Highway Structures & Bridges
Contract preparation

CP 495 Instructions for specifiers for CC 495 Miscellaneous

(formerly Series NG 2600)

Version NI/LIVE_2025-02-19

The 'SUMMARY' field is missing from the Document Information. Please populate this field before publication.

This document incorporates specific requirements for the Department for Infrastructure Northern Ireland. Alternative versions of this document are available for other Overseeing Organisations.

Feedback and Enquiries
Users of this document are encouraged to raise any enquiries and/or provide feedback on the content and usage of this document to the dedicated team in the Department for Infrastructure, Northern Ireland. The email address for all enquiries and feedback is: dcu@infrastructure-ni.gov.uk

This is a controlled document.

Contents

Latest release notes

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change
CP 495	NI/ LIVE_2025-02-19	Not available	Core document, Scotland NAA	Change to policy, major revision, new document development
For approval in principle				

Previous versions

Document Code	Version number	Date of publication of relevant change	Changes made to	Type of change

Foreword

This document provides specifier instructions for the production of the works specific requirements for CC 495 Miscellaneous.

This document does not form part of the works specification.

The works specification is made up of both the Specification for Highway Works and the works specific requirements completed by the Specifier.

This document is applicable for contracts throughout the UK, complemented by the additional specification requirements and contractual changes of each Overseeing Organisation.

Users are responsible for applying all appropriate documents applicable to their contract.

Users are responsible for archiving contract documentation in accordance with the user's quality management system.

1. Bedding Mortar

General requirements for high strength bedding mortar

1.1 The requirements in this section shall apply to high strength bedding mortar used for accurate location of bridge bearing units, baseplates of metal structural sections, baseplates of metal vehicle restraint system posts, and precast concrete structural units.

1.2 Bedding mortar shall be a proprietary product, unless otherwise stated in CC 495/WSR/001.

SI.1.2 The quantity and proportions of constituent materials for cementitious bedding mortar shall be [enter free text].

1.3 Bedding mortar products shall be flowable when freshly mixed and during placement.

1.4 28-day cube compressive strength of bedding mortar shall not be less than 50 MPa, unless otherwise stated in CC 495/WSR/001.

SI.1.4 The 28-day cube compressive strength of bedding mortar shall be [enter a number] .

1.5 Physical and chemical properties of bedding mortar shall be compatible with existing materials at the interfacing surfaces and not cause any adverse reaction.

1.6 The following Documentation shall be submitted for compatibility of bedding mortar materials prior to the commencement of pre-works laboratory suitability testing: Declaration of binder type in proposed proprietary bedding mortar.

1.7 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to declaration of binder type in proposed proprietary bedding mortar.

Requirements for other materials used within a mortar plinth

1.8 Shims, packers or washers shall only be used as spacers within bedding mortar under bearing baseplates where the spacers are located around the shanks of holding down bolts.

1.9 Total plan area of packers, shims or washers used around holding down bolts under baseplates shall not exceed 7 % of plan area of baseplate.

1.10 Shims, packers or washers used within the bedding mortar shall be made of either austenitic corrosion resisting steel complying with BS EN

10088-2 [Ref 26.N] and hardness class 200HV or above in accordance with BS EN ISO 2039-2 [Ref 8.N], or made of plastic with elastic modulus greater than 5 GPa.

1.11 Shims, packers or washers shall not be used within bedding mortar under baseplates of permanent road restraint systems unless specified in manufacturer’s RRS installation instructions or indicated in technical documents for legacy road restraint systems.

1.12 The following Documentation shall be submitted for packers, shims or washers prior to the commencement of mortar plinth construction: Declaration of types, sizes and materials.

1.13 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to the declaration of types sizes and material for packers, shims or washers intended for use within mortar plinth construction.

Product requirements for proprietary high strength bedding mortar

1.14 The product requirements for proprietary high strength bedding mortar shall be as specified in CC 495/WSR/001.

The product requirements for proprietary high strength bedding mortar					
Structure ID or description of other asset	**Location of structure or other asset**	**Construction application for high strength proprietary bedding mortar**	**ID of high strength proprietary bedding mortar**	**Maximum aggregate size**	**Permitted thickness range of proprietary bedding mortar plinth**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify the structure or other asset for which proprietary bedding mortar is required.

b) Enter a unique reference, to where is existing or new asset located?.

c) Enter a unique reference, to for what construction application can bedding mortar be used? e.g. under new mechanical bearing, under parapet baseplate, under baseplate of flexible barrier, under gantry baseplate, in conjunction with precast concrete structural units etc.

d) Enter a unique reference, to ID of high strength proprietary bedding mortar linking it to the construction application.

e) Enter a number in units of mm, to maximum aggregate size if not 2.8mm default size.

f) Enter a number range (e.g. "40-60") in units of mm, to range of thickness of proprietary bedding mortar in a plinth if not 10-30mm.

Contractor design requirements for designed cementitious bedding mortar

1.15 The cementitious bedding mortar to be Contractor designed shall be as stated in CC 495/WSR/001.

1.16 The design of constituent material proportions for designed cementitious bedding mortar shall be in accordance with CD 350 [Ref 41.N].

1.17 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 10.N] shall apply to designed cementitious bedding mortar.

1.18 The constituent materials of designed cementitous bedding mortar shall be selected to achieve the product requirements specified in CC 495/WSR/001 and performance requirements for characteristics specified by preworks laboratory tests.

Product requirements for Contractor designed cementitious bedding mortar

1.19 The product requirements for Contractor designed cementitious bedding mortar shall be as specified in CC 495/WSR/001.

The product requirements for Contractor designed cementitious bedding m								
Structure ID or description of other asset	**Location of structure or other asset**	**Construction application for designed bedding mortar**	**ID of designed cementitious bedding mortar**	**Minimum 28-day compressive strength**	**Minimum cement content**	**Maximum cement content**	**Maximum effective water/cement ratio**	**M m ag at**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter a unique reference, to identify the structure or other asset for which designed cementitious bedding mortar is required.

b) Enter a unique reference, to where is existing or new asset located?.

c) Enter text, to for what construction application or applications can designed bedding mortar be used? e.g. under new mechanical bearing, under parapet baseplate, under baseplate of flexible

barrier, under gantry baseplate, in conjunction with precast concrete structural units etc.

d) Enter a unique reference, to ID of high strength proprietary bedding mortar linking it to the construction application.

e) Enter a number in units of MPa, to identify the minimum compressive strength of designed cementitious bedding mortar when tested at 28 days.

f) Enter a number in units of $kg.m^2$, to identify minimum cement content of designed cementitious bedding mortar.

g) Enter a number in units of kg/m^2, to identify maximum cement content of designed cementitious bedding mortar.

h) Enter a number, to identify the maximum effective water/cement ratio of designed cementitious bedding mortar, but not greater than 0.40.

i) Enter a number in units of mm, to maximum aggregate size of designed cementitious bedding mortar if not 2.8mm default size.

