table 18	If water -absorption< 1 % FNR, MS NR If water-absorption > 1 % F1 or MS18
Magnesium sulfate categories	Table 19	NR
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	NR
Lightweight organic contaminators	6.4.1 and annex G.4	For aggregates from a source not used before the performance shall be evaluated.

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Table A.16 — Requirements in SWITZERLAND

Location of requirements: SN 670 102a-NA: Gesteinskörnungen für Beton (Aggregates for concrete) [4] SN 670 115: Qualitative und quantitative Mineralogie und Petrographie von Gesteinskörnungen (Qualitative and quantitative mineralogy and petrography of aggregates) [5] SN 670 116: Qualitative und quantitative Mineralogie und Petrographie von Gesteinskörnungen von Füllern (Qualitative and quantitative mineralogy and petrography of fillers)		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	$G_C85/20$, $G_C90/15$
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	G_A85
Flakiness Index categories	Table 8	$FI_{declared}$
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	$f_{1,5}$, $f_{declared}$ f_{11}, $f_{declared}$
Fines content categories	Table 11	$f_{declared}$
Los Angeles categories	Table 12	NR
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR; PSV_{44} (roads)
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	[4], [5]
Magnesium sulfate categories	Table 19	[4], [5]
Acid-soluble sulfate categories	Table 20	$AS_{0,8}$
Drying shrinkage not greater than 0,075 %	5.7.2	[4], [5]
Lightweight organic contaminators	6.4.1 and annex G.4	NR

Table A.17 — Requirements in UNITED KINGDOM

Location of requirements: BS 8500: Concrete — Complementary British Standard to BS EN 206-1 Part 2: Specification for constituent materials and concrete, sub-clause 4.3		
Aggregate categories	**EN 12620 table**	**Requirement (use NR if no national requirement)**
Coarse aggregate grading categories	Table 2	NR
Graded coarse aggregate categories	Table 3	NR
All-in aggregate	4.3.5	NR
Flakiness Index categories	Table 8	NR
Shape Index categories	Table 9	NR
Shell content categories	Table 10	NR
Fines content categories for coarse aggregate, natural graded 0/8 mm aggregate, all-in aggregate and fine aggregate	Table 11	NR
Fines content categories	Table 11	NR
Los Angeles categories	Table 12	LA_{40} [a]
Resistance to impact categories	Table 13	NR
Resistance to wear categories	Table 14	NR
Resistance to polishing categories	Table 15	NR
Resistance to surface abrasion (AAV) categories	Table 16	NR
Resistance to abrasion by studded tyres	Table 17	NR
Freeze-thaw resistance categories	Table 18	[b]
Magnesium sulfate categories	Table 19	[b]
Acid-soluble sulfate categories	Table 20	NR
Drying shrinkage not greater than 0,075 %	5.7.2	Yes
Lightweight organic contaminators	6.4.1 and annex G.4	NR

[a] Weaker aggregates are permitted if proof of adequate performance is provided.

[b] In exposure classes XF3 and XF4, freeze-thaw resisting aggregates are required

Tabelle NAD 6 — Mindestanforderungen an Gesteinskörnungen bei den verschiedenen Umweltklassen bzw. empfohlene Betonsorten (sämtliche Bezeichnungen und sonstige Festlegungen für die Gesteinskörnungen entsprechen ÖNORM B 3131)

Anforderung an Gesteinskörnung	X0	XC1	XC2	B1, XC3	B4, B8, B9 XC4	XD1, XD2	XD3	B2, B10 – B12, XF1	B5, XF2	B3, XF3	B7, XF4	XA1L	B6, XA2L	XA3L	XA1T	XA2T	XA3T	XM1	XM2	XM3
Kornrohdichte	angegebener Wert ± 30 kg/m³																			
Kornzusammensetzung > 4 mm	G_A90			G_C90/15, G_C85/20																
Kornzusammensetzung ≤ 4 mm	G_F85			G_F85, Kategorie gemäß Tabelle C.1 der ÖNORM EN 12620:2003																
Kornform	SI_{NR}			SI_{40}																
Muschelschalengehalt	SC_{10}																			
Gehalt an Feinteilen grob	$f_{1,5}$																			
Gehalt an Feinteilen fein	f_{16}			f_{10} (bei max. 5 % Feinanteil: siehe ÖNORM B 3131:2003, Tabelle 1, Fußnote 2)																
Gehalt an Feinteilen in 0/8	f_{10}			Verwendung von Körnung 0/8 nicht zulässig																
Gehalt an Feinteilen Korngemisch	f_{11}			Verwendung von Korngemischen nicht zulässig																
Widerstand gegen Zertrümmerung	LA_{NR}																	LA_{20} [a]		
Widerstand gegen Verschleiß	M_{DE}NR																			
Widerstand gegen Polieren	PSV_{NR}																	PSV_{50}		
Widerstand gegen Oberflächenabrieb	AAV_{NR}																			
Widerstand gegen Abrieb Spike	A_NNR																			
Frost-Tau-Widerstand bei > 4 mm	F_{NR}			F_2					F_1	F_2	F_1	F_2								
Frost-Tau-Widerstand bei ≤ 4mm [f]	F_{NR}							F_1				F_{NR}								
Raumbeständigkeit Schwinden	vergleiche ÖNORM B 3131, im Allgemeinen kein Nachweis erforderlich																			
Alkali- Kieselsäure- Reaktivität	vergleiche 5.2.3.4																			
wasserlösliches Chlorid	chloridfrei (≤ 0,01 %)																			
säurelösliches Sulfat	$AS_{0,8}$																			
Erstarrungsverhalten	keine Beeinträchtigung gemäß ÖNORM EN 12620:2003, Abschnitt 6.4.1																			
CO_2 – Gehalt bei ≤ 4 mm	keine Anforderung												15 %[b]	2 %	keine Anforderung			c	d	e

