General Specification for Civil Engineering Works

2006 Edition

AMENDMENT NO. 1/2014

VOLUME 1

SECTION 1 GENERAL

INTERPRETATION OF DOCUMENTS

(a) Clause 1.02(1)

Replace Abbreviations for CS1 and CS2 with the following:

CS Construction Standard issued by Standing Committee on Concrete Technology, HKSAR

(b) Clause 1.05(1)

Add the following after the last sentence:

which shall be deemed to include all amendments/corrigenda issued or published on or before the original date set for close of tender

APPENDIX 1.1 - STANDARDS

(c) Appendix 1.1

Delete all index numbering of standards in Appendix 1.1

Delete the following standards:

BS 812:Part 1:1975, BS 812:Part 2:1995, BS 812:Part 4:1976, BS 812:Part 102:1989, BS 812:Part 103, BS 812:Section 103.1:1985, BS 812:Section 103.2:1989, BS 812:Part 105, BS 812:Section 105.1:1989, BS 812:Section 105.2:1990, BS 812:Part 110:1990, BS 812:Part 111:1990, BS 812:Part 112:1990, BS 812:Part 117:1988, BS 812:Part 118:1988, BS 812:Part 121:1989, BS 903:Part A1:1980 (1988), BS 903:Part A2:1989, BS 903:Part A5:1974, BS 903:Part A26:1969, BS 1006:1990, BS 1155:1986, BS 1181:1989, BS 2782:Part 3:Method 365D:1978 (1983), BS 2782:Part 4:Methods 430A to 430D:1983, BS 2869:Part 2:1988, BS 3661, BS 4043:1989, BS 4052:1987, BS 4098:1975 (1996), BS 4223:1989 (1996), BS 4393:1969 (1985), BS 4428:1991, BS 4466:1989, BS 4550:1Part 1:1978, BS 4790:1987 (1996), BS 4797:1978, BS 5325:2001, BS 5808:1991 (1996), BS 5837:1991, BS 6558:1985, ASTM C 127-88, ASTM C 128-88, ASTM C 131-81 (1987), ASTM C 188-84, ASTM C 535-81, ASTM D 546-88, ASTM D 854-83, ASTM D 1559-82, APHA 3500-K-C 18th Edition (1992), APHA 3500-Na-C 18th Edition (1992), BS EN 459:Part l:2001, BS EN 545:2002, BS EN 598:1995, BS EN 969:1996 (2000), BS EN 1097-2:1998, BS EN 10025:1993:2004, BS EN 10137:1996, BS EN ISO 8492:2004 and ISO 1183:1999

Replace the following standards:

Replace	with
BS 718:1979 (1985)	BS 718:1991
BS 1377:1990 (as modified in accordance with Geospec 3, entitled “Model Specification for Soil Testing”, except for Clause 7.39(1) where the year of edition remains to be 1975)	BS 1377:1990 (as modified in accordance with Geospec 3, entitled “Model Specification for Soil Testing”)
BS 4449:1997 (2001) Specification for carbon steel bars for the reinforcement of concrete	BS 4449:2005 Steel for the reinforcement of concrete – Weldable reinforcing steel – Bar, coil and decoiled product - Specification
BS 4482:1985 Specification for cold reduced steel wire for the reinforcement of concrete	BS 4482:2005 Steel wire for the reinforcement of concrete products - Specification
BS 4483:1998 Specification for steel fabric for the reinforcement of concrete	BS 4483:2005 Steel fabric for the reinforcement of concrete - Specification
BS 6657:1986 Guide for prevention of inadvertent initiation of electro-explosive devices by radio-frequency radiation	BS 6657:2002 Assessment of inadvertent initiation of bridge wire electro-explosive devices by radio-frequency radiation - Guide
BS 6920:Section 2.1:1990	BS 6920-2.1:2000
CS1:2010 (Current version)	CS1:2010
CS2:1995 (Current version) Carbon Steel Bars for the Reinforcement of Concrete	CS2:2012 Steel Reinforcing Bars for the Reinforcement of Concrete
BS ISO 37:2005	BS ISO 37:2011
BS ISO 48:2007	BS ISO 48:2010

Add the following standards:

BS 8666:2005	Scheduling, dimensioning, bending and cutting of steel reinforcement for concrete – Specification
CS3:2013	Aggregates for Concrete
BS EN ISO 62:2008	Plastics - Determination of water absorption
BS EN ISO 1183-1:2012	Plastics - Methods for determining the density of non-cellular plastics, Part 1: Immersion method, liquid pyknometer
BS ISO 2285:2007	Rubber, vulcanized or thermoplastic - Determination of tension set under constant elongation, and of tension set, elongation and creep under constant

	tensile load
BS ISO 2781:2008	Rubber, vulcanized or thermoplastic - Determination of density

SECTION 5 DRAINAGE WORKS

TESTING: AGGREGATES FOR GRANULAR BED

(d) Clause 5.86(3) **Replace** "BS 812:Part 102" **with** "CS3".

