



The Institute of Concrete Technology

Briefing Note

BN 14/1

August 2014

Guide to Changes in BS EN 206:2013

*Produced by Gareth David, AMICT,
of TEMPRA Consulting Services Ltd*

August 2014

Overview

The revised version of BS EN 206 was issued in December 2013. However, this version had editorial errors as well as referencing the 2013 versions of the aggregate standards that were subsequently withdrawn. This meant that BS EN 206 had to be amended and was re-issued on 31st May 2014 incorporating the corrigendum.

This guidance note is intended to highlight the principal changes from the previous version BS EN 206-1:2000, however it does not give detailed interpretation of the changes. Further information and interpretations may be acquired through other documents, such as the ERMCO Guide to EN206:2013.

Where the text has been altered from the previous standard but there is no significant difference in the meaning or intent of the text then this has been referred to as a minor editorial change. Where changes to clause, figure or table numbers has occurred the previous reference number has been included in blue text for ease of cross-referencing. The revised standard has adopted a new policy of numbering all paragraphs – this change has not been highlighted unless there has been paragraphs inserted or omitted.

Whilst all effort has been made to ensure accuracy, no liability will be considered for any omission or error in this guide.

Gareth David, AMICT
Director
Tempra Consulting Services Ltd
tempraconsulting@virginmedia.com



Title

As well as the obvious change in date, the standard title has also dropped the “Part 1” status. Originally it was planned to have a series of EN 206 standards and EN 206-9:2010 (Self-compacting concrete) was issued but has now been withdrawn. Instead, the bulk of EN 206-9 has been incorporated as an Annex in the new EN 206 and no further parts are envisaged.

National foreword

The principal amendments are to describe the corrections in the corrigendum from the original December 2013 version.

Contents

This has been amended to reflect the changes in the standard as well as being reduced to principal clause heading only and the lists of figures and tables are omitted.

Foreword

This states that the standard should be published and implemented by June 2014 and conflicting national standards should be withdrawn by June 2014. However, UK concrete producers supply to BS 8500-2:2006+A1:2012 which has a normative reference to BS EN 206-1:2000. The revision to BS8500-2 to update to BS EN 206:2013 is currently being undertaken but will not be ready for issue until early 2015. Until the revised BS 8500-2 is issued it would not be advised for concrete producers to implement the changes in BS EN 206:2013.

The forward also makes reference to the main items that were subject to change from the previous version of EN 206-1.

Figure 1. has been updated to include the latest EN standards that have a relationship with EN 206.

Introduction

Minor editorial changes including paragraph on how conforming concrete may be deemed to satisfy durability requirements (previously in 5.3.2)

1. Scope

Minor editorial changes.

Concretes with additional or different requirements in other European Standards (5) and concretes with supplementary requirements or different testing procedures (6) are given their own paragraphs.

(6) Includes concrete with a D_{max} of 4mm and concrete with open structure (“No Fines”)

(7) Concrete with open structure (“No Fines”) no longer exempt

2. Normative references

References updated for latest versions

3.1 Terms and definitions

All terms and definitions have been re-numbered and listed alphabetically in sections:

- 3.1.1 General
- 3.1.2 Constituents
- 3.1.3 Fresh concrete
- 3.1.4 Hardened concrete
- 3.1.5 Conformity and production control

The following are the principal changes:

- 3.1.1.5 design working life – renamed and reworded (3.1.40)
- 3.1.1.6 document – new
- 3.1.1.8 precast element – renamed and reworded (3.1.6)
- 3.1.1.9 precast product – new
- 3.1.1.12 provisions valid in the place of use – new
- 3.1.1.14 self-compacting concrete (SCC) – new
- 3.1.1.17 specification of concrete – renamed (3.1.36)