[a] Vvergleiche 5.5.6
[b] Vergleiche …
[c] Siehe, Fußnote 14a)
[d] Siehe, Fußnote 14b)
[e] Siehe, Fußnote 14c)
[f] Nachweis gemäß ÖNORM B 3303:2002, Abschnitt 9.2

Annex B

Limiting values

Annex B contains a summary of national limiting values and permitted cement types.

Table B.1 — Summary of national recommendations for exposure class XC1 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C20/25	0,65	260	√																										
AT		NR	0,70	260	√	√	√			√	√		√		√	√			√*			√*		√*	√*	√*					
BE	15	C16/20	0,65	260	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C20/25	0,65	260	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√					
DK	10	C12/15	NR	NR	√*					√*			√*	√*	√*				√*					√*							
FI	10	C20/25	NR	200	√	√	√			√				√	√	√			√					√	√	√					
FR		C20/25	0,65	260*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	10	C16/20	0,75	240	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	x	√	√	√	√1)	√	√	x	x	√2)	√3)	√4)
IE	15	C25/30	0,65	280	√																										
IT	10	C25/30	0,60	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	10*	C20/25	0,70	240	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	x	x	x	x
NL	15	NR	0,65	260	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	15* or φ	NR	0,60	250	√	√	√			√			√																		
PT	15	C25/30	0,65	240	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,65	260												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK		C20/25	0,65	260	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√		√	√					
SE	10	C12/15	0,90	NR	√	√	√			√				√	√	√			√					√	√						
CH	20	NR	0,65	280	√	√	√							√	√*								√		√	√					

Table B.1 (*continued*)

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
UK	15	C20/25	0,70	240*	√	√	√			√			√	√		√			√						√	√		√*	√*		
		NR to C25/30	NR to 0,60	NR to 300																											

√ Permitted for this exposure class

x Not permitted for this exposure class

NR No requirement

(blank) No guidance provided

* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:

1) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T; S-LL; D-LL; P-LL; V-LL; T-LL)

2) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)

3) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043

4) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043

Table B.2 — Summary of national recommendations for exposure class XC2 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C25/30	0,60	280	√																										
AT		NR	0,65	260	√	√	√			√	√		√		√	√			√*			√*		√*	√*	√)					
BE	25	C20/25	0,60	280	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C25/30	0,60	280	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DK	20	C25/30	0,55	150	√*					√*			√*	√*					√*												
FI	20*	C25/30	NR	230	√	√	√			√				√	√	√			√					√	√	√					
FR		C20/25	0,65	260*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	20	C16/20	0,75	240	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
IE	25	C28/35	0,60	300	√																										
IT	10	C25/30	0,60	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	20*	C20/25	0,70	240	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	x	x	x	x
NL	25*	NR	0,60	280	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	25*	NR	0,60	250	√	√	√			√			√																		
PT	15	C25/30	0,65	240	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,65	260												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK		C25/30	0,60	280	√	√	√	√	√	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
SE	20	NR	0,60	200	√	√	√			√				√	√	√			√					√	√						
CH	35	NR	0,65	280	√	√	√							√	√*								√		√	√					
UK	25	C25/30	0,65	260*	√	√	√			√			√	√		√			√						√	√		√*	√*		
		NR to C28/35	NR to 0,55	150 to 300																											

√	Permitted for this exposure class
x	Not permitted for this exposure class
NR	No requirement
(blank)	No guidance provided
*	Indicates that there are qualifications, e.g. types of main constituents.
NOTE	The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Table B.3 — Summary of national recommendations for exposure class XC3 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C30/37	0,55	280	√																										
AT		NR	0,60	280	√	√	√			√	√		√		√	√			√			√*		√*	√*	√*					
BE	25	C25/30	0,55	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C30/37	0,55	280	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
DK	20	C25/30	0,55	150	√*					√*			√*	√*					√*												
FI	25*	C25/30	NR	250	√	√	√			√				√	√	√			√					√	√	√					
FR		C25/30	0,60	280*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	20	C20/25	0,65	260	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	25	C30/37	0,55	320	√																										
IT	10	C28/35	0,55	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	20*	C25/30	0,60	280	√	√	√			√		√	√	√	√	√									√	√		x	x	x	x
NL	25*	NR	0,55	280	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	25*	NR	0,60	250	√	√	√			√			√																		
PT	25	C30/37	0,60	280	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,55	300												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK		C30/37	0,55	280	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
SE	15	NR	0,55	200	√	√	√			√				√	√	√			√					√	√						
CH	35	NR	0,60	280	√	√	√							√	√*								√		√	√					
UK	25*	C32/40	0,55	300	√	√	√			√			√	√		√			√						√	√		√*			
		C40/50	0,45	340																									√*		
		NR to C32/40	NR to 0,45	150 to 340																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR (blank) No requirement / No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (*m*/*m*)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043