(e) Clause 5.87 **Replace** "BS 812:Part 103 and BS 812:Part 111" **with** "CS3".

SECTION 6 EARTHWORKS

BLASTING

(f) Clause 6.36 **Replace the 1st sentence of Sub-clause (3) with the following:**

Unless otherwise permitted by the Commissioner of Mines, blast holes shall be stemmed and decked using free-flowing granular material.

Replace the Sub-clauses (4) to (7) with the following:

(4) Unless permitted by the Commissioner of Mines, electric detonators shall not be used within 60 m of overhead power lines. The use of electric detonators in the vicinity of static or mobile radio transmitters shall comply with BS 6657.

(5) Unless otherwise permitted by the Commissioner of Mines, delay blasting with millisecond delays shall be used for all blasting, except as stated in Clause 6.37(5).

(6) Unless permitted by the Engineer, blasting shall not be carried out within a distance of:

(a) 60 m from water retaining structures or water tunnels, and

(b) 6 m from water mains or other water supply structures or installations.

(7) Unless permitted by the Engineer, the vibrations at structures and installations due to blasting measured in terms of peak particle velocity and vibrational amplitude shall not exceed the values stated in Table 6.2.

APPENDIX 6.4 - ADJUSTMENT OF THE MAXIMUM CONVERTED BULK DENSITY FOR THE DETERMINATION OF THE RELATIVE COMPACTION

(g) Clause 6.4.4 **Add the following equation after the 1st sentence:**

$$MCBD = MCBD_{20}\left[1 + \frac{m}{1 + \frac{z}{100}}\left(1 - \frac{MCBD_{20}}{G_s}\right)\right] Mg/m^3$$

SECTION 7 EARTHWORKS

PART 3: SLOPE TREATMENT WORKS - MATERIALS

(h) Clause 7.88 **Replace** "to BS 4483" **with** "GS Section 15".

SOIL NAILS

(i) Clause 7.139(3) **Replace** "grade 460" **with** "Grade 500B".

TESTING: GRANULAR FILTER MATERIAL

(j) Clause 7.242(3) **Replace** "BS 812:Part 102" **with** "CS3".

SECTION 9 CARRIAGEWAYS: SUB-BASE MATERIAL AND BITUMINOUS MATERIALS

MATERIALS

(k) Clause 9.03(2) **Replace** "10 %" **with** "ten per cent".

(l) Clause 9.03(4) **Replace** "65" **with** "65%".

(m) Clause 9.05(4) **Replace** "BS 3892:Part 1" **with** "BS 3892:Part 1 or BS EN 450-1".

TESTING: SUB-BASE MATERIAL

(n) Clause 9.45(2) **Replace** "BS 812:Part 102" **with** "CS3".

(o) Clause 9.46(2) **Replace** "BS 812:Part 103.1" **with** "CS3".

(p) Clause 9.46(3) **Replace the sub-clause with the following:**

The method of testing for ten per cent fines value shall be in accordance with CS3 under a soaked condition.

(q) Clause 9.47(1) **Replace** "10 %" **with** "ten per cent".

(r) Clause 9.47(2) **Replace** "BS 812:Part 103.1" **with** "CS3".

(s) Clause 9.47(3) **Replace the sub-clause with the following:**

The method of testing for ten per cent fines value shall be in accordance with CS3 under a soaked condition.

(t) Clause 9.47(6) **Replace** "BS 812:Part 121" **with** "CS3".

TESTING: AGGREGATES, FILLER AND BITUMEN FOR BITUMINOUS MATERIALS

(u) Table 9.10 **Replace the table with the following:**

Material	Minimum size of sample	Method of sampling
Aggregate	CS3	CS3
Filler	5 kg	ASTM D 242
Bitumen	2 litres	ASTM D 140

(v) Table 9.11 **Replace** "BS 812:Part 2", "BS 812:Part 103.1", "BS 812:Part 105" and "BS 812:Part 111" **with** "CS3".

SECTION 10 CONCRETE CARRIAGEWAYS

GENERAL

(w) Clause 10.04 **Append the following sentence:**

In addition, the abrasion resistance in Los Angeles value for coarse aggregates in concrete shall not exceed 30% loss in accordance with CS3.

MATERIALS

(x) Clause 10.07 **Delete the Sub-clause (1) and the Sub-clause number (2); and**

Replace "CS2**" with "**Section 15**".**

VOLUME 2

SECTION 14 FORMWORK AND FINISHES TO CONCRETE

MATERIALS

(y) Clause 14.17(1)

In the 2nd sentence, replace "specified nominal cover" **with** "specified cover".