The product requirements for Contractor designed cementitious bedding mortar (continued)			
Structure ID or description of other asset	**Chloride content class (BS EN 206)**	**BS 8500 cement type options**	**Permitted thickness range of designed bedding mortar plinth**
(a)	(j)	(k)	(l)

j) Enter text, to identify BS EN 206 chloride content class for the designed cementitious bedding mortar.

k) Enter one or more values, from options CEM I, CEM II/A-D, CEM II/A-L, CEM II/A-P, CEM II/A-Q, CEM II/A-S, CEM II/A-V for designed cementitious bedding mortar, to select one or more.

l) Enter a number range (e.g. "40-60") in units of mm, to range of thickness of designed bedding mortar in a plinth if not 10-30mm.

Constituent material requirements for designed cementitious bedding mortar

Cement for designed bedding mortar

1.20 Cement used for a designed bedding mortar shall be compliant with BS EN 197-1 [Ref 3.N].

1.21 The cement shall meet the performance characteristics as stated in table 1.24.

1.22 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to cement used for a designed bedding mortar.

1.23 Cement for designed bedding mortar shall be any one cement type from table 1.24 as defined in BS 8500-2 [Ref 7.N], Table 1.

1.24 Cement for designed cementitious bedding mortar shall be in accordance with performance requirements for the characteristics shown in table 1.24.

Table 1.24 Characteristic and performance requirements for cement	
Characteristic	Performance requirement
Common cement constituents and composition	Constitution as defined in table 1 of BS EN 197-1 [Ref 3.N] for cement types specified in CC 495/WSR/001, or if not specified for any one cement type from CEM I, CEM II/A-D, CEM II/A-L, CEM II/A-P, CEM II/A-Q, CEM II/A-S, CEM II/A-V.
Compressive strength	Standard strength class of cement suitable for achieving the specified mortar strength
Soundness - expansion	≤ 10 %
Soundness - SO_3 content	≤ 4 %
Chloride content	≤ 0.1 %

Aggregates for designed bedding mortar

1.25 Aggregates for bedding mortar shall be compliant with BS EN 12620 [Ref 2.N].

1.26 The aggregates for bedding mortar shall meet the performance characteristics as stated in table 1.28.

1.27 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to aggregates for bedding mortar.

1.28 Aggregate for bedding mortar shall be in accordance with performance requirements for the characteristics shown in table 1.28.

Table 1.28 Essential characteristic and performance requirements for aggregate		
Essential characteristics	Sub-set of characteristic	Requirement

Particle shape, size and density	Aggregate size	Maximum size of 2.8 mm or as specified otherwise in CC 495/WSR/001
Composition/content	Acid soluble sulfate	Percentage by mass <1 %
Composition/content	Chlorides	Declared value
Durability against freeze thaw	Freeze/thaw resistance of coarse aggregate	F2

1.29 Maximum aggregate size in bedding mortar material shall be 2.8 mm, unless otherwise stated in CC 495/WSR/001.

1.30 Crushed concrete aggregate (CCA) and recycled aggregate (RA) shall not be used.

Aggregate fillers for designed bedding mortar

1.31 Fillers aggregates for bedding mortar shall be compliant with BS EN 12620 [Ref 2.N].

1.32 The filler aggregates shall meet the performance characteristics as stated in table 1.34.

1.33 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to filler aggregates for bedding mortar.

1.34 Aggregate filler shall be in accordance with performance requirements for the characteristics shown in table 1.34.

Table 1.34 Essential characteristic and performance requirements for filler aggregate

Essential characteristics	Sub-set of characteristic	Requirement
Fineness/particle size and density	Filler aggregate	Pass
Composition/content	Chlorides	Declared value
Durability against freeze/thaw	Freeze/thaw resistance of coarse aggregate	F2

Admixtures for designed bedding mortar

1.35 Admixtures used in a designed bedding mortar shall be compliant with BS EN 934-2 [Ref 1.N].

1.36 The admixtures shall meet the performance characteristics as stated in table 1.38.

1.37 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to admixture for bedding mortar.

1.38 Admixtures for bedding mortar shall be in accordance with performance requirements for the essential characteristics shown in table 1.38.

Table 1.38 Essential characteristic and performance requirements for bedding mortar admixtures	
Essential characteristics	Performance requirement
Chloride ion content	≤ 0,10 % by mass
Compressive strength	At 28 days: test mix ≥ 100 % of control mix
Initial Setting time	At 20° C: test mix ≥ 30 min. At 5° C : test mix ≤ 60 % of control mix

Product requirements for proprietary bedding mortar

1.39 Proprietary bedding mortar products shall be in accordance with requirements for performance characteristics indicated in table 1.39.

Table 1.39 Minimum performance requirements for proprietary bedding mortar products		
Performance characteristic	Test method	Requirement
Compressive strength	BS EN 12190 [Ref 16.N]	≥ 50 MPa
Chloride ion content	BS EN 1015-17 [Ref 13.N]	≤ 0.05 %
Adhesive bond	BS EN 1542 [Ref 21.N]	≥ 2.0 MPa
Restrained shrinkage/expansion	BS EN 12617-4 [Ref 20.N]	Bond strength after test ≥ 2.0 MPa
Carbonation resistance	BS EN 13295 [Ref 19.N]	dk ≤ control concrete (MC(0,45))
Elastic modulus	BS EN 13412 [Ref 17.N]	≥ 20 GPa
Capillary absorption	BS EN 13057 [Ref 18.N]	≤ 0.5 $kg \cdot m^{-2} \cdot h^{-0.5}$
Short term expansion (hydraulic or polymer hydraulic (CC or PCC binder) products)	ASTM C827 [Ref 27.N]	> +0.25 % and < +2.50 % at 24 hours
Linear shrinkage (polymer (PC binder)	ASTM C531	> -0.60 % and <

products)	[Ref 29.N]	+1.00 % at 24 hours

1.40 The following Documentation shall be submitted for proprietary bedding mortar products prior to the commencement of preworks laboratory suitability tests: report confirming product performance complies with requirement for indicated performance characteristics.

1.41 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to report confirming performance complies with requirement for indicated characteristics for proprietary bedding mortar products.

Product requirements for all cementitious bedding mortars

Water for mixing cementitious or polymer cementitious mortars (hydraulic or polymer hydraulic)

1.42 Water for mixing cementitious or polymer cementitious bedding mortar shall be compliant with BS EN 1008 [Ref 14.N].

1.43 Water for mixing cementitious or polymer cementitious bedding mortar shall not be sourced from the sea, estuaries nor tidal rivers.