- 3.1.2.1 addition – reworded (3.1.23)
- 3.1.2.2 type I addition – new
- 3.1.2.3 type II addition – new
- 3.1.2.5 aggregate – reworded (3.1.24)
- 3.1.2.6 all-in aggregate – new
- 3.1.2.7 aggregate size – new
- 3.1.2.9 fines in concrete – new
- 3.1.2.13 polymer fibres – new
- 3.1.2.14 reclaimed washed aggregate – new
- 3.1.2.15 reclaimed crushed aggregate – new
- 3.1.2.16 recycled aggregate – new
- 3.1.2.17 steel fibres – new

- 3.1.3.10 passing ability – new
- 3.1.3.11 segregation resistance – new
- 3.1.3.12 slump flow – new
- 3.1.3.15 viscosity of concrete – new
- 3.1.3.16 water/cement ratio – note included for when additions are used (3.1.31)

- 3.1.4.1 lightweight concrete – reworded (3.1.8)

- 3.1.5.1 average outgoing quality AQL - new
- 3.1.5.2 average outgoing quality limit AOQL – new
- 3.1.5.3 acceptable quality level AQL – new
- 3.1.5.5 compressive strength class – new

The definition for high strength concrete has been omitted (3.1.10)

3.2 Symbols and abbreviations

The list has been significantly extended:

SF1 to SF3	Slump flow – new
VS1, VS2	Viscosity classes for the t_{500} time – new
VF1, VF2	Viscosity classes for the V-funnel – new
t_{500}	Time to 500mm in a slump-flow test - new
t_v	Time of flow in a V-funnel test – new
PL1, PL2	Passing ability classes for the L-box test – new
PJ1, PJ2	Passing ability classes for the J-ring test – new
SR1, SR2	Segregation resistance classes – new
SCC	Self-compacting concrete – new
ECPC	Equivalent concrete performance concept – new
EPCC	Equivalent performance of combinations concept – new
$f_{ctk,sp}$	Characteristic tensile splitting strength – revised (f_{tk})
$f_{ctm,sp}$	Mean tensile splitting strength – revised (f_{tm})
$f_{cti,sp}$	Individual test result for tensile splitting test – revised (f_{ti})
ggbs	Ground granulated blastfurnace slag – new
Cl, ...	Chloride class – new
D	Upper sieve size in aggregate categorised as d/D – new
D_{lower}	Smallest value of D permitted – new
D_{upper}	Largest value of D permitted – new
D_{max}	Declared value of D – reworded
AOQ	Average outgoing quality – new
AOQL	Average outgoing quality limit – new
AQL	Average quality level – reworded
V0 to V4	Consistence classes for Vebe time – omitted

4.1 Exposure classes related to environmental actions

Minor editorial changes

New text in paragraph (2) related to chemical attack

Note in Table 1 Section 2 omitted

Note in Table 1 Section 6 omitted

Boxed text in Table 2 has been moved to form paragraph (3) of the main text

NH_4^+ mg/l Reference test method ISO 7150-2 omitted in Table 2

Acidity ml/kg Reference test method prEN 16502 included in Table 2

4.2.1 Consistence classes

Note regarding specifying consistence by target value in special cases now references the text in Annex L (informative)

Vebe classes omitted ([Table 4](#))

Table 4 Compaction classes extended to include C4 for lightweight concrete ([Table 5](#))

Flow classes Table 5 ([Table 6](#))

New Slump-flow classes in Table 6

4.2.2 Classes for additional properties of SCC

All new section (replaces Classes related to maximum aggregate size, which is omitted).
Includes tables for viscosity and passing ability classes

4.3.1 Compressive strength classes

Note regarding specifying intermediate strength levels now references the text in Annex L (informative)
Table of strength classes renumbered to Table 12 (Table 7)
Table 13 renumbered (Table 8)

4.3.2 Density classes for lightweight concrete

Table 14 renumbered (Table 9)

5.1 Basic requirements for constituents

5.1.1 General

Paragraph (1) and (2) reworded

5.1.2 Cement

Paragraph (1) extended to include cement to EN 14216 for massive structures
New paragraph (2) for calcium aluminates and supersulfated cements

5.1.3 Aggregates

Includes use of reclaimed aggregates conforming to 5.2.3.3 and recycled aggregates where suitability is established by provisions valid in place of use