SECTION 15 STEEL REINFORCEMENT

GLOSSARY OF TERMS

(z) Clause 15.02

Amend the title of Clause to read as follows:

Reinforcement

Replace the clause with the following:

Reinforcement is steel bar, wire or fabric used in its untensioned state in concrete.

MATERIALS

(aa) Clause 15.03

Amend the title of Clause to read as follows:

Reinforcing steels

Replace the clause with the following:

Except as stated in Clause 15.04 below, reinforcing steels for the reinforcement shall comply with the following:

Category	Reinforcement	Compliance
A	Steel reinforcing bar covered by CS2 (including steels for fabric/wire)	CS2
B	Other reinforcing steels of Grade 500 (including steels for fabric) not covered by CS2	BS 4449
C	Other reinforcing steels (diameter > 12 mm) of Grade 250 (including steels for fabric) not covered by CS2	BS 4449:1997

D	Other reinforcing steels (diameter ≤ 12 mm) of Grade 250 (including steels for fabric) not covered by CS2	BS 4482
E	Steel fabric sheet	BS 4483

(ab) Clause 15.04

Replace the clause with the following:

Stainless steel bars for the reinforcement shall be ribbed bar to BS 6744. The steel designation numbers are in accordance with BS EN 10088-1. The requirements on sampling, testing and acceptance criteria shall be in accordance with BS 6744 except otherwise stated.

(ac) Clause 15.05

Replace the clause with the following:

(1) Epoxy coatings to reinforcement and patching materials for epoxy coatings shall comply with BS ISO 14654 except as stated in Clauses 15.05(2), 15.22, 15.32, 15.34 and 15.38. The coatings shall be applied by the electrostatic spray method complying with BS ISO 14654 at a factory approved by the Engineer.

(2) The film thickness of the coating after curing shall be at least 0.17 mm and shall not exceed 0.30 mm over the complete periphery including deformations and ribs. The bond classification of coated bars determined in bond performance tests shall not be less than that of uncoated bars.

(ad) Clause 15.06(2)

Replace the sub-clause with the following:

Materials for repair to hot dip galvanized reinforcement shall comply with BS EN ISO 1461.

(ae) Clause 15.10

Replace the 1st sentence of the clause with the following:

Tying wire for reinforcement adjacent to and above Class F4 and F5 finishes and stainless steel reinforcement shall be 1.2 mm diameter stainless steel wire.

SUBMISSIONS

(af) Clause 15.12

Amend the title of Clause to read as follows:

Particulars of reinforcement

Replace the clause with the following:

(1) The following particulars of the proposed steel reinforcement shall be submitted to the Engineer:

(a) For Category A (i.e. CS2) reinforcement, a certificate

from the quality assured stockist and a copy of the manufacturer's certificate/document in accordance with CS2 Cl. 4.1.

(b) For other reinforcement, a certificate/document from the manufacturer showing the manufacturer's name, the place of manufacture and showing that the reinforcement complies with the requirements stated in Clause 15.03, including:
- Chemical composition (cast analysis) and calculation of carbon equivalent value
- Dimensions and mass per metre
- Tensile properties and bend performance
- Bond property or evidence that the bond property has complied with the requirements
- Sheet dimensions and shear force of welded joints for steel fabric sheet

(2) The particulars together with other requirements stated in the Contract shall be submitted to the Engineer for information for each batch of reinforcement delivered to the Site and at least 14 days before fixing of the reinforcement starts.

(ag) Clause 15.13

Replace the clause with the following:

(1) The following particulars of the proposed epoxy coatings to reinforcement shall be submitted to the Engineer:

(a) Name and location of the coating factory,

(b) Date and place of the coating application, and

(c) Original Certificate(s) of the coating materials in compliance with BS ISO 14656, including:
- Corrosion resistance
- Chemical resistance
- Cathodic disbondment
- Salt spray resistance
- Abrasion resistance
- Impact strength
- Coating flexibility

The above tests shall be carried out once every 5 years or when there are changes in the composition of the coating materials whichever is the earlier.

(2) The particulars shall be submitted to the Engineer at least 14 days before the first delivery of epoxy-coated reinforcement to the Site. Certificates together with the particulars of the reinforcement shall be submitted for each batch of epoxy-coated reinforcement delivered to the Site and at least 14 days before fixing of the reinforcement starts.

(ah) Clause 15.14(2)

Replace the sub-clause with the following:

The particulars shall be submitted to the Engineer at least 14 days before the first delivery of galvanized reinforcement to the Site. Certificates together with the particulars of the reinforcement shall be submitted for each batch of galvanized reinforcement delivered to the Site and at least 14 days before fixing of the reinforcement starts.