1.44 The SO_4 sulfate content of mixing water shall not exceed a concentration of 1.4g per litre of water.

Verification requirements for mix composition of designed bedding mortar product

Confirmation of composition for designed bedding mortar

1.45 Verification shall be undertaken for total chloride content of the designed bedding mortar by calculation in accordance with BS 8500-2 [Ref 7.N].

1.46 The frequency of total chloride calculation shall be once per mortar mix design per construction application.

1.47 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to the calculation of total chloride content of the mix.

1.48 Total chloride ion content of the designed bedding mortar mix shall not exceed 0.1 % of the mass of cement..

1.49 Verification shall be undertaken for total acid soluble sulfate of the designed bedding mortar mix by calculation in accordance with BS EN 1744-1 [Ref 39.N].

1.50 The frequency of total acid soluble sulfate calculation shall be once per mortar mix.

1.51 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to the calculation of total acid soluble sulfate content of the bedding mortar mix.

1.52 The total acid soluble sulfate content of the bedding mortar mix expressed as SO_4 shall not exceed 5 % by mass of cement.

Reporting of total chloride and sulfate content of designed bedding mortar mix

1.53 The following Documentation shall be submitted for designed bedding mortar mixes prior to the commencement of laboratory approval testing: Calculation report including confirming total chloride content and total acid soluble sulfate content of bedding mortar mix.

1.54 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to calculation report including confirming total chloride content and total acid soluble sulfate content of bedding mortar mix.

General verification requirements for suitability of bedding mortar product by preworks laboratory LT type tests

1.55 Verification shall be undertaken for bedding mortar proposed for the works using the following laboratory testing indicated in table 1.58, tests LT1 to LT4b as relevant to bedding mortar type.

1.56 The frequency of bedding mortar testing shall be once for each construction application of bedding mortar per project contract.

1.57 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to all types of testing for each bedding mortar.

1.58 Preworks laboratory tests required for flowable bedding mortars shall be in accordance with table 1.58.

Table 1.58 Required preworks laboratory testing for types of bedding mortar product

Type of flowable bedding mortar product	Laboratory tests required
Proprietary hydraulic or polymer hydraulic mortar (binder types CC or PCC) in accordance with BS EN 1504-1 [Ref 15.N])	LT1, LT2, LT4a
Proprietary polymer mortar (binder type PC in accordance with BS EN 1504-1 [Ref 15.N])	LT1, LT2, LT4b

Designed cementitious bedding mortar	LT1, LT2, LT3, LT4a

1.59 Temperatures specified for laboratory tests shall be in accordance with table 1.59.

Table 1.59 Temperature tolerances for laboratory tests of bedding mortar

Nominal temperature specified for laboratory test	Permitted tolerance on temperature for test to be valid
5°C	-0°C to +2°C
10°C	-0°C to +2°C
20°C	-0°C to +2°C
45°C	-2°C to +2°C

1.60 Flowable bedding mortar for laboratory testing shall be mixed in accordance with the manufacturer's instructions and the proposed method of installation on site.

Preworks laboratory test LT1 for calibration of flow of bedding mortar product, temperature sensitivity

1.61 Verification shall be undertaken for flow characteristics of the proposed bedding mortar using the Flow Cone Test method in ASTM C939 [Ref 28.N].

1.62 The frequency of LT1 test for flow characteristics shall be once for each bedding mortar mix.

1.63 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to testing of mortar flow characteristics.

1.64 Verification for flow characteristics of the proposed bedding mortar using the Flow Cone Test method in ASTM C939 [Ref 28.N] shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

1.65 Efflux times shall be measured using only the standardised flow cone apparatus compatible with the flow of grout test procedure in ASTM C939 [Ref 28.N].

1.66 At least two flow cone tests at each temperature shall be carried out on mortar to measure time of efflux for lower and for upper temperature conditions.

1.67 Measured times of efflux carried out at each temperature condition shall be carried out until two results are within +/- 5 % of each other when the results are deemed to be valid.

1.68 Valid efflux times for flow cone tests shall be averaged and reported for upper and lower temperature condition to nearest 0.2 seconds.

1.69 The difference between efflux times measured for a flowable mortar material at upper and lower temperatures shall not exceed the times in table 1.69 when measured by method for flow cone in ASTM C939 [Ref 28.N].

Table 1.69 Maximum difference in eflux times for chemical types of flowable mortar	
Chemical type of flowable mortar with reference to BS EN 1504-1 [Ref 15.N]	Maximum difference in efflux time measured at lower and upper test temperature
Hydraulic (CC) or polymer hydraulic (PCC) flowable mortar	60 seconds
Polymer (PC) flowable mortar	120 seconds

Calibration of flow by flow cone at lower temperature condition, test $LT1_{lt}$

1.70 The test shall be carried out when ambient temperature is at 5° C and within 15 minutes of starting to mix.

1.71 The temperature of flow cone and mixer; the dry material or binder; and the water shall be 5° C, 10° C and 20° C respectively.