Table B.4 — Summary of national recommendations for exposure class XC4 for an intended working life of at least 50 years

CEN member	Minimal cover mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C30/37	0,50	300	√																										
AT		NR	0,50	300	√	√	√			√	√		√		√	√			√			√*		√*	√*	√*					
BE	30	C30/37	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C30/37	0,50	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
DK	20	C25/30	0,55	150	√*					√*			√*	√*					√*												
FI	25*	C28/35	NR	270	√	√	√			√				√	√																
FR		C25/30	0,60	280*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	25	C25/30	0,60	280	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	30	C30/37	0,55	320	√																										
IT	15	C32/40	0,50	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	25*	C25/30	0,60	280	√	√	√			√		√	√	√	√	√									√	√		x	x	x	x
NL	25*	NR	0,50	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	25*	NR	0,60	250	√	√	√			√			√																		
PT	30	C30/37	0,60	280	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,55	300												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK		C30/37	0,50	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
SE	15	NR	0,55	200	√*	√*	√*			√*				√*	√*																
CH	40	NR	0,50	300	√	√	√							√	√*										√	√					
UK	25*	C32/40	0,55	300	√	√	√			√			√	√		√			√						√	√		√*			
		C40/50	0,45	340																									√*		
		NR to C32/40	NR to 0,45	150 to 340																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (*m*/*m*)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043

Table B.5 — Summary of national recommendations for exposure class XD1 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C30/37	0,55	300	√																										
AT		NR	0,55	300	√	√	√			√	√		√		√	√			√			√*		√*	√	√*					
BE	35	C30/37	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C30/37	0,55	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
DK	30	C35/45	0,45	150	√*					√*			√*	√*																	
FI	30*	C28/35	0,55	300	√	√	√			√				√	√	√			√					√	√	√					
FR		C25/30	0,60	280*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	40	C30/37 6)	0,55	300	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C30/37	0,55	320	√																										
IT		C28/35	0,55	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	40*	C30/37	0,55	300	√	√	√			√		√	√	√	√	√									√	√		x	x	x	x
NL	30-40*	NR	0,55	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	40*	NR	0,45	300	√	√	√			√						√			√						√						
PT	35	C30/37	0,55	320			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C40/50	0,45	360	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SK		C30/37	0,55	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
SE	25*	NR	0,45	200	√*	√*	√*			√*				√*	√*																
CH	40	NR	0,50	300	√	√	√							√	√*										√	√					
UK	35	C28/35	0,60	300	√	√	√			√			√	√		√			√						√	√	√	√*	√*		
		NR to C40/50	0,60 to 0,45	150 to 360																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) With the use of AEA: One strength class lower

Table B.6 — Summary of national recommendations for exposure class XD2 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C30/37	0,55	300	√																										
AT		NR	0,55	300	√	√	√			√	√		√		√	√			√			√*		√*	√	√*					
BE	40	C30/37	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C30/37	0,55	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√	√				
DK	40	C40/50	0,40	150	√*					√*																					
FI	35*	C28/35	0,55	300	√	√	√			√				√	√																
FR		C30/37	0,55	330	√	√	√	√		√			√*	√*	√*	√								√*	√	√	√			√	√
DE	40	C35/45 6)	0,50	320 7)	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C35/45	0,50	360	√																										
IT		C32/40	0,50	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	40*	C30/37	0,55	300	√	√	√			√		√	√	√	√	√									√	√		x	x	x	x
NL	30-40*	NR	0,50	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	40*	NR	0,40	330	√*	√	√			√						√			√						√						
PT	40	C30/37	0,55	320			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C40/50	0,45	360	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SK		C30/37	0,55	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√	√				
SE	30*	NR	0,45	200	√*	√*	√*			√*				√*	√*																
CH	55	NR	0,50	300	√	√	√							√	√*										√	√					
UK	35*	C32/40	0,50	340	√	√	√			√			√	√		√															
		C28/35	0,50	340															√						√	√		√*			
		C25/30	0,50	340																											
		NR to C40/50	0,55 to 0,40	150 to 360																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) With the use of AEA or slow/very slow concrete (r < 0,3): One strength class lower
7) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³