(ai) Clause 15.16 **Replace the clause with the following:**

Bending schedules of reinforcement complying with BS 8666 shall be prepared by the Contractor and submitted to the Engineer before bending of reinforcement starts.

(aj) Clause 15.17 **Replace the clause with the following:**

Samples of the following proposed materials shall be submitted to the Engineer at the same time as particulars of the materials are submitted:

(a) Reinforcement,

(b) Epoxy-coated reinforcement,

(c) Galvanized reinforcement,

(d) Reinforcement connectors for tension joints and compression joints,

(e) Cover spacers and other spacers, and

(f) Tying wire, tying devices and clips.

HANDLING AND STORAGE OF MATERIALS

(ak) Clause 15.18(2) **Replace the 2nd sentence of the sub-clause with the following:**

Bundles shall be lifted with a strong back or with multiple supports to prevent abrasion.

(al) Clause 15.19(1) **Replace the last sentence of the sub-clause with the following:**

Reinforcement shall be stored horizontally.

CUTTING AND BENDING REINFORCEMENT

(am) Clause 15.20(1) to (3) **Replace the sub-clauses with the following:**

(1) Reinforcement shall be cut and bent in accordance with BS 8666 to the specified shapes and dimensions and shall be bent at temperatures of at least 5°C and not exceeding 100°C.

(2) Epoxy tends to become brittle at lower temperatures, additional care should be exercised when fabrication is performed

during cold weather. Surfaces of bending equipment in contact with epoxy-coated reinforcement shall be fitted with nylon or plastic mandrels.

(3) Grade 500 and stainless steel reinforcement shall not be rebent or straightened after bending. Grade 250 reinforcement which projects from the hardened concrete may be bent aside and rebent provided that the internal radius of the bend is at least twice the diameter of the bar and that bending is not carried out by levering against the concrete or by other methods which in the opinion of the Engineer are likely to damage the concrete.

(an) Clause 15.22(2) to (3) **Replace the sub-clauses with the following:**

(2) Except as stated in Clause 15.22(1), all damaged areas and cut ends of epoxy-coated reinforcement shall be repaired using sealing material applied in accordance with the manufacturer's recommendations. The sealing material shall comply with BS ISO 14654 and shall be submitted to the Engineer for approval.

(3) Except as stated in Clause 15.22(1), all damaged areas and cut ends of galvanized reinforcement shall be repaired by materials to be approved by the Engineer. Sufficient material shall be applied to provide a coating of at least the same thickness as the galvanized coating. The Contractor shall refer to Section 6.3 and Annex C of BS EN ISO 1461 for advice on repair of damaged areas.

FIXING REINFORCEMENT

(ao) Clause 15.23(1) **Replace** "Bar reinforcement, fabric reinforcement and reinforcement connectors" **with** "Reinforcement and reinforcement connectors".

(ap) Clause 15.23(8) **Replace** "specified minimum concrete cover" **with** "specified concrete cover".

(aq) Clause 15.26 **Add the following sentence at the end:**

Reinforcement shall be re-coated by the same method if in the opinion of the Engineer the original coating has begun to deteriorate.

TOLERANCES

(ar) Clause 15.28 **Replace the clause with the following:**

(1) Tolerances on cutting and bending reinforcement shall comply with BS 8666 Table 5.

(2) The actual concrete cover to the outermost layer of reinforcement (including links, stirrups, surface reinforcement, etc.) shall be within 5 mm tolerance of the cover specified on the Drawings.

TOLERANCES

TESTING: REINFORCEMENT

(as) Clause 15.30

Replace the clause with the following:

(1) For the purpose of testing, the Category A (i.e. CS2) reinforcement delivered to the Site is to be subdivided into batches in accordance with CS2.

(2) A batch of other reinforcement or reinforcement connectors is any quantity of reinforcement or reinforcement connectors of the same type, size and grade, manufactured by the same mill, covered by the same mill and testing certificates and delivered to the Site at any one time. In addition, for epoxy-coated reinforcement and galvanized reinforcement, the coatings shall have been applied at the same coating factory and shall be covered by the same original test certificates with original signatures and official authorization chop.

(at) Clause 15.31

Replace the clause with the following:

(1) Samples of reinforcement and reinforcement connectors for tension joints, except for epoxy-coated reinforcement, shall be provided from each batch of the material delivered to the Site and at least 14 days before fixing of the reinforcement starts. For epoxy-coated reinforcement, samples shall be provided at least 20 working days before fixing of the reinforcement starts. The number of samples to be provided from each batch shall be as stated in Table 15.1.