Calibration of flow by flow cone at upper temperature condition, test $LT1_{ut}$

1.72 The temperature of flow cone and mixer; the dry material, and the water or binder shall all be 20° C.

1.73 The test shall be carried out when ambient temperature is 20°C and within 15 minutes of starting to mix.

Preworks laboratory test LT2 for bedding mortar flow between glass plates

Test apparatus for bedding mortar flow between glass plates

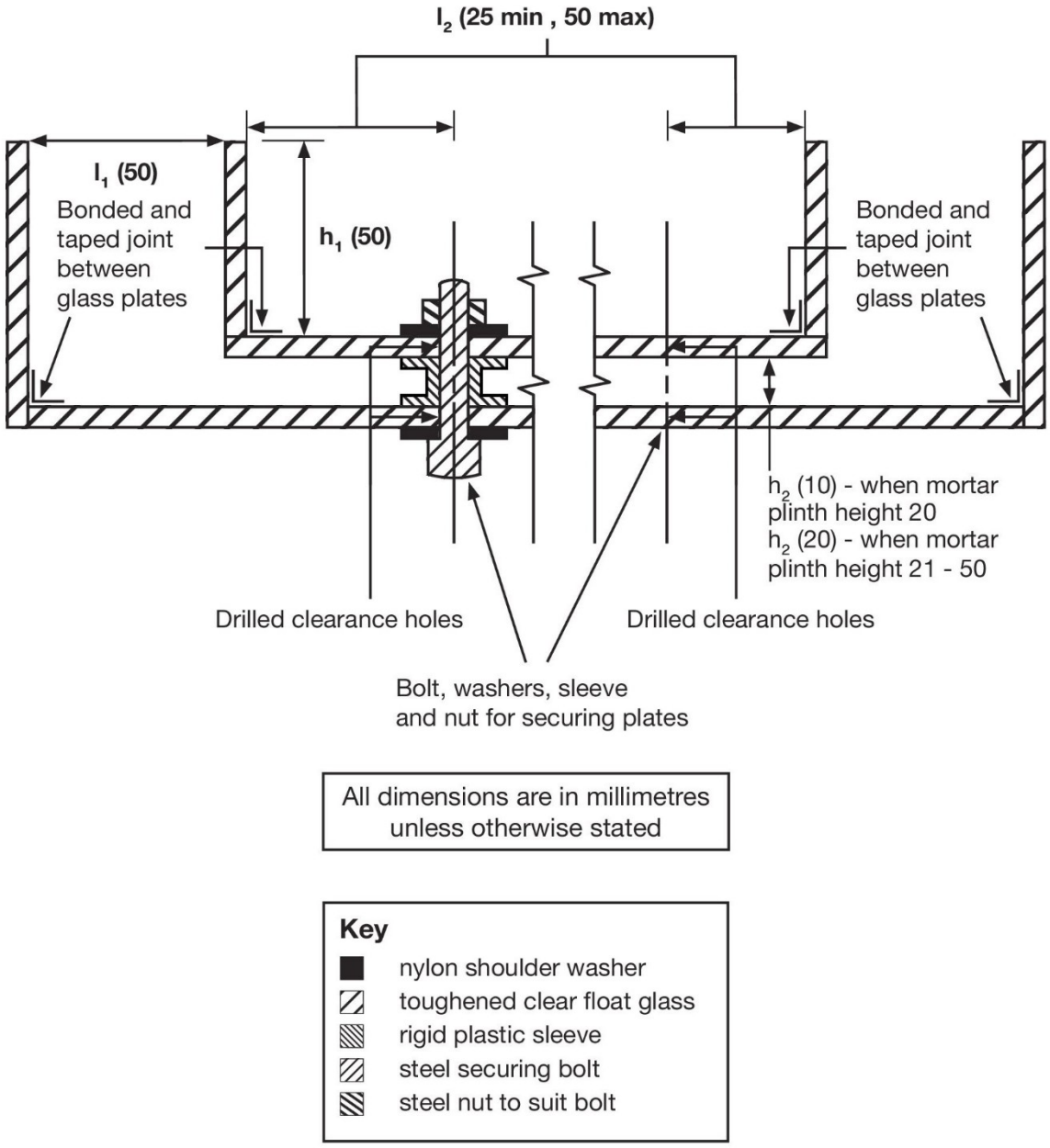
1.74 Verification shall be undertaken for flow characteristics between glass plates of the proposed bedding mortar using the testing apparatus shown below in figure 1.77.

1.75 The frequency of LT2 test for flow between glass plates shall be once for each construction application of bedding mortar.

1.76 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to testing of flow characteristics between glass plates.

1.77 The test apparatus to be used to determine flow characteristics between glass plates of bedding mortar shall be as shown below in figure 1.77

Figure 1.77 Test apparatus for flow between glass plates



1.78 Symbols "l" and "h" in figure 1.77 shall refer to horizontal dimension (width) and vertical dimension (height) respectively.

1.79 The top glass plate of the test apparatus shall be 375 mm x 300 mm of 6 mm thick clear float glass in accordance with BS EN 572-2 [Ref 11.N] and subsequently thermally toughened.

1.80 The bottom glass plate of the test apparatus shall be 475 mm x 400 mm of 6 mm thick clear float glass in accordance with BS EN 572-2 [Ref 11.N] and subsequently thermally toughened.

1.81 4 no. loose fit clearance holes to suit securing bolts shall be drilled though 6 mm thick clear float glass top and bottom plates before glass plates are thermally toughened.

1.82 Clearance holes drilled in float glass shall be located with the same spacing and relative position as holes in baseplates required for the permanent works.

1.83 The tolerance on diameter and position of clearance holes in clear float glass shall be in accordance with BS EN 12150-1 [Ref 12.N].

1.84 Glass plate containing walls shall be 6 mm think clear float glass in accordance with BS EN 572-2 [Ref 11.N]and subsequently thermally toughened.

1.85 Thermal toughening of 6 mm thick clear float glass top and bottom plates shall be in accordance with BS EN 12150-1 [Ref 12.N].

1.86 Where the plan area of the metal baseplate of the permanent works bearing or VRS post is more than 50 % larger than the plan area of the upper glass plate (375 mm x 300 mm), plan dimensions of the top and bottom glass plates for the test apparatus shall be scaled up to take account of the difference.

1.87 Top and bottom glass plates of the test apparatus shall be secured in position using 4 no. bolts of 12 mm shank diameter and nuts.

1.88 Washers and sleeve to accompany securing bolts for the test apparatus shall be made of nylon plastic at least 1mm thick.

1.89 Glass top and bottom plates of the test apparatus shall be set and maintained on a horizontal plane during pouring and curing of the mortar.

General requirements for flow between glass plate test

1.90 The following Documentation shall be submitted for planning the test of bedding mortar flow between glass plates prior to the commencement of preworks laboratory test LT2: Details of the proposed method of installing bedding mortar for structural or VRS components on site.

1.91 Documentation for proposed method of installing bedding mortar for structural or VRS components on site shall be submitted to the test laboratory before starting to plan assembly of the test equipment.

1.92 Two tests to measure flow between glass plates shall be carried out for an air temperature at location of test of 5° C and also for an air temperature at location of test of 20° C.

1.93 Verification shall be undertaken for temperature of test apparatus, mixer, dry material, water, binder and ambient temperature at place of test for each referenced test of flow between glass plates tests undertaken by measurement and recording.

1.94 The frequency of measuring and recording temperature of test apparatus, mixer, dry material, water, binder and ambient temperature shall be once per referenced test for flow between glass plates.

1.95 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to measuring and recording temperature of test apparatus, mixer, dry material, water, binder and ambient temperature.

1.96 Flowable bedding mortar to be tested for flow between glass plates shall be mixed in accordance with the product manufacturer's recommendations relevant for the proposed method of installing structural or VRS components on site.

1.97 The flow requirement shall be satisfied if mortar flows between the top and the bottom glass plates of the test apparatus and rises at least 10 mm at all positions above the underside of top plate without visible segregation, bleeding, effervescence or air bubble inclusions.

Flow between glass plates at lower temperature condition, test $LT2_{lt}$

1.98 Temperature of the test apparatus and mixer; the dry material, the water or binder for test of flow between glass plates at lower temperature shall be be 5° C, 10° C and 20° C respectively.