Table B.7 — Summary of national recommendations for exposure class XD3 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C35/45	0,45	320																											
AT			0,45	320	√	√	√			√	√		√		√	√			√			√*		√*	√	√*					
BE	45	C35/45	0,45	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ		C35/45	0,45	320	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
DK	40	C40/50	0,40	150	√*					√*																					
FI	40*	C35/45	0,45	320	√	√	√			√				√	√																
FR		C35/45	0,50	350	√	√	√	√		√			√*	√*	√*	√								√*	√	√	√			√	√
DE	40	C35/45 6)	0,45 8)	320 7)	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C40/50	0,45	400	√																										
IT		C35/45	0,45	360	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	40*	C35/45	0,45	340	√	√	√			√		√	√	√	√	√									√	√		x	x	x	x
NL	30-40*	NR	0,45	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	40*	NR	0,40	330	√*	√	√			√						√			√						√						
PT	45	C35/45	0,45	340			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C50/60	0,40	380	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SK		C35/45	0,45	320	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√					
SE	35*	NR	0,40	200	√*	√*	√*			√*				√*	√*																
CH	55	NR	0,45	320	√	√	√							√	√*										√	√					
UK	45*	C40/50	0,40	380	√	√	√			√			√	√		√															
		C32/40	0,45	360															√						√	√		√*			
		C28/35	0,45	360																											
		NR to C50/60	0,50 to 0,40	150 to 400																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) With the use of AEA: One strength class lower
7) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³
8) Max. w/c-ratio 0,50 if a minimum content of FA (20 % by mass of (z + f)) is used or if cement CEM II/B-V, CEM III/A, CEM III/B is used for massive concrete structures with a smallest dimension of 0,80 m.

Table B.8 — Summary of national recommendations for exposure class XS1 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C30/37	0,50	300	√																										
BE	35	C30/37	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
DK	30	C35/45	0,45	150	√*					√*			√*	√*																	
FI	30*	C32/40	0,50	300	√	√	√			√				√	√	√			√					√	√	√					
FR		C30/37	0,55	330	√*	√*	√*	√*		√*			√*	√*	√*	√*								√*	√*	√	√			√	√
DE	40	C30/37 6)	0,55	300	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C30/37	0.55	320	√																										
IT		C32/40	0,50	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
NL	30-40*	NR	0,50	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	40*	NR	0,45	300	√	√	√			√						√			√						√						
PT	35	C30/37	0,55	320			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C40/50	0,45	360	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SE	25*	NR	0,45	200	√*	√*	√*			√*				√*	√*																
UK	35*	C35/45	0,45	360	√	√	√			√			√	√		√															
		C32/40	0,45	360															√						√	√		√*			
		C25/30	0,50	340																											
		NR to C40/50	0,55 to 0,45	150 to 360																											

√ Permitted for this exposure class — NR No requirement — * Indicates that there are qualifications, e.g. types of main constituents.

x Not permitted for this exposure class — (blank) No guidance provided

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) With the use of AEA: One strength class lower

Table B.9 — Summary of national recommendations for exposure class XS2 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C35/45	0,45	320	√																										
BE	40	C35/45	0,45	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
DK	35	C35/45	0,45	150	√*					√*			√*	√*																	
FI	35*	C35/45	0,45	320	√	√	√			√				√	√																
FR		C30/37	0,55	330	√*	√*	√*	√*		√*			√*	√*	√*	√*								√*	√*	√	√			√	√
DE	40	C35/45 6)	0,50	320 7)	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C35/45	0,50	360	√																										
IT		C35/45	0,45	360	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
NL	30-40*	NR	0,45	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	40*	NR	0,40	330	√*	√	√			√						√			√						√						
PT	40	C30/37	0,55	320			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C40/50	0,45	360	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SE	40*	NR	0,45	200	√*	√*	√*			√*				√*	√*																
UK	35*	C32/40	0,50	340	√	√	√			√			√	√		√															
		C28/35	0,50	340															√						√	√		√*			
		C25/30	0,50	340																											
		NR to C40/50	0,55 to 0,40	150 to 360																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) For air entrained concrete designed for exposure to freeze/thaw attack (XF) or slow/very slow concrete (r < 0,3): One strength class lower
7) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³

Table B.10 — Summary of national recommendations for exposure class XS3 for an intended working life of at least 50 years

CEN member	Minimal cover, mm	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1		C35/45	0,45	340	√																										
BE	45	C35/45	0,45	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
DK	40	C40/50	0,40	150	√*					√*																					
FI	40*	C35/45	0,45	320	√	√	√			√				√	√																
FR		C35/45	0,50	350	√*	√*	√*	√*		√*			√*	√*	√*	√*								√*	√*	√	√			√	√
DE	40	C35/45 6)	0,45 8)	320 7)	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	45	C40/50	0,45	400	√																										
IT		C35/45	0,45	360	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
NL	30-40	NR	0,45	320*	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	50*	NR	0,40	330	√*	√	√			√						√			√						√						
PT	45	C35/45	0,45	340			√				X	X				√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
		C50/60	0,40	380	√	√		√	√	√	x	x	√	√	√					x	x	x	x				x				
SE	35*	NR	0,40	200	√*	√*	√*			√*				√*	√*																
UK	45*	C45/55	0,35	380	√	√	√			√			√	√		√															
		C32/40	0,45	360															√						√	√		√*			
		C28/35	0,45	360																											
		NR to C50/60	0,50 to 0,35	150 to 400																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (*m*/*m*)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) A strength class lower shall be used for air entrained concrete designed for exposure to freeze/thaw attack (XF).
7) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³
8) Max. w/c-ratio 0,50 if a minimum content of FA (20 % by mass of (z + f)) is used or if cement CEM II/B-V, CEM III/A, CEM III/B is used for massive concrete structures with a smallest dimension of 0,80 m.