5.1.5 Admixtures

Includes use of non-EN 934-2 that conform to general requirements of EN 934-1 and provisions valid in place of use

5.1.6 Additions

Filler aggregate conforming to prEN 13055 allowed
Only category B pigments allowed in reinforced concrete
Fly ash conforming to EN450-1 only
Ground granulated blastfurnace slag to EN15167-1 included

5.1.7 Fibres

New section
Steel fibres to EN14889-1
Polymer fibres to EN14889-2

5.2 Basic requirements for composition of concrete

5.2.1 General

Minor editorial changes

Note 2 omitted

Paragraph (4) new text for designed and prescribed concretes

Paragraph (5) composition restrictions for standardized prescribed concretes removed, to be replaced by provisions in the place of use (BS 8500)

Paragraph (6) new text referencing Annex D, concrete for special geotechnical works.

5.2.3 Use of aggregates

5.2.3.1 General

Paragraph (2) redefines requirement for specification of D_{max}

5.2.3.2 All-in aggregate

Size range must be greater than 0/8

5.2.3.3 Reclaimed aggregate

Renamed

Restriction on use internally by the producer

Reclaimed crushed aggregate > 5% must be treated as recycled aggregate

5.2.3.4 Recycled aggregates

New section but no recommendations for use given

Refers to Annex E, Recommendation for the use of aggregate (Informative)

5.2.3.5 Resistance to alkali-silica reaction

Minor editorial changes

Note omitted and moved to Annex L (Informative)

5.2.4 Use of mixing water

Text extended but no change in requirements

5.2.5 Use additions

5.2.5.1 General

Extensive rewording to include ECPC, EPCC and use of ggbs

Note 1 and 2 omitted and moved to Annex L (Informative)

5.2.5.2 k-value concept for flyash, silica fume and ground granulated blastfurnace slag

Extensive rewording and technical changes

Review of requirements recommended

5.2.5.3 Principles of the Equivalent Concrete Performance Concept

Minor editorial changes

Reference to Annex E omitted (no guidance on application in standard, referred to CEN/TR 16639)

Concept allowed with EN 197-1 cements plus one or more additions

5.2.5.4 Principles of the Equivalent Performance of Combinations Concept

New section

Review recommended

5.2.6 Use of admixtures

Paragraph (2) text extended to allow alternative methods of adding small dosages.

Note relating to high consistency concrete omitted

Note relating to compatibility of air-entrainer with other admixtures in Annex L (Informative)

5.2.7 Use of fibres

New section

Review recommended

5.2.8 Chloride content (5.2.7)

New Note C in Table 15 (Table10)

New paragraph (3)

5.3 Requirements related to exposure classes

5.3.2 Limiting values for concrete composition

Minor editorial changes

Final paragraph has been moved to the Introduction

5.3.3 Performance-related methods

Minor editorial changes

5.4 Requirements for fresh concrete

5.4.1 Consistence, viscosity, passing ability and resistance to segregation

Changes to title and text to include

slump flow

time t_{500}

time t_v

L-box test

J-ring test

Vebe test omitted

Table 11 – tolerances for target values of consistence moved to section 8.2.3.3 (Table 23)

5.4.2 Cement content and water/cement ratio

Note 1 moved to Annex L (Informative)

New Note 2

Paragraph (3) text changed

Reference to w/c ratio determination $< +0.2$ above limiting value omitted (in Table 22)

5.4.3 Air content

Reference to specifying air content by minimum value and upper limit $+4\%$ omitted (limits in Table 21)

5.4.4 Fibre content

New section

Requirement for recording fibre content

5.5 Requirements for hardened concrete

5.5.1 Strength

5.5.1.1 General

Minor editorial changes

5.5.1.2 Compressive strength

Minor editorial changes

5.5.1.3 Tensile splitting strength

Additional note regarding flexural strength

5.5.2 Density

Minor editorial changes

5.5.3 Resistance to water penetration

Minor editorial changes

5.5.4 Reaction to fire

Minor editorial changes

6 Specification of concrete

6.1 General

Minor editorial changes

Inclusion of design working life in paragraph 2

Requirements related to cover reworded in general requirements related to aggregate size