1.99 The test for flow between glass plates at the lower temperature, $LT2_{lt}$ shall be carried out by pouring in one corner of the apparatus when the ambient temperature is at 5° C and between 15 and 22 minutes after starting to mix the bedding mortar.

Flow between glass plates at upper temperature condition, test $LT2_{ut}$

1.100 The temperature of the test apparatus and mixer, the dry material, the water and binder shall be 20° C when starting to mix the bedding

mortar product or constituent materials prior to the test of flow between glass plates at upper temperature, $LT2_{ut}$.

1.101 The test for flow between glass plates at upper temperature, $LT2_{ut}$ shall be carried out by pouring the mixture in one corner of the apparatus when the ambient temperature is 20° C and between 15 and 22 minutes of starting to mix the bedding mortar product or constituent materials.

Preworks laboratory test LT3 for compressive strength of designed cementitious bedding mortar

1.102 Verification shall be undertaken for compressive strength in accordance with BS EN 12390-3 [Ref 35.N].

1.103 The frequency of compressive strength testing shall be once for each designed bedding mortar mix and for every construction application.

1.104 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to compressive strength testing.

1.105 Verification for compressive strength shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

1.106 Six 100 mm cubes of cementitious bedding mortar shall be made in accordance with BS EN 12390-2 [Ref 37.N]to determine compressive strength.

1.107 The temperature of mixer, dry material, water and mould for test of compressive strength of designed cementitious bedding mortar shall be 20° C.

1.108 Cube specimens of designed cementitious bedding mortar shall be made in the mould without compaction, then covered by a steel plate at least 15mm thick and damp cured for 24 hours.

1.109 Cube specimens of designed cementitious bedding mortars shall then be demoulded and water cured until 28 days old in accordance with BS EN 12390-2 [Ref 37.N].

1.110 Tests for compressive strength of cementitious bedding mortar shall be undertaken when the mortar is 28 days old.

1.111 The compressive strength requirement shall be satisfied if all strength results are at least the specified minimum strength and the difference between highest and lowest results is not greater than 20 % of the average.

Preworks laboratory test LT4a for elastic stability of hydraulic or polymer hydraulic bedding mortar

1.112 Verification shall be undertaken for elastic stability of hydraulic or polymer hydraulic bedding mortar in accordance with the LT4a test method.

1.113 The frequency of elastic stability testing of hydraulic or polymer hydraulic bedding mortar shall be once per contract for each construction application of hydraulic or polymer hydraulic bedding mortar.

1.114 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to testing elastic stability of hydraulic or polymer hydraulic bedding mortar.

Making of hydraulic or polymer hydraulic mortar cubes for elastic stability test

1.115 Verification for making and curing of hydraulic or polymer hydraulic mortar cubes for elastic stability testing in accordance with BS EN 12390-2 [Ref 37.N] shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

1.116 Three 100 mm hydraulic or polymer hydraulic bedding mortar cubes shall be made in accordance with BS EN 12390-2 [Ref 37.N]to determine elastic stability of the bedding mortar.

1.117 Hydraulic or polymer hydraulic bedding mortar cubes for elastic stability testing shall be made when the mixer, dry material, water and mould is at a temperature of 20° C.

1.118 Hydraulic or polymer hydraulic bedding mortar cubes shall be made in the mould without compaction, damp-cured and covered by a steel plate for 24 hours.

Further conditioning and testing of hydraulic or polymer hydraulic mortar cubes

1.119 Hydraulic or polymer hydraulic bedding mortar cube specimens shall then be demoulded and water cured for 28 days in accordance with BS EN 12390-2 [Ref 37.N].

1.120 Hydraulic or polymer hydraulic bedding mortar cube specimens shall be placed in water at temperature of 20°C and water temperature raised at a uniform rate to 45° C in 24 hours.

1.121 Hydraulic or polymer hydraulic bedding mortar cube specimens shall then be removed from water and sealed individually in plastic bags.

1.122 Each bagged hydraulic or polymer hydraulic bedding mortar cube specimen shall then be loaded at a compressive stress of 30 MPa and stress maintained for six hours at a temperature of 45° C.

1.123 The elastic stability requirement shall be satisfied if calculated vertical compressive strain on each hydraulic or polymer hydraulic bedding mortar cube specimen at completion of the loading phase does not exceed 1 %.

Preworks laboratory test LT4b for elastic stability of polymer bedding mortar

1.124 Verification shall be undertaken for elastic stability of polymer bedding mortar in accordance with the LT4b test method below.

1.125 The frequency of elastic stability testing of polymer bedding mortar shall be once per contract for each construction application of bedding mortar.

1.126 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to testing elastic stability of polymer bedding mortar.

Making of polymer mortar cubes for elastic stability test

1.127 Verification for making and curing polymer bedding mortar cubes for elastic stability testing in accordance with BS EN 12190 [Ref 16.N] shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

1.128 Two 40 mm polymer bedding mortar cubes shall be made in accordance with BS EN 12190 [Ref 16.N]to determine elastic stability of polymer mortar.

1.129 Polymer bedding mortar cube specimens for elastic stability test shall made in the mould, demoulded and cured in accordance with BS EN 12190 [Ref 16.N], unless otherwise stated in CC 495/WSR/001.

SI.1.129 The curing period of polymer bedding mortar cube specimens for LT4b elastic stability test shall be [enter a number] .

Conditioning and testing of polymer mortar cubes

1.130 Fully cured and demoulded polymer bedding mortar cube specimens shall be conditioned in a standard laboratory climate for 24 hours.

1.131 Following completion of conditioning, the temperature of cured polymer bedding mortar cube specimens shall be raised by heating in water at a uniform rate to 45° C for a further 24 hours.

1.132 Each polymer bedding mortar cube specimen shall be loaded at a compressive stress of 30 MPa and stress maintained for six hours at an air temperature of 45° C.

1.133 Each polymer bedding mortar cube specimen shall be quickly sealed in a plastic bag before being placed in the loading frame.

1.134 Strain measurements shall be undertaken on vertical faces of each loaded polymer mortar cube specimen.

1.135 The elastic stability requirement shall be satisfied if calculated vertical compressive strain on each polymer mortar cube specimen does not exceed 1 % at completion of the loading phase.

Reporting of laboratory results of mortar suitability tests

1.136 The following Documentation shall be submitted for all compliant and non-compliant laboratory suitability tests of bedding mortar prior to the commencement of mortar plinth construction: Factual and interpretive report of bedding mortar suitability tests and results.

1.137 Documentation Factual and interpretive laboratory report of bedding mortar suitability tests and results shall be submitted no less than two weeks before commencement of permanent works bedding mortar plinth construction.