Table B.11 — Summary of national recommendations for exposure class XF1 for an intended working life of at least 50 years

CEN member	Comp. strength class	Air entrainment required	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C30/37	No	0,55	300	√																										
AT	NR	No	0,55	300	√	√	√			√	√*		√		√	√			√			√*		√*	√	√*					
BE	C25/30	No	0,55	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ	C30/37	No	0,55	300	√	√	√	√	√	√		√		√		√	√	√	√		√				√	√*					
DK	C25/30	Yes	0,55	150	√*					√*			√*	√*					√*												
FI	**	No	0,60	270	√	√	√			√				√	√	√									√	√					
FR	C25/30	No	0,60	280*	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	C25/30	No	0,60	280	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	C28/35	No	0,60	300	√																										
IT	C32/40	No	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	NR	No	0,60	280	√	√	√			√		√	√	√	√*	√									√	√		x	x	x	x
NL	NR	No	0,55	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	NR	No	0,60	250	√	√	√			√			√																		
PT	C30/37	No	0,60	280	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,55	300												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK	C20/25	No*	0,60	300	√	√	√	√	√	√		√		√		√	√	√	√		√				√	√					
SE	NR	No	0,60	200	√*	√*	√*			√*				√*	√*	√*			√*					√*							
CH	NR	No	0,50	300	√	√	√							√	√*										√	√					
UK	C28/35	No	0,60	280	√	√	√			√			√	√		√			√						√	√		√*	√*		
	NR to C32/40		0,60 to 0,50	NR to 300																											

√ Permitted for this exposure class — NR No requirement — * Indicates that there are qualifications, e.g. types of main constituents.

x Not permitted for this exposure class — (blank) No guidance provided — ** F-factor and testing

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043

Table B.12 — Summary of national recommendations for exposure class XF2 for an intended working life of at least 50 years

CEN member	Comp. strength class	Air entrainment required	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C25/30	Yes	0,55	300	√																										
AT	NR	Yes	0,50	320	√	√	√*			√	√*		√		√	√			√*			√*		√*	√*	√*					
BE	C30/37 C20/25	No Yes	0,50 0,55	320 300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
CZ	C25/30	Yes	0,55	300	√	√	√					√		√		√					√				√	√*				
DK	C35/45	Yes	0,45	150	√*					√*			√*	√*																	
FI	**	Yes	**	**	√	√	√			√				√	√																
FR	C25/30	Yes	0,55	300	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	C25/30	Yes	0,55	300	√	√	√	x	x	x	x	√	x	√	√1)	√	x	x	x	x	√	x	x	√2)	√	√	x	x	x	x	x
	C35/45 3)	No	0,50	320 4)																											
IE	C30/37	Yes*	0,55	320	√																										
IT	C25/30	Yes	0,50	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	C30/37	No	0,50	320	√	√										√												x	x	x	x
NL	NR	Yes	0,55	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	NR	Yes	0,45	300	√		√			√																					
PT	C30/37	Yes	0,55	280	√	√	√	√	√	√	x	x	√	√	√					x	X					X	X				
			0,50	300												√	√	√	√	x	x	√	√	√	√*	x	x	√	√*	√	√*
SK	C25/30	No*	0,55	300	√	√	√					√		√		√					√				√	√					
SE	NR	Yes	0,45	200	√*	√*	√*			√*				√*	√*																
CH	NR	Yes	0,50	300	√		√																								
UK	C32/40	No	0,55	300	√	√	√			√			√	√		√			√						√	√		√*	√*		
	NR to C35/45		NR to 0,45	NR to 340																											

√ Permitted for this exposure class — NR No requirement — * Indicates that there are qualifications, e.g. types of main constituents.

x Not permitted for this exposure class — (blank) No guidance provided — ** P-factor and testing

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany: 1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL)

2) Applicable: CEM II/B-M (S-D; S-T; D-T)

3) With slow/very slow concrete (r < 0,3): One strength class lower

4) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³

Table B.13 — Summary of national recommendations for exposure class XF3 for an intended working life of at least 50 years