6.2 Specification for designed concrete

6.2.2 Basic requirements

(1)d changed from max nominal upper aggregate size to D_{upper} and D_{lower} with additional note

(1)e reference to Table 15 ([Table 10](#))

(4)h reference to “special cases” omitted for target value of consistence with additional note for specifying consistence for SCC

6.2.3 Additional requirements

Minor editorial changes

New paragraph for fibres and performance classes of fibre reinforced concrete

New paragraph includes drying shrinkage, creep and modulus of elasticity

New paragraphs for geotechnical concretes and SCC

6.3 Specification for prescribed concrete

6.3.2 Basic requirements

Minor editorial changes

(1)d Note moved to Annex L (Informative)

(1)e reference to density of aggregates moved to (1)f

(1)g reference to maximum nominal upper size of aggregate changed to D_{upper} and D_{lower} with additional note ((1)f)

(1)h includes fibres ((1)g)

7 Delivery of fresh concrete

7.2 Information from the producer of the concrete to the user

First two sentences omitted

(1)c & (1)d new requirements for description and content of fibres

(1)i new requirement for D_{max}

Second paragraph omitted

Table 16 renumbered (Table 12)

7.3 Delivery ticket for ready-mixed concrete

(2)a designed concrete

new requirement for type and content of fibres or performance class of fibre reinforced concrete

maximum nominal upper aggregate size changed to D_{max}

(2)b prescribed concrete

maximum nominal upper aggregate size changed to D_{max}

new requirement for type and content of fibres

7.5 Mix adjustments after the main mixing process and prior to discharge

Section re-titled

Significantly re-worded to include addition of pigments and fibres

Requirement for a “conformity control” to be carried out on the sample if any water is added.

“Conformity control” is defined in 8.1(1) and refers to production control in Section 9. Conformity can only be carried out by the producer, so the inference is that it is the producer’s responsibility.

Interpretation of this clause will need debating. The Note has been moved to Annex L (informative) but may still be applied.

8 Conformity control and conformity criteria

8.1 General

Minor editorial changes

8.2.1 Conformity control for compressive strength

8.2.1.1 General

Minor editorial changes

8.2.1.2 Sampling and testing plan

Minor editorial changes

Table 17 renumbered Paragraph (3) says the Table F.1 refers to the use of *common cements conforming to EN 197-1* ... Previously it was just *CEM I*.

(Table 13):

- initial production changed to 1 per 3 production days
- continuous production changed to 1 per 5 production days and 1 per calendar month
- Note c changed to include limits of S_n in Table 19 – if S_n exceeds upper limit then sampling rate for initial production should be adopted for the next 35 results

8.2.1.3 Conformity criteria for compressive strength

Section subdivided into new sections and reworded

8.2.1.3.1 Criteria for individual results

Previously [Criterion 2](#)

$$f_{ci} \geq (f_{ck} - 4) \text{ N/mm}^2$$

8.2.1.3.2 Criteria for mean results

Previously [Criterion 1](#)

Method A: Initial production

Mean strength of non-overlapping or overlapping groups of 3 consecutive results

$$f_{cm} \geq (f_{ck} + 4) \text{ N/mm}^2$$

Method B: Continuous production

Assessment period is governed by the testing rate of the plant:

Lower testing rate – less than 35 per 3 months

Higher testing rate – 35 or more per 3 months

Lower testing rate assessment period:

At least 15 and no more than 35 results over a period not exceeding 6 months

Higher testing rate assessment period:

At least 15 results not exceeding a period of 3 months

Mean strength of non-overlapping or overlapping groups in an assessment period

$$f_{cm} \geq (f_{ck} + 1.48\sigma) \text{ N/mm}^2$$

All transposed results for a single family member must comply with the requirements of Table 18 ([Table 15](#)), previously known as [Criterion 3](#). The table has expanded to include ≥ 15 results.