Installation requirements for bedding mortar plinths

Dimensions of bedding mortar plinth

1.138 Bedding mortar plinth thickness shall be at least 10 mm, but not greater than 30 mm, unless otherwise stated in CC 495/WSR/001.

1.139 Mortar cover to packers, shims, washers or holding down bolts used under bearing plates within a bedding mortar plinth shall be at least 50 mm.

Preparation of substrates before installation of bedding mortar

1.140 Cementitious substrates interfacing with bedding mortar shall be roughened by blasting to concrete surface profile grade CSP 3 or higher in accordance with Technical Guideline 310.2R [Ref 23.N], cleaned of dust and debris before placement of bedding mortar material.

1.141 Cementitious substrates to receive cementitious or polymer cementitious bedding mortar shall be pre-wetted with water complying with BS EN 1008 and maintained in a saturated surface dry condition until placement of the bedding mortar material.

1.142 The underside of metal baseplates shall be clean and free of corrosion or loose mill scale prior to placement of bedding mortar.

1.143 Metal packers, shims and washers shall be isolated from direct contact with holding down bolts or the underside of a metal baseplate to prevent bimetallic corrosion between dissimilar metals.

1.144 Cementitious substrates to receive polymer mortars shall be clean and dry before applying a polymer mortar.

1.145 Bonding primers required for polymer bedding mortar type PC complying with BS EN 1504-1 [Ref 15.N] shall be applied to substrates in accordance with manufacturer's instructions.

Installation requirements for bedding mortar product

Site mixing, placing, compaction and curing of bedding mortar

1.146 The same materials and methods used in laboratory approval tests shall be used to fill the void between upper and lower surfaces of baseplates.

1.147 Proprietary products shall be stored before use in a dry environment to ensure their properties are not impaired and in accordance with the manufacture's instructions.

1.148 Proprietary bedding mortar products shall be installed in accordance with the manufacturer's instructions.

1.149 Only full containers or packs of proprietary bedding mortar products shall be mixed for use.

1.150 Freshly mixed bedding mortar shall completely fill all spaces between base plates and the substrate and around holding down bolts without compaction being required.

1.151 Bedding mortar material shall not be added to the sides of the plinth until bedding mortar material has flowed completely under all of the baseplate.

1.152 Bedding mortar material shall be placed when the ambient temperature is between 5° C and 25° C inclusive.

1.153 Bedding mortar material shall not be mixed or placed when ambient temperature or the temperature of substrate at interfaces with the bedding mortar is less than 5° C.

1.154 Installed bedding mortar material shall be protected from temperatures lower than 5°C and be maintained at temperature of 5° C or above for 24 hours after placement of bedding mortar material.

1.155 The surface of installed bedding mortar material shall be maintained at or below 25° C for at least 24 hours when ambient temperatures rise above 25° C.

1.156 Cementitious or polymer-cementitious bedding mortar material shall be installed in its final position within 25 minutes of mixing.

1.157 Cementitious and polymer cementitious mortar material shall be covered after completion of installation for at least three days to prevent loss of moisture by evaporation.

1.158 Polymer bedding mortar material shall be installed in its final position within 60 minutes of mixing unless indicated otherwise by the product manufacturer's instruction.

Loading of completed bedding mortar plinth

1.159 Bedding mortar shall not be loaded until the specified characteristic 28-day compressive strength has been reached, unless otherwise stated in CC 495/WSR/001.

SI.1.159 The minimum characteristic compressive strength of bedding mortar before loading shall be [enter a number] .

Installation verification for bedding mortar

Site trials of bedding mortar placement method

1.160 A site trial of the proposed bedding mortar placement method shall be carried out for bedding mortar mixes used under bridge bearings, unless otherwise stated in CC 495/WSR/001.

SI.1.160 The site trial of proposed placement method for bedding mortar mixes shall be [enter free text].

1.161 Verification shall be undertaken for installing bedding mortar mix using proposed method of placement.

1.162 The frequency of demonstrating bedding mortar placement method shall be once per structure.

1.163 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to proposed method of installing bedding mortar mix.

General requirements for site control tests to verify flow of bedding mortar, SCT tests

1.164 SCT1a and SCT 1b tests on site for confirming flow of accepted bedding mortar shall be by the flow cone test carried out at ambient temperature by the method described for test reference LT1.

1.165 Ambient temperature to verify flow of bedding mortar for the SCT1a or SCT 1b tests shall be between 5°C and 25°C inclusive where bedding mortar is to be installed.

1.166 Verification for confirming flow on site of accepted bedding mortar by the SCT1a or SCT 1b tests shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

Verifying bedding mortar flow on site if laboratory efflux times are similar i.e. within stated range, test SCT 1a

1.167 Verification on site by the SCT1a test shall be undertaken for confirming bedding mortar flow where laboratory LT test efflux times reported for 5° C and 20° C are within 10 % or two seconds of each other whichever is the longer time period.

1.168 Verification shall be undertaken for on-site flow of bedding mortar where laboratory test efflux times were similar and ambient site temperature is 10°C or higher using the Flow Cone Test method in ASTM C939 [Ref 28.N].

1.169 The frequency of on-site confirmation of flow shall be each batch of mortar.

1.170 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to calibration of flow on site.

1.171 At least two flow cone tests for the SCT 1a test shall be carried out on bedding mortar to measure time of efflux at ambient temperature.

1.172 Measured time of efflux at ambient temperature for the SCT 1a test shall agree within ± 10 % or ± two seconds whichever is the greater, of the acceptable efflux time obtained in the laboratory tests undertaken at 20° C.

Verifying bedding mortar flow on site if laboratory times of efflux times are outside stated range, test SCT 1b

1.173 Verification on site by the STC 1b test shall be undertaken for confirming bedding mortar flow where laboratory test (LT test) efflux

times reported for 5° C and 20° C are NOT within 10 % or two seconds of each other whichever is the longer time period.

1.174 Verification shall be undertaken for on-site calibration of flow for bedding mortar where laboratory test efflux times are not similar using the using the Flow Cone Test method in ASTM C939 [Ref 28.N].

1.175 The frequency of on-site confirmation of flow shall be each batch of mortar.

1.176 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to calibration of bedding mortar flow on site.

1.177 At least two flow cone tests for the SCT 1b test shall be carried out on bedding mortar to measure time of efflux at ambient temperature.

1.178 Where ambient temperature is less than 10°C for the SCT 1b test, measured time of efflux shall agree within ± 10 % or ± two seconds whichever is the greater, of the acceptable efflux time obtained in the laboratory approval tests undertaken at 5° C.

1.179 Where ambient temperature is 10°C or greater for the SCT 1b test, measured time of efflux shall agree within ± 10 % or ± two seconds whichever is the greater, of the acceptable efflux time obtained in the laboratory approval tests undertaken at 20° C.