CEN member	Comp. strength class	Air entrainment required	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C30/37	Yes	0,50	320	√														√			√*		√*	√	√*					
AT	NR	Yes	0,55	300	√	√	√*			√	√		√		√	√			√			√*		√*	√	√*					
BE	C30/37	No	0,50	320	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
	C20/25	Yes	0,55	300																											
CZ	C30/37	Yes	0,50	320	√	√	√	√	√	√		√		√		√	√	√	√		√				√	√*					
DK	C35/45	Yes	0,45	150	√*					√*			√*	√*																	
FI	**	Yes	0,50	300	√	√	√			√				√	√	√									√	√					
FR	C30/37	Yes	0,55	315	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
DE	C25/30	Yes	0,55	300	√	√	√	√	√	√	x	√	x	√	√1)	√	√	√	x	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
	C35/45 6)	No	0,50	320 7)																											
IE	C30/37	Yes*	0,55	320	√																										
IT	C25/30	Yes	0,50	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	C30/37	No	0,50	320	√	√	√			√		√	√	√	√	√*									√	√		x	x	x	x
NL	NR	No	0,50	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	NR	Yes	0,45	300	√		√			√																					
SK	C30/37	No*	0,50	320	√	√	√	√	√	√		√		√		√	√	√			√				√	√					
SE	NR	Yes	0,55	200	√*	√*	√*			√*				√*	√*																
CH	NR	Yes	0,50	300	√	√	√							√	√*										√						
UK	C25/30	Yes	0,60	280	√	√	√			√			√	√		√			√						√	√		√*			
	C40/50	No	0,45	340																											
	NR to C40/50		0,60 to 0,45	NR to 340																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.
** F-factor and testing

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) With slow/very slow concrete (r < 0,3): One strength class lower
7) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³

Table B.14 — Summary of national recommendations for exposure class XF4 for an intended working life of at least 50 years

CEN member	Comp. strength class	Air entrainment required	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C30/37	Yes	0,45	340	√																										
AT	NR	Yes	0,45	340	√	√	√*			√	√*		√		√	√			√*			√*		√*	√*	√*					
BE	C35/45	No	0,45	340	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√			√*	
	C25/30	Yes	0,50	320																											
CZ	C30/37	Yes	0,45	340	√	√	√					√		√		√					√				√	√*					
DK	C40/50	Yes	0,40	150	√*					√*																					
FI	**	Yes	**	**	√	√	√			√				√	√																
FR	C30/37	Yes	0,45	340	√*	√*	√*	√*		√*			√*	√*	√*	√*								√*	√*	√	√			√	√
DE	C30/37	Yes	0,50 3)	320	√	√	√	x	x	x	x	√	x	√	√1)	√	x	x	x	x	√	x	x	√2)	√*	√*	x	x	x	x	x
IE	C40/50	No	0,45	400	√																										
IT	C28/35	Yes	0,45	360	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
LU	C30/37	Yes	0,50	340	√	√										√												x	x	x	x
NL	NR	Yes	0,50	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	NR	Yes	0,45	300	√		√			√																					
SK	C30/37	No*	0,45	340	√	√	√					√		√		√					√				√						
SE	NR	Yes*	0,45	200	√*					√*				√*																	
CH	NR	Yes	0,45	340	√		√																								
UK	C28/35	Yes	0,55	300	√	√	√			√			√	√		√			√						√	√		√*			
	C40/50	No	0,45	340																											
	NR to C40/50		NR to 0,40	NR to 400																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.
** P-factor and testing

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany: 1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T)
3) Earth-moist (stiff) concrete w/c ≤ 0,40 without air entrainment

Table B.15 — Summary of national recommendations for exposure class XA1 for an intended working life of at least 50 years

CEN member	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C30/37	0,55	300	√																										
AT	NR	0,45	300	√*	√*	√*			√*					√*										√	√					
BE	C25/30	0,55	300	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*			√*	
CZ	C30/37	0,55	300	√	√	√	√	√	√		√	√	√		√	√	√	√		√				√	√	√				
DK	C25/30	0,55	150	√*					√*			√*	√*					√*												
FI	C32/40	0,50	300	√	√	√			√				√	√	√			√					√	√	√					
FR	C30/37	0,55	330	√*	√*	√*	√*		√*			√*	√*	√*	√*								√*	√*	√	√			√	√
DE	C25/30	0,60	280	√	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√	x	x	√3)	√4)	√5)
IE	C30/37	0,55	320 280	√ SR																										
IT	C28/35	0,55	320	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
LU	C25/30	0,60	320	√	√	√			√		√	√	√	√*	√									√	√		x	x	x	x
NL	NR	0,55	300	√	√	√*	√*	√*	√	√*	√*	√*	√*	√*	√	√*	√*	√	√*	√	√*	√*	√*	√	√	√*	√*	√*	√*	√*
NO	NR	0,45	300	√	√	√			√						√			√						√						
PT	C30/37	0,55	320			√				X	X		x	x	√	√	√	√	X	X	X	X	√	√	√	X	√	√	√	√
	C35/45	0,50	340	√	√		√	√	√	x	x	√	x	x					x	x	x	x				x				
SK	C16/20	0,55*	300	√*	√*	√*	√*	√*	√*		√*	√*	√*		√*	√*	√*	√*		√*				√*	√*	√*				
SE	NR	0,50	200	√*	√*	√*			√*				√*	√*	√*			√*					√*	√*	√*					
UK	NR	0,55	320															√*						√*	√*			√*		
	NR	0,50	340	√	√	√			√			√*	√*		√															
	NR	0,45	360									√*	√*																	
	NR	0,40	380																											
	NR to C35/45	0,60 to 0,40	150 to 380																											

√ Permitted for this exposure class
x Not permitted for this exposure class
NR No requirement
(blank) No guidance provided
* Indicates that there are qualifications, e.g. types of main constituents.