Paragraph (8) describes the new assessment of changes in sd. These are now governed by the limits set in Table 19. If a significant change in sd is identified then the estimate of **sd of the most recent 35 results** should be used for the subsequent assessment period.

Method C: Use of control charts

This is a new section allowing the use of control charts to demonstrate conformity for strength. Any type of control chart could be used as long as it can be demonstrated that it can achieve a maximum AOQ of 5%, as well as other listed criteria.

Annex H (Informative) gives guidance on using Shewhart charts and Cusum control charts.

8.2.2 Conformity control for tensile splitting strength

8.2.2.3 Conformity criteria for tensile splitting strength

As for compressive strength, the assessment period depends on the testing rate

Lower testing rate – less than 35 per 3 months
Higher testing rate – 35 or more per 3 months

Lower testing rate assessment period:

At least 15 and no more than 35 results over a period not exceeding 6 months

Higher testing rate assessment period:

At least 15 results not exceeding a period of 3 months

The conformity criteria in Table 20 ([Table 16](#)) remain the same, except that the new method of calculation for sd given in 8.2.1.3.2 Method B is adopted.

8.2.3 Conformity control for properties other than strength

8.2.3.1 General

This is a new section that sets out the requirements of non-strength conformity control. The assessment period must not exceed 6 months for all non-strength properties.

8.2.3.2 Sampling and testing plan (8.2.3.1)

Minor editorial changes

Reference to the new Table 21 ([Table 18](#)) and Table 22 ([Table 17](#))

8.2.3.3 Conformity criteria for properties other than strength (8.2.3.2)

Minor editorial changes

Reference to acceptance numbers in Table 24 ([Table 19a](#))

New Paragraph (2) states that where a batch fails the individual criterion then it is declared as non-conforming and excluded from all further consideration of conformity

Table 21 ([Table 18](#)) renamed and extended to include new consistence tests, SCC properties and homogeneity of fibre distribution:

- Maximum allowed deviation upper limit for slump reduced to +10mm ([+20mm](#)) and +20mm for spot sample ([+30mm](#))

- Vebe time omitted
- Maximum allowed deviation lower limit for degree of compactibility reduced to -0.03 (-0.05) and -0.04 for spot sample (-0.07)
- Maximum allowed deviation lower limit for flow reduced to -10mm (-15mm) and -20mm for spot sample (-25mm)
- Maximum allowed deviation upper limit for flow reduced to +10mm (+30mm) and +20mm for spot sample (+40mm)
- New requirements for slump flow, viscosity, passing ability and segregation resistance
- Air content moved from Table 17. Maximum allowed deviation upper limit redefined as +5.0% by volume (+1.0% absolute value)
- New requirement for homogeneous mixing of fibres

Table 22 (Table 17) renamed and extended

- New requirement for steel fibre content
- New requirement for polymer fibre content
- Maximum water/cement ratio amended to include additions
- New requirement for minimum cement content
- Air content moved to Table 21
- Chloride content omitted

Table 23 (Table 11) renamed and extended

- Vebe time omitted
- Tolerances on degree of compactibility increased to ± 0.13 (0.10), ± 0.11 (0.08) and ± 0.08 (0.05)
- Tolerance on flow diameter increased to ± 40 mm (30mm)
- New tolerances for slump flow, t_{500} and t_v

Table 24 (Table 19a) renamed

8.3 Conformity control of prescribed concrete including standardized prescribed concrete

Minor editorial changes to include reference to additions

9 Production control

9.1 General

Paragraph (2):

- Concrete design changed to concrete composition
- New reference to calibration of equipment

9.2 Production control systems

Table 25 (Table 20)

- Declaration of performance added to requirements for constituents
- Tests on fresh concrete now include, where specified, viscosity, segregation resistance, passing ability and fibre content