Verifying compressive strength of bedding mortar on site, test SCT 2

1.180 On-site identity testing of compressive strength by the SCT 2 test shall be undertaken for bedding mortars with cementitious, polymer cementitious and polymer binders.

1.181 Specimens for testing compressive strength of cementitious or polymer cementitious bedding mortar by the SCT 2 test shall be three 100 mm cubes made in accordance with BS EN 12390-2 [Ref 37.N].

1.182 Specimens for testing compressible strength of polymer bedding mortar by the SCT 2 test shall be three 40 mm cubes made in accordance with BS EN 12190 [Ref 16.N].

1.183 Cube specimens made of mortar with cementitious, polymer cementitious or polymer binders for the SCT 2 test shall be made in the mould without compaction, then covered with a 15 mm thick steel plate for 24 hours and stored next to the location where bedding mortar has been installed.

1.184 Cementitious or polymer cementitous bedding mortar cube specimens for the SCT 2 test shall then be demoulded and stored in the same location without additional curing until the specimen is 28 days old.

1.185 Polymer bedding mortar cube specimens for the SCT 2 test shall then be demoulded and stored in the same location without additional curing until the specimen is 7 days old.

1.186 Verification for cube compressive strength of cementitious, polymer cementitous or polymer bedding mortar for the SCT 2 test shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

1.187 Testing for compressive strength of cementitious or polymer cementitious bedding mortar for the SCT 2 test shall be undertaken when the specimen is 28 days old.

1.188 Testing for compressive strength of polymer bedding mortar for the SCT 2 test shall be undertaken when the specimen is 7 days old.

1.189 Where strength assessment of bedding mortar strength from the SCT2 test is required before 28 days for cementitious or polymer cementitious bedding mortar, or before 7 days for polymer bedding mortar, compressive strength shall be confirmed by testing of additional bedding mortar cubes made of the same material in accordance with BS EN 12390-2 [Ref 37.N]or BS EN 12190 [Ref 16.N]and stored under conditions that simulate field conditions.

1.190 Verification shall be undertaken for compressive strength of cementitious or polymer cementitious bedding mortar in accordance with BS EN 12390-3 [Ref 35.N] or in accordance with BS EN 12190 [Ref 16.N] for polymer bedding mortar.

1.191 The frequency of compressive strength testing shall be each batch of mortar.

1.192 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to testing compressive strength of cementitious or polymer cementitious bedding mortar cubes made on site.

1.193 Where all compressive strength test results from the SCT 2 test of are at least the required 28-day strength and the difference between highest and lowest results is not greater than the average, the compressive strength requirement shall be acceptable.

1.194 The following Documentation shall be submitted for compressive strength of cementitious, polymer cementitious or polymer cubes from the SCT 2 test prior to the commencement of loading bearing plinths: laboratory report of cube compressive strength.

1.195 Documentation compressive strength of cementitious, polymer cementitious or polymer cubes shall be submitted 5 working days before commencement of loading bearing plinths.

2. Concrete for Ancillary Purposes

General requirements for ancillary concrete

2.1 Concrete used for ancillary purposes shall be designated concrete complying with BS 8500-1 [Ref 6.N]and BS 8500-2 [Ref 7.N] as amended and complemented by this document.

2.2 Designated concrete mixes required for ancillary purposes not covered elsewhere in other Specification documents shall be in accordance with table 2.2, unless otherwise stated in CC 495/WSR/002.

Table 2.2 Use of concrete for ancillary purposes	
Generic description of ancillary purpose	BS 8500 designated concrete mix reference
1. Low strength non-structural mass concrete. Suitable for void filing and layer regulating in non-aggressive natural ground or highway construction.	GEN1
2. Moderately low strength non-structural mass concrete used in non-aggressive natural ground or highway construction and suitable for light duty applications providing support and resistance to modest dead load, earth pressure and/or light fluctuating load effects.	GEN2
3. Moderately low strength mass or lightly reinforced concrete in non-aggressive natural ground or highway construction and intended for light duty applications subjected to dead load, earth pressure and/or light vehicle load effects.	GEN3
4. Normal strength mass or lightly reinforced concrete applications in non-aggressive natural ground or highway construction and capable of providing support and resistance to moderate dead, dynamic compressive and/or lateral/impact load effects.	RC20/25
5. Normal strength mass or lightly reinforced concrete capable of resisting localised heavy wheel load effects without fracture	RC25/30

2.3 Designated concrete mix references for ancillary purposes shall be used for the construction applications specified in CC 495/WSR/002.

Designated concrete mix references for ancillary purposes				
Highway construction discipline	**Site location where ancillary concrete mix required**	**Construction application for ancillary concrete**	**Scheme reference ID for designated concrete mix**	**BS 8500-1/BS 8500-2 designated concrete mix type required**
(a)	(b)	(c)	(d)	(e)

a) Enter a value, from options boundary fencing, road restraints, drainage, earthworks, pavements, traffic signs, lighting and masts, highway communications, masonry walls, other (please specify), to Highway construction discipline.

b) Enter text, to Site location where concrete mix required e.g. all slip road verges with natural ground below the topsoil layer or within the verge adjacent to nearside s'bound entry slip at M5, junction 6.

c) Enter text, to construction application e.g. access steps to communications cabinets; bed and surround to drainage run X; legacy VRS post foundations or legacy VRS end anchorages.

d) Enter a unique reference, to identify concrete mix reference to link with other schedules elsewhere in the contract information.

e) Enter a unique reference, to Type of designated concrete mix required e.g. designated GEN<x>, FND<x>, RC<x/y> concrete etc where <x> or <y> are numbers in accordance with BS 8500-1/BS 8500-2.

Constituent material requirements of concrete for ancillary purposes

Cement for ancillary concrete

2.4 Common cement for ancillary concrete shall be compliant with BS EN 197-1 [Ref 3.N].

2.5 The common cement for ancillary concrete shall meet the performance characteristics as stated in table 2.10.

2.6 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to common cements for ancillary concrete.

2.7 Portland-composite cement CEM II/C-M and Composite cement CEM VI for ancillary concrete shall be compliant with BS EN 197-5 [Ref 4.N].

2.8 The Portland-composite cement CEM II/C-M and Composite cement CEM VI for ancillary concrete shall meet the performance characteristics as stated in table 2.10.

2.9 Cement used in concrete for ancillary purposes shall be any one of the Common cement, Portland-composite or Composite cement types listed in table 2.10 as permitted in BS 8500-2 [Ref 7.N], Table 7 for designated concrete specified.

2.10 Common cement, Portland-composite cement and Composite cement shall be in accordance with performance requirements for the characteristics shown in table 2.10, unless otherwise stated in CC 495/WSR/002.