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (*m*/*m*)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043

Table B.16 — Summary of national recommendations for exposure class XA2 for an intended working life of at least 50 years

CEN member	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C30/37	0,50	320	√*																										
AT				√*	√*	√*			√*					√*																
BE	C30/37	0,50	320	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*			√*	
CZ	C30/37	0,50	320	√*	√*	√*	√*	√*	√*		√*				√*	√*	√*	√*		√*				√*	√*	√*				
DK	C35/45	0,45	150	√*					√*			√*	√*																	
FI	C35/45	0,45	320	√*	√*	√*			√*					√*	√*								√*	√*	√*					
FR	C35/45	0,50	350	√*	√*		√*		√*					√*	√*									√*	√	√			√	√
DE 6)	C35/45 7)	0,50	320 8)	√*	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√*	√*	x	√3)	√4)	√5)
IE	C35/45	0,50	360 320	√* SR																										
IT	C32/40	0,50	340	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
LU	C30/37	0,50	320	√*	√*				√*						√*									√*	√*		x	x	x	x
NL	NR	0,50	320	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
NO	NR	0,45	300	√*	√*	√*			√*						√*			√*						√*						
PT	C35/45	0,50	340			√*				X	X		x	x	√*	√*	√*	√*	X	X	X	X	√*	√*	√*	X	√*	√*	√*	√*
	C40/50	0,45	360	√*	√*		√*	√*	√*	x	x	√*	x	x					x	x	x	x				x				
SK	C16/20	0,50*	320	√*	√*	√*	√*	√*	√*		√*	√*	√*		√*	√*	√*	√*		√*				√*	√*	√*				
SE	NR	0,45	200	√*	√*	√*			√*				√*	√*	√*			√*					√*	√*	√*	√*				
UK	NR	0,50	340																						√*					
	NR	0,45	360	*√														√*						√*				√*		
	NR	0,40	380																											
	NR to C40/50	0,50 to 0,40	150 to 380																											

Comment: The * against cement type in general indicates that the national requirements specify sulfate-resisting cement where the aggressive species is sulphate

√ Permitted for this exposure class — NR No requirement — * Indicates that there are qualifications, e.g. types of main constituents.

x Not permitted for this exposure class — (blank) No guidance provided

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.

Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) If sulfate attack applies, SR cements (CEM I-SR, CEM III/B(-SR), CEM III/C(-SR)) have to be used
7) For air entrained concrete designed for exposure to freeze/thaw attack (XF) or slow/very slow concrete (r < 0,3): One strength class lower
8) The minimum cement content of massive structures (with a smallest dimension of 0,80 m) shall be 300 kg/m³

Table B.17 — Summary of national recommendations for exposure class XA3 for an intended working life of at least 50 years

CEN member	Comp. strength class	Max. w/c ratio	MCC	CEM I	II/A-S	II/A-D	II/A-P	II/A-Q	II/A-V	II/A-W	II/A-T	II/A-L	II/A-LL	II/A-M	II/B-S	II/B-P	II/B-Q	II/B-V	II/B-W	II/B-T	II/B-L	II/B-LL	II/B-M	III/A	III/B	III/C	IV/A	IV/B	V/A	V/B
EN 206-1	C35/45	0,45	360	√*																										
AT	NR	?	?	√*	√*	√*			√*					√*																
BE	C35/45	0,45	340	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*			√*	
CZ	C35/45	0,45	360	√*	√*	√*	√*	√*	√*		√*				√*	√*	√*	√*		√*				√*	√*	√*				
DK	C40/50	0,40	150	√*					√*																					
FI	C40/50	0,40	330	√*	√*	√*			√*					√*	√*			√*					√*	√*	√*					
FR	C40/50	0,45	385	√*	√*		√*		√*					√*	√*									√*	√	√			√	√
DE 6)	C35/45 7)	0,45	320	√*	√	√	√	√	√	x	√	√	√	√1)	√	√	√	√	x	√	x	x	√2)	√	√*	√*	x	√3)	√4)	√5)
IE	C40/50	0,45	400 360	√* SR																										
IT	C32/40	0,45	360	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
LU	C35/45	0,45	340	√*	√*				√*						√*									√*	√*		x	x	x	x
NL	NR	0,45	340	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*	√*
NO	NR	0,40	330	√*	√*	√*			√*						√*			√*						√*						
PT	C35/45	0,45	360			√*				X	X		x	x	√*	√*	√*	√*	X	X	X	X	√*	√*	√*	X	√*	√*	√*	√*
	C40/50	0,45	380	√*	√*		√*	√*	√*	x	x	√*	x	x					x	x	x	x				x				
SK	C16/20	0,45	360	√*	√*	√*	√*	√*	√*		√*	√*	√*		√*	√*	√*	√*		√*				√*	√*	√*				
SE	NR	0,40	200	√*	√*	√*			√*				√*	√*	√*			√*					√*	√*	√*					
UK	NR	0,45	360																						√*					
	NR	0,40	380	√*														√*						√*			√*			
	NR	0,35	380																											
	NR to C40/50	0,45 to 0,35	150 to 400																											

Comment: The * against cement type in general indicates that the national requirements specify sulfate-resisting cement where the aggressive species is sulphate

√ Permitted for this exposure class NR No requirement * Indicates that there are qualifications, e.g. types of main constituents.
x Not permitted for this exposure class (blank) No guidance provided

NOTE The minimum cover to reinforcement is not part of EN 206-1, but it has been included for information purposes.
Germany:
1) Applicable: CEM II/A-M (S-D; S-T; S-LL; D-T; D-LL; T-LL; S-P; S-V; D-P; D-V; P-V; P-T; P-LL; V-T; V-LL)
2) Applicable: CEM II/B-M (S-D; S-T; D-T; S-P; D-P; P-T; S-V; D-V; P-V; V-T)
3) Applicable: CEM IV/B (P) and valid only for trass according to DIN 51043, used as a main constituent up to a maximum content of 40 % (m/m)
4) Applicable: CEM V/A (S-P) and valid only for trass according to DIN 51043
5) Applicable: CEM V/B (S-P) and valid only for trass according to DIN 51043
6) If sulfate attack applies, SR cements (CEM I-SR, CEM III/B(-SR), CEM III/C(-SR)) have to be used
7) With slow/very slow concrete (r < 0,3): One strength class lower

Annex C

Use of Ground Granulated Blastfurnace Slag

This Annex provides information about the use of ground granulated blastfurnace slag (Ggbs) as a type II addition in concrete to EN 206-1 in different CEN Member Countries.

Table C 1 — This Annex provides information about the use of ground granulated blastfurnace slag (Ggbs) as a type II addition in concrete to EN 206-1 [a]

CEN Member Countries	Types of cement used with ggbs	Maximum permitted percentage of ggbs [b]	Percentage of ggbs normally used [b]	'k-value' for ggbs	Ggbs taken into account for minimum cement content	Source of reference for provisions for the use of ggbs	Use of ggbs as a separate addition	
							Tonnes per year are currently used	Ggbs used since/for
Austria	CEM I	25	Unknown	0,4	MCC may be reduced by k*ggbs	ÖNORM B 4710-1:2007	Unknown	
	CEM II/A	15 - 20						
	CEM II/B	0 -10						
Belgium	CEM I	Normally 30% and 15% for XS1, XS2, XS3, XD2, CD3, XF4, 0% for XA3.	30 %	0,9	By applying a k-factor in the limits defined in column 3	ATG 04/2609 and also in the National Annex to EN 206-1	Unknown	Since 2002
Czech Republic	CEM I, CEM II	Not specified	25 – 45 %	Not used	Individually according to initial tests [EN 206-1, 5.2.5.3.]	None	90 000	4 years
Finland	CEM I, CEM II	80%	25 to 50%	0.8 1.0 in XA, XF1 and XF3	MCC may be reduced by k*ggbs	National Annex to EN206-1	30,000	25 years
France	CEM I	normally 30% 15% for XS1, XS2, XS3, XD2, XD3 XF4 0% for XA3	30%	0.9	By applying a k factor of 0.9, in the limits defined in column 3	National Annex to EN206-1	Unknown	Unknown
Germany	Not allowed	----	----	----	----	Under development	0	Not used

Table C.1 (*continued*)

Holland	CEM I + PFA	80%	25-70%	1,0	Fully taken into account	BRL 9325 & BRL 9340, and also in the National Annex to EN 206-1	Unknown	Since 2002.
Ireland [c]	CEMI	70%	70%	1.0	Fully taken into account	National Annex to EN 206-1	Unknown	Since 2004
	CEM II/A-L CEM II/A-LL CEM II/A-V	50%	50%	1.0	Fully taken into account	National Annex to EN 206-1	Unknown	Since 2004
Italy	Not specified	Not specified	Ggbs is not normally used	Not specified	Not specified	Italian Technical Rules for Buildings (DM 14/09/2005) This specifies a generic "equal performance" criteria for concrete.	Not used Ggbs is produced in Italy, but it is mainly exported or used in premix mortars	Not used
Norway	CEM I, CEM II, CEM III	44%	Ggbs is not normally used	0.6	MCC may be reduced by k*ggbs	National Annex to EN206-1	~0	Not used
Poland	Not used	----	----	----	----	----	----	Not used
Spain	Not allowed	----	----	----	----	----	----	Not used
Sweden	CEM I and CEM II	For CEM I: 70 % for X0 60 % for XC1, XC2 0 % for XF4 20 % for other exp.	60 %	0.6	With k-value 0,6	National annex to EN 206-1	5,000	25 years
Switzerland	not allowed	----	----	----	----	----	----	Not used
UK	CEM I	80% (but lower recommendations apply for specific applications)	50%	Counts fully as cement if compliance testing in BS 8500 is satisfied	Counts fully as cement if compliance testing in BS 8500 is satisfied	BS 8500: 'Concrete - Complementary British Standard to EN206-1'	2,000,000	40 years

[a] Does not include any use of ggbs as part of an EN 197-1 cement
[b] Expressed as ggbs/(cement+ggbs)
[c] Response from Ireland is provisional, because Irish National Annex to EN 206-1is still under revision. Revised document is due to be issued in April 2007.

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