(2) The number of specimens in each sample shall be as follows:

Category of reinforcement	**Number of specimens**
A (i.e. CS2)	In accordance with CS2 Table 10
B (i.e. Grade 500)	In accordance with BS 4449 Cl. 8.1.2
C (i.e. Grade 250 & d > 12 mm)	In accordance with BS 4449:1997 Cl. 10
D (i.e. Grade 250 & d ≤ 12 mm)	In accordance with BS 4482 Cl. 8.1.2
E (i.e. fabric sheet)	Additional

for welded fabric dimensions and shear force of welded joints	specimens in accordance with BS 4483
Epoxy-coated or galvanized reinforcement	2 additional specimens
Reinforcement connectors for tension joints	3

(3) Each specimen of bar or wire reinforcement shall be at least 1 m long. Each specimen of fabric reinforcement shall be at least 1.2 m long by 1.2 m wide and shall contain at least three bars/wires in each direction. Each specimen of reinforcement connectors shall consist of one reinforcement connector joined to two lengths of bar each at least 500 mm long. The bars shall be of the same type, size and grade as the bars to which the reinforcement connector will be fixed in the permanent work.

(4) Each specimen of reinforcement shall be taken from different units in the batch. The ends of specimens shall be cut square before delivery to the laboratory.

(5) For epoxy-coated bar reinforcement, each specimen for testing epoxy coating properties shall be a 2 m length piece cut at least 1 m from the ends of a 12 m length bar. Specimens shall be selected from different bundles of the reinforcement batch.

(au) Table 15.1 **Replace the table with the following:**

Description	**Size of batch**	**No. of samples per batch**
Reinforcement	All sizes	1
Reinforcement connectors for tension joints	less than 100 no.	1
	100 - 500 no.	2
	exceeding 500 no.	3

(av) Clause 15.32

Replace the clause with the following:

1) Each sample of reinforcement shall be tested in accordance with the following requirements:

Category of reinforcement	**Testing requirement**
A (i.e. CS2)	CS2 Cl. 5.1.1
B (i.e. Grade 500)	BS 4449 Cl. 8.1.2 with methods in Cl. 9
C (i.e. Grade 250 & d > 12 mm)	BS 4449:1997 Cl. 10
D (i.e. Grade 250 & d ≤ 12 mm)	BS 4482 Cl. 8.1.2 with methods in Cl. 9

(2) Each sample of steel fabric sheet shall be tested, in addition, to determine the welded fabric dimensions and shear force of welded joints in accordance with BS 4483 Cl. 8.1.2 with methods in Cl. 9.

(3) Each additional specimen as required in Clause 15.31(2) of epoxy-coated reinforcement shall be tested to determine the thickness, adhesion and continuity of the coating in accordance with Clause 15.33.

(4) Each additional specimen as required in Clause 15.31(2) of galvanized reinforcement shall be tested to determine the thickness of coating in accordance with BS EN ISO 1461 for compliance.

(5) Each sample of reinforcement connectors for tension joints shall be tested to determine the tensile properties in accordance with Clause 15.35.

(6) The number of tests on each sample shall be as stated in Table 15.2.

(aw) Clause 15.33

Replace the clause with the following:

(1) The thickness test shall be in accordance with Methods 7A, 7B and 7C of BS EN ISO 2808. For bars/wires of 12 mm diameter or below, only instruments which operate on magnetic flux principle (Methods 7B and 7C) can be used. For bars of 16 mm diameter or above, instruments which operate on either magnetic flux principle (Methods 7B and 7C) or magnetic pull-off principle (Method 7A) can be used. All measuring instruments shall be calibrated to an accuracy of ±5%.

(2) For thickness test, five recorded measurements shall be obtained approximately evenly spaced along each side of the test specimen (a total of ten recorded measurements per bar). A single recorded thickness measurement is the average of three individual reading obtained in between the ribs of three consecutive deformations.

(3) The adhesion and continuity tests shall be in accordance with BS ISO 14654.

(ax) Table 15.2

Replace the table with the following and insert after the clause 15.33

Table 15.2: Number of tests on each sample of reinforcement

Description	**Type and number of tests**						
	Tensile properties	Bend performance	Mass per metre	Chemical composition (product analysis)	Bond property	Thickness, adhesion and continuity	Thickness and uniformity
Reinforcement	In accordance with Clause 15.32(1)					-	-
Epoxy coating	-	-	-	-	-	2	-
Galvanized coating	-	-	-	-	-	-	2
Reinforcement connectors for tension joints	3	-	-	-	-	-	-

(ay) Clause 15.33A

Add the title of the new clause to read as follows:

Compliance criteria: reinforcement

Add the new clause with the following:

(1) For Category A (i.e. CS2) reinforcement, if the results of the tests performed on the test specimens meet the requirements specified in CS2 Cl. 5.1.2, the batch shall be deemed to comply with the requirements.