Table 2.10 Performance requirements for cement used in ancillary concrete

Characteristic	Performance requirement
Common cement constituents and composition complying with BS EN 197-1 [Ref 3.N]	Any one Common cement type from CEM I, CEM II/A-D, CEM II/A-S, CEM II/A-P, CEM II/A-Q, CEM II/A-V, CEM II/A-L, CEM II/A-M, CEM II/B-M, CEM II/B-S, CEM II/B-P, CEM II/B-Q, CEM II/B-V, CEM III/A, CEM IV/B-P, CEM IV/B-Q, CEM IV/B-V or equivalent combination.
Portland-composite cement CEM II/C-M and Composite cement CEM VI constituents and composition complying with BS EN 197-5 [Ref 4.N]	Any one Portland-composite or Composite cement type from CEM II/C-M, CEM VI (S-L), CEM VI (S-V) or equivalent combination
Compressive strength	Standard strength class of cement needed to achieve the strength for the specified designated concrete mix.
Soundness (SO_3 content)	≤ 4 %
Chloride content	< 0.10 %
C_3A in clinker	≤ limits for C_3A given in BS EN 197-1 [Ref 3.N]if a sulfate resisting cement is specified

SI.2.10 The type of sulfate-resisting cement, where required, shall be [select one or more from: CEM I-SR 0, CEM I-SR 3, CEM II/B-P+SR, CEM II/B-Q+SR, CEM II/B-V+SR, CEM II/C-M(S-L)+SR, CEM II/C-M(V-L)+SR, CEM IIIA+SR, CEM VI(S-L)+SR] in accordance with Table 1 of BS 8500-2 [Ref 7.N].

2.11 The following Documentation shall be submitted for Portland-composite cement CEM II/C-M and Composite cement CEM VI for ancillary concrete prior to the commencement of concreting works: certificate of conformity in accordance with Section 8 of BS EN 197-5 [Ref 4.N]demonstrating that the Portland-composite cement CEM II/C-M and

Composite cement CEM VI for ancillary concrete meet the specification requirements.

2.12 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to certificate of conformity for Portland-composite cement CEM II/C-M and Composite cement CEM VI for ancillary concrete.

Aggregates for ancillary concrete

2.13 Aggregates for ancillary concrete shall be compliant with BS EN 12620 [Ref 2.N].

2.14 The aggregates for ancillary concrete shall meet the performance characteristics as stated in table 2.16.

2.15 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to aggregates for ancillary concrete.

2.16 Aggregate shall be in accordance with performance requirements for the characteristics shown in table 2.16.

Table 2.16 Essential characteristic and performance requirements for aggregates used in ancillary concrete

Essential characteristic	Sub-set of characteristics	Performance requirement
Particle shape, size and density	Aggregate size	20 mm maximum size of aggregate
Durability against freeze thaw	Freeze/thaw resistance of coarse aggregate	F2
Durability against alkali silica reactivity	Alkali silica reactivity	Declared value
Composition/content	Chlorides	Declared value
Composition/content	Acid soluble sulfate	$AS_{0.8}$

2.17 Recycled aggregate (RA) except crushed concrete aggregate (CCA) and crushed concrete fine aggregate (fine CCA) as defined in BS 8500-1 [Ref 6.N] shall not be used in designated concretes used for ancillary purposes.

2.18 Potash and incinerator bottom ash aggregate shall not be used in designated concrete used for ancillary purposes.

2.19 Crushed concrete aggregate (CCA) as defined in BS 8500-1 [Ref 6.N] shall not be used in designated concretes types GEN3, nor RC20/25 nor designated FND type concretes listed in BS 8500-1 [Ref 6.N] or BS 8500-2 [Ref 7.N].

2.20 Coarse crushed concrete aggregate (coarse CCA) as defined in BS 8500-1 [Ref 6.N] shall only be used in designated concretes type GEN1 or GEN2 listed in BS 8500-1 [Ref 6.N]and BS 8500-2 [Ref 7.N].

2.21 Where used in designated concrete for ancillary purposes, coarse crushed concrete aggregate (coarse CCA) as defined in BS 8500-1 [Ref 6.N] shall be classified as normal reactivity and conform to BS 8500-2 [Ref 7.N] with further limitations on use with types of designated concrete specified in this document.

2.22 Coarse crushed concrete aggregate (CCA) as defined in BS 8500-1 [Ref 6.N] used in designated GEN1 or GEN2 type concrete shall comprise 20% or less of mass fraction of the coarse aggregate.

Admixtures for ancillary concrete

2.23 Air entraining admixtures for ancillary concrete shall be compliant with BS EN 934-2 [Ref 1.N].

2.24 The concrete admixtures for ancillary concrete shall meet the performance characteristics as stated in table 2.26.

2.25 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to air entraining admixtures for ancillary concrete.

2.26 Air entraining admixtures for ancillary concrete shall be in accordance with performance requirements for the essential characteristics shown in table 2.26.

Table 2.26 Essential characteristic and performance requirements for air entraining admixtures

Essential characteristic	Performance requirement
Chloride ion content	≤ 0,10 % by mass
Compressive strength	At 28 days : test mix ≥ 75 % of control mix
Air content in fresh concrete (entrained air)	Test mix ≥ 2.5 % by volume above control mix Total air content 4 % to 6 % by volume

Water for mixing ancillary concrete

2.27 Water for mixing ancillary concrete shall be compliant with BS EN 1008 [Ref 14.N].

2.28 Water for mixing ancillary concrete shall not be sourced from the sea, estuaries nor tidal rivers.

Product requirements of concrete for ancillary purposes

2.29 Product requirements of fresh designated concrete for ancillary purposes shall be as specified in CC 495/WSR/002.

Product requirements of fresh designated concrete for ancillary purposes				
Mix reference of designated concrete for ancillary purposes	**Purpose for ancillary concrete**	**Fresh mix consistence class (slump)**	**Air-entrainment required**	**Minimum air content by volume of air-entrained fresh concrete**
(a)	(b)	(c)	(d)	(e)

a) Enter a unique reference, to which type of designated concrete.

b) Enter a unique reference, to for what purpose is the concrete required e.g. bedding, race or backing to kerbs;VRS post foundation or end anchorage.

c) Enter a value, from options semi-dry, S1, S4, S5, to which BS EN 206 [Ref 5.N]consistence class of fresh ancillary concrete is required.

d) Enter a value, from options yes, no, to identify any requirement for air-entrainment of fresh ancillary concrete.

e) Enter a number in units of %, to minimum air content by volume of fresh air-entrained ancillary concrete at delivery.

2.30 Chloride class for GEN1 concrete shall be Cl 1,0 in accordance with BