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A CRH COMPANY

CONCRETE SPECIFICATION GUIDANCE ON I.S. EN 206: 2013

INTRODUCTION

I.S. EN 206 :2013 -Concrete Specification, Performance, production and Conformity, is the current Irish standard for the specification and production of concrete and should be used in conjunction with the Irish National Annex I.S. EN206:2013/NA:2015. This is an easy-to-use introductory guide to understanding and interpreting the new standard, courtesy of Roadstone, the standard-bearers for excellence in concrete production. Notable changes to the standard include revised requirements for fibre reinforced concrete, recycled aggregates and additions (fly ash & GGBS). The requirements for conformity assessment have also been revised including additional requirements for Self Compacting Concrete and concrete for geotechnical works.

The National annex takes these changes into account for Irish conditions with reduced cement contents for some exposure classes, reduced the slump tolerances and increased the strength class for Freeze Thaw. Alternative equivalent design mixes can now be supplied in place of standard prescribed mixes, if supplied from third party accredited, I.S. EN 206:2013, ready mix concrete producer. See Table NB.2: Alternative Equivalent Design Mixes.

The National Annex also provides specific additional information and responsibilities for the specifier, user and producers in Ireland. Refer to I.S. EN 206 :2013: Tables NA5, NA6 & NA77 (table NC1 to NC6 where the design life & cover are known). The format for specifying and ordering concrete remains the same as that previously specified in I.S. EN206-1: 2002 including compressive strength, consistence and exposure classes.

Compressive Strength Classes

A dual classification has been adapted for compressive strength. The letter "C" is followed by two numbers, the first being the minimum characteristic cylinder strength and the second number is the minimum characteristic cube strength, e.g. 35N is now expressed as C28/35 (see Table 1).

Note: Descriptors for identifying the size of aggregate required. e.g. 20mm aggregate is now described as D20. (14mm = D14, 10mm = D10).

Consistence Classes

The term "workability" is replaced by the term "consistence". The slump is now identified by the letter "S" followed by a number e.g. 75mm slump is now expressed as S2. There are five Consistence Classes (see Table 2).

Table 2. Consistence Classes

Target Slump Range	Consistence Classes
10 - 40mm	S1
50 - 90mm	S2
100 - 150mm	S3
160 - 210mm	S4
220mm+	S5

Refer to Table 3 (Irl). I.S. EN 206.

Exposure Classes

The Exposure Class is very significant. There is now a more complex prescriptive approach to specifying the durability required over the designed life of the concrete. This is determined by the end-use, e.g. concrete in the interior of a building will have a different exposure rating to concrete used in the foundations. The letter "X" denotes the exposure class followed by additional letters and numbers to identify a specific exposure (see Table 3). Other key factors for ordering concrete continue to be the aesthetic finish required, the rate of placement, the method of placement and reinforcement cover etc. The exposure classes are divided into six broad areas.

Note: Concrete can fall into more than one exposure class. in this instance the most onerous exposure class takes precedence and the concrete should be specified to meet the min. strength class, water cement ratio and min cement content of that exposure class (all three requirements have to be met to comply with the Exposure Class).

COMPLIANCE:

Conformity

Conformity is assessed by a series of tests and procedures undertaken by the concrete producer to assure the user/specifier that the delivered concrete conforms to the specified requirements of I.S. EN 206-1.

Identity Testing

On-site testing may be undertaken to verify the concrete characteristic strength requirements are achieved as specified.

Table 1. Compression Strength Classes

Concrete Strength	Strength Classes - Cylinder / Cube
10N	C 8 /10
15N	C 12 / 15
20N	C 16 / 20
25N	C 20 / 25
30N	C 25 / 30
35N	C 28 / 35
37N	C 30 / 37
40 N	C 32 / 40
45N	C 35 / 45
50N	C 40 / 50
55N	C 45 / 55
60N	C 50 / 60

Refer to table NA. 1 Na:2015 to I.S. EN 206 :2015

Table 2A. Slump Tolerance

Specified target slump mm	Not more than the following from the specified target value		Consistence Class
≤40	-30	+30	S1
50 to 90	-40	+40	S2
≥100	-50	+50	S3/S4

Refer to Table NA. 8 of NA:2015 to I.S. EN206:2013

Table 3. Exposure Classes

Refer to Table NA. 5 of NA: 2015 to I.S. EN 206 2013

Class Designation	Description of environment	Informative examples where exposure may occur
No risk of corrosion attack		
XO	For concrete without reinforcement or embedded metal: All exposures except where there is a freeze/thaw, abrasion or chemical attack. For Concrete with reinforced or embedded metal: Very Dry	Concrete inside buildings with very low air humidity
Corrosion induced by carbonation		
XC1	Dry or permanently wet	Concrete inside buildings with low air humidity, e.g. floor slabs. Concrete permanently submerged in water.
XC2	Wet, rarely dry	Concrete surfaces subject to long term water contact, many foundations.
XC3	Moderate humidity	Concrete inside buildings with moderate or high air humidity. External concrete sheltered from rain.
XC4	Cyclic wet and dry	Concrete surfaces subject to water contact, not within exposure class XC2.
Corrosion induced by chlorides		
XD1	Moderate humidity	Concrete surfaces exposed to airborne chlorides.
XD2	Wet, rarely dry	Swimming pools, Concrete exposed to industrial waters containing chlorides.
XD3	Cyclic wet and dry	Parts of bridges exposed to spray containing chlorides, pavements, car park slabs.
Corrosion induced by chlorides from sea air		
XS1	Exposed to airborne salt but not in direct contact with sea water	Structures near to or on the coast.
XS2	Permanently submerged	Parts of marine structures.
XS3	Tidal and spray zones	Parts of marine structures.
Freeze/thaw attack with or without de-icing agents		
XF1	Moderate water saturation without de-icing agent	Vertical concrete surfaces exposed to rain and freezing.
XF2	Moderate water saturation with de-icing	Vertical concrete surfaces of road structures exposed to freezing & agent airborne de-icing agents.
XF3	High water saturation without de-icing agent	Horizontal concrete surfaces exposed to rain and freezing.
XF4	High water saturation, with de-icing agent or sea water	Road and bridge decks exposed to de-icing agents. Concrete surfaces exposed to direct spray containing de-icing agents and freezing. Splash zones or marine structures exposed to freezing.
Chemical attack		
XA1	Slightly aggressive chemical environment according to I.S. EN 206.	
XA2	Moderately aggressive chemical environment according to I.S. EN 206.	
XA3	Highly aggressive chemical environment according to I.S. EN 206.	

Guidance chart for selecting mixes

Exposure	X0	XC1	XC2	XC3	XA1	XS1	XS3	XF1(AE)
(x) Code				XC4		XS2	XD3	XF2(AE)
				XD1		XD2	XF3	XF3(AE)
				XF1		XF2	XF4	XF4(AE)
						XA2	XA3	
Max W/C Ratio		0.65	0.6	0.55	0.5	0.5	0.45	
Min Strength	C12/15	C25/30	C28/35	C30/37	C32/40	C35/45	C40/50	See
Min Cement		270	290	310	340	360	400	Note below

Note:
Air entrained concrete to meet the XF Freeze/ Thaw exposure class

XF1 -C25/30 Air Entrained
XF2 -C30/37 Air Entrained
XF3 -C30/37 Air Entrained
XF4 -C32/40 Air Entrained

The addition a air entrainment to the concrete requires the cement content to be increase to compensate for loss in strength. Air entrained concrete may not be suitable for other exposure classes and applications. Alternative non Air entrained mix which meet the XF exposure class are available as above.

Additional Note:
Alternative XA aggressive chemical environment exposure classes are available with CEM/GGBS combinations. See Table NA.7 of NA:2015 to I.S. EN 206: 2013

Table NB.2 – Alternative equivalent design mix

Standard prescribed mix	Atlernative equivalent mix if supplied from a third party accredited readymix concrete supplier N/mm²
ST1	C12/15
ST2	C12/15
ST3	C12/15
ST4	C16/20

Note: Because these mixes are (equivalent) design mixes, the minimum strength class in Table NA.5 is used for ST1, ST2 and ST3

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