(2) For Category B (i.e. Grade 500) reinforcement, if the results of the tests performed on the test specimens meet the requirements specified in BS 4449 Cl. 8.1.3.1 and 8.1.3.2 (but excluding bond property), the batch shall be deemed to comply with the requirements.

(3) For Category C (i.e. Grade 250 & d > 12 mm) reinforcement, if the results of the tests performed on the test specimens meet the requirements specified in BS 4449:1997 Cl. 5, 6, 8.2 and 11, the batch shall be deemed to comply with the requirements.

(4) For Category D (i.e. Grade 250 & d ≤ 12 mm) reinforcement, if the results of the tests performed on the test specimens meet the requirements specified in BS 4482 Cl. 8.1.3.1 and 8.1.3.2 (but excluding bond property), the batch shall be deemed to comply with the requirements.

(5) For Category E (i.e. fabric sheet) reinforcement, if the longitudinal and transverse bars/wires of the fabric sheet comply with the relevant clauses (1) to (4) above and the results of the additional tests performed on the test specimens meet the requirements specified in BS 4483 Cl. 7.2.4 and 7.3, the batch shall be deemed to comply with the requirements.

(az) Clause 15.34

Replace the clause with the following:

The results of tests for thickness, adhesion and continuity of epoxy coatings to reinforcement shall comply with all the following requirements:

(a) Coating thickness
At least 90% of all recorded thickness measurements of coating shall be within the specified range. Thickness measurements below 0.13 mm shall be considered cause for rejection.

(b) Coating adhesion:
The adhesion test shall comply with the requirements in BS ISO 14654. The surface of the bent test piece shall not exhibit cracking, disbonding or ductile tearing when viewed under well-lit conditions using normal or corrected vision.

(c) Coating continuity
The continuity test shall comply with the requirements in BS ISO 14654. The continuity of the coating shall be free of holes, voids, cracks and damaged areas discernible to a person with normal or corrected vision.

(ba) Clause 15.35

Replace the clause with the following:

The results of tensile properties tests on specimens of reinforcement connectors for tension joints shall comply with the following requirements:

(a) The tensile strength shall exceed 287.5 MPa for grade 250, 540 MPa for grade 500B and 575 MPa for grade 500C reinforcement.

(b) When a test is made of a representative gauge length assembly comprising reinforcement of the size, grade and profile to be used and a reinforcement connector for tension joints of the precise type to be used, the permanent elongation after loading to 0.6 times of the

specified characteristic strength and unloading shall not exceed 0.1 mm. The gauge length shall span over the reinforcement connector.

(bb) Clause 15.36 **Amend the title of Clause to read as follows:**

Non-compliance: reinforcement

Replace the clause with the following:

For Category A (i.e. CS2) reinforcement, if the result of any test fails, the acceptance of retests shall be considered in accordance with CS2 Cl. 5.1.4.

(bc) Clause 15.37 **Delete the title of Clause**

Replace the clause with the following:

For other reinforcement not covered by CS2, if the result of any test fails, two additional test specimens shall be taken from different reinforcement of the same batch and be subjected to the test or tests which the original specimen failed. For properties other than chemical composition (product analysis), the batch shall be considered as not complying with the specified requirements for the properties if the result of any additional test fails. For chemical composition (product analysis), the batch shall be considered as not complying with the specified requirements of the property if the result of any additional test fails unless it is demonstrated by alternative method as accepted in CS2 Cl. 6.3. If all of the additional test specimens pass the retests, the batch shall be deemed to comply with the requirements. Otherwise the batch of reinforcement shall be rejected and removed from the Site.

(bd) Clause 15.38 **Amend the title of Clause to read as follows:**

Non-compliance: epoxy coatings

Replace the clause with the following:

For each test specimen fails to meet the coating thickness, coating adhesion or coating continuity requirements, two additional test specimens shall be taken from the same batch and be subjected to the test or tests which the original specimen failed. If all of the additional test specimens pass the retests, the batch from which they have been taken shall be deemed to comply with the specified requirements for the properties. Otherwise this batch shall be rejected and removed from the Site.

(be) Clause 15.39 **Amend the title of Clause to read as follows:**

Non-compliance: galvanized coatings

Replace the clause with the following:

(1) If the result of any test for thickness of galvanized coatings

to reinforcement does not comply with the specified requirements for the property, additional samples shall be provided from the same batch and additional tests for the property shall be carried out. The number of additional samples shall be as stated in Table 15.1.

(2) The number of specimens in each additional sample shall be as follows:

(i)	Galvanized bar/wire reinforcement	4
(ii)	Galvanized fabric reinforcement	2
(iii)	Galvanized reinforcement connectors for tension joints	4

(3) The number of tests on each additional sample shall be four.