9.4 Testing

Minor editorial changes

9.5 Concrete composition and initial testing

Minor editorial changes

Includes requirement for initial testing on SCC

9.6 Personnel, equipment and installation

9.6.1 Personnel

Minor editorial changes

9.6.2.2 Batching equipment

Paragraphs 2 and 3 omitted

New Table 26 – Requirements for batching equipment. Sets out permissible error in terms of the % of the load

9.6.2.3 Mixers

Additional requirements for measuring and dispensing of fibres

9.7 Batching of constituents

Minor editorial changes

9.8 Mixing of concrete

Paragraph (3) rewritten with reference to Section 7.5

Note moved to Annex L (Informative)

9.9 Production control procedures

Minor editorial changes

Paragraph (2), [Table 22](#) and [Note](#) omitted

New Paragraph (2) lists procedure requirements for delivery, storage and use of constituents.

New Note relating to SCC

New Paragraph (3) relating to compliance for producer owned aggregates

Table 28 ([Table 23](#)):

Minor editorial changes

Table 29 ([Table 24](#)):

Minor editorial changes

8. New requirement for daily consistence test on SCC

9. Viscosity – new

10. Passing ability – new

11. Segregation resistance – new

10. Evaluation of conformity

10.1 General

Minor editorial changes

11. Designation for designed concrete

Minor editorial changes

Annex A Initial Test (Normative)

A.4 Test conditions

Minor editorial changes

New Paragraph (6) relating to fibres

New Paragraph (7) relating to SCC

New Paragraph (8) relating to using recovered water

New Paragraph (9) relating to using recycled aggregates

A.5 Criteria for adoption of initial tests

Minor editorial changes

New Paragraph (5) relating to SCC

Paragraph (6) re-numbered (5)

Annex B Identity testing (normative)

Change to title and inclusion of non-strength testing

B.2 Sampling and testing plan

New Paragraph (5) relating to non-strength tests

B.4 Identity criteria for consistence and air content

New section

B.5 Identity criteria for fibre content and homogeneity of fresh concrete

New section

Annex C Provisions for assessment, surveillance and certification of production control (normative)

No changes

Annex D Additional requirements for specification and conformity of concrete for special geotechnical works (normative)

New annex dealing with the constituents and design piling concretes including recommendations for:

- Cement and aggregate types
- Minimum fines and cement contents
- Water/cement ratio
- Consistence

Annex E Recommendation for the use of aggregate (Informative)

New annex with recommendations for the properties of:

- Normal-weight aggregate
- Heavy-weight aggregate
- Air-cooled blast furnace slag
- Coarse recycled aggregates
- Lightweight aggregates

Annex F Recommendation for limiting values of concrete composition (Informative)

Minor editorial changes

Table F.1:

Note b re-worded

New Note c relating to the use of the *k*-value concept

Paragraph 3 says the table refers to the use of common cements conforming to EN 197-1 ... when previously it was just CEM I.

Annex G Guidelines for self-compacting concrete requirements in the fresh state (Informative)

New annex with recommendations for specifying and producing SCC

Annex H Rules of application for 8.2.1.3, Method C (Informative)

New annex with recommendations for rules on the operation of Cusum and Shewhart control systems for demonstrating strength conformity

Annex J Deviation to accommodate a notified Spanish Regulation (Informative)

New annex – not applicable to UK

Annex K Concrete families (Informative)

Minor editorial changes

Annex L Further information regarding specific paragraphs (Informative)

New annex that is a depository for many of the Notes that were in the previous standard, thus changing the status of these Notes from normative to informative

Annex M Guidance on provisions valid in the place of use (Informative)

New annex that aids cross-referencing where the standard requires or permits that provisions valid in place of use to be established in corresponding National Standards

Bibliography (Annex D)

Significantly extended and updated

[Annex E Guidance on the application of the equivalent performance concept of concrete properties – omitted](#)

[Annex G Accuracy requirements for batching equipment – omitted](#)

[Annex H Additional provisions for high strength concrete – omitted](#)

[Annex J Performance-related design methods with respect to durability – omitted](#)