(4) The batch shall be considered as not complying with the specified requirements for the property if the result of any additional test does not comply with the specified requirements for the property.

(bf) Clause 15.40

Amend the title of Clause to read as follows:

Non-compliance: reinforcement connectors

Replace the clause with the following:

(1) If the result of any test for tensile properties of reinforcement connectors for tension joints does not comply with the specified requirements as stated in Clause 15.35, additional samples shall be provided from the same batch and additional tests as stated in Clause 15.35 shall be carried out. The number of additional samples shall be as stated in Table 15.1.

(2) The number of specimens in each additional sample shall be six.

(3) The number of tests on each additional sample shall be six.

(4) The batch shall be considered as not complying with the specified requirements for tensile properties if the result of any additional test does not comply with the specified requirements as stated in Clause 15.35.

SECTION 16 CONCRETE AND JOINTS IN CONCRETE

GLOSSARY OF TERMS

(bg) Clause 16.03(1)

Add the following sentence at the end:

PFA, GGBS and CSF are referred to as supplementary

cementitious materials in this GS.

MATERIALS

(bh) Clause 16.07(1) **Replace the sub-clause with the following:**

(1) PFA shall comply with either BS 3892:Part 1 with the following modifications:

(a) Use Portland cement BS EN 197-1: CEM I (52.5N) to determine water requirement, strength factor at 28 days, soundness and initial setting time.

(b) The criteria for water requirement and strength factor at 28 days shall not apply, but the values of water requirement and strength factor at 28 days shall be reported on certificates as required in Clause 16.17(1)(b).

(c) PFA of total lime content over 10% but not over 20% and with soundness value not more than 10 mm is acceptable as "high-lime PFA'. When "high-lime PFA" is used, it shall be reported in certificates as required in Clause 16.17(1)(c).

or BS EN 450-1 with the following modifications

(a) The loss on ignition shall be either Category A or B.

(b) The fineness of Category N PFA, if used, shall be declared.

(bi) Clause 16.08(2) and (3) **Replace the sub-clauses with the following:**

(2) Fine aggregate shall be clean and hard complying with CS3. Natural sand shall not be used unless with the prior agreement of the Engineer.

(3) Coarse aggregate shall be clean and hard complying with CS3. Coarse recycled aggregates may be used subject to the prior agreement of the Engineer.

(bj) Clause 16.09(2) **Replace the sub-clause with the following:**

Non-saline water from other sources may be used subject to the Engineer's approval, provided that it can be demonstrated that the water is neutral in PH value, free from suspended solids and liquid contaminants non-miscible with water. It shall be tested and comply with BS EN 1008.

CONCRETE

(bk) Clause 16.12(9)(a) **Replace** "cement" **with** "cementitious materials".

(bl) Clause 16.12(9)(f) **Replace the sub-clause with the following:**

The chloride ion contents of aggregates shall be measured in accordance with CS3.

(bm) Table 16.4

Replace "Grading of fine aggregate (BS 882:Table 5)" **with** "Grading of fine aggregate (CS3)" **in the table header**.

SUBMISSIONS

(bn) Clause 16.17(1)(b) to (d)

Replace the sub-clauses with the following:

(b) A certificate not older than 6 months for PFA showing the source of the PFA and showing that the PFA complies with the requirements stated in the Contract and including results of tests required in either Clause 14.1 of BS 3892:Part 1 or Clauses 5.2 and 5.3 of BS EN 450-1.

(c) If "high-lime PFA" as stated in Clause 16.07 is used, the certificates that accompany delivery of "high-lime PFA" shall mention that the PFA is high-lime.

(d) Certificates/documents not older than 6 months for each nominal maximum aggregate size in accordance with Clause 6.2.2 of CS3 and other test certificates showing the compliance of requirements as stated in the Contract (e.g. Los Angeles value, aggregate impact value, drying shrinkage, sulphur content).

(bo) Clause 16.18(1)(a)

Replace "cement" **with** "cementitious materials".

TESTING: CEMENT, PFA, GGBS, AGGREGATE, ADMIXTURE, CURING COMPOUND, RECYCLED WATER

(bp) Clause 16.51(2)

Replace "testing" **with** "testing and acceptance criteria".

(bq) Table 16.6

Replace the table with the following:

Material	Size of sample	Method of sampling
Cement	20 kg	BS EN 196-7
PFA	20 kg	BS EN 196-7
GGBS	20 kg	BS EN 196-7
Coarse aggregate	25 kg for physical and chemical tests; 25 kg for assessment of potential alkali-reactivity	CS3
Fine aggregate	10 kg for physical and chemical tests; 10 kg for assessment of potential alkali-reactivity	CS3
Admixture (powdered)	1 kg	BS EN 934-2
Admixture (liquid)	1 L	BS EN 934-2
Curing compound	5 L	BS EN 934-2

(br) Table 16.7 **Replace the table and its title with the following:**

Table 16.7: Testing cement, PFA, GGBS, aggregate, admixture and curing compound

Material	Property	Testing Method and Acceptance Criteria
PC, SRPC, PFAC	Composition	BS EN 197-1
	Chemical properties	BS EN 196-2
	Compressive strength at 2, 7 and 28 days	BS EN 196-1
	Initial setting time	BS EN 196-3
	Soundness	BS EN 196-3
PFA	Chemical composition	BS EN 196-2
	Physical tests	BS 3892:Part 1 or BS EN 450-1
GGBS	Composition	BS EN 197-1
	Chemical requirements	BS EN 196-2
	Fineness	BS EN 196-6
	Relative density	BS EN 196-6
	Activity index	BS EN 15167-1 and BS EN 196-1
	Initial setting time	BS EN 196-3

Material	Property	Testing Method and Acceptance Criteria
Coarse aggregate and fine aggregate	Grading Fines content Oven-dried particle density Potential alkali-reactivity Presence of organic substances	CS3
Fine aggregate	Water-soluble chloride ion content	CS3
Coarse aggregate	Flakiness index Elongation index (natural aggregate) Ten per cent fines value Water absorption Magnesium sulphate soundness value (natural aggregate) Water-soluble chloride ion content (natural aggregate) Foreign materials content (recycled aggregate) Acid-soluble chloride ion content (recycled aggregate) Acid-soluble sulphate content (recycled aggregate) Los Angeles Value (when required)	CS3
Admixture	Chloride content	BS EN 934-2
Curing compound	Efficiency index	Appendix 16.1

MATERIALS

(bs) Table 16.12

Replace "70 – 90 IRHD" **with** "70 – 90 Shore A Hardness" **for PVC Waterstops hardness**.

TESTING: MATERIALS FOR JOINTS

(bt) Table 16.14

Replace the table with the following:

Property	Method of testing	
	Rubber waterstops	**PVC waterstops**
Density	BS ISO 2781	BS EN ISO 1183-1
Hardness	BS ISO 48	ASTM D 2240
Tensile stress-strain properties	BS ISO 37 and BS ISO 2285	BS 2782:Part 3, Methods 320A to 320F
Water absorption	BS 903:Part A18	BS EN ISO 62

Softness number	-	BS 2782:Part 3, Method 365A

SECTION 21 MARINE WORKS

GENERAL

(bu) Clause 21.07

Add the following sentence at the end:

In addition, the abrasion resistance in Los Angeles value for coarse aggregates in concrete shall not exceed 30% loss in accordance with CS3.

MATERIALS

(bv) Table 21.5

Replace "Test method and condition Part No. of BS 903" **with** "Test method and condition" **in the table header**.

Replace "Part A1" **with** "BS ISO 2781".

Replace "Part A6 Method A" **with** "BS 903:Part A6 Method A".

Replace "Part A9 Method C" **with** "BS 903:Part A9 Method C".

TESTING: RELATIVE DENSITY, WATER ABSORPTION, AGGREGATE IMPACT VALUE, TEN PERCENT FINES VALUE, AGGREGATE ABRASION VALUE, SOUNDNESS, RESISTANCE TO FRACTURE AND WEIGHT OF ROCK ARMOUR AND ROCK FOR UNDERLAYER

(bw) Clause 21.95(2)

Replace the sub-clause with the following:

(2) The method of testing shall be in accordance with the following:

Relative density	: CS3
Water absorption	: CS3
Aggregate impact value	: CS3
Ten percent fines value	: CS3
Aggregate abrasion value	: BS 812:Part 113
Soundness	: BS 6349:Part 1, Appendix B

MATERIALS

(bx) Clause 21.2.2A

Add the title of the new clause to read as follows:

Aggregates

Add the new clause with the following:

Clause 16.08 – New sub-clause (6) is added below: -

(6) The abrasion resistance in Los Angeles value for coarse aggregates in concrete shall not exceed 30% loss in accordance with CS3.

SECTION 24 BUILDING WORKS

MATERIALS

(by) Clause 24.65(4)

Replace the sub-clause with the following:

The quantity of clay, fine silt and fine dust present in the sand shall not exceed 10% by mass when determined in accordance with BS 812:Part 101 and CS3. The chloride content of sand or crushed rock shall not exceed 0.03 % by mass when determined in accordance with CS3.

Quality Management & Standards Unit
Civil Engineering and Development Department
24 November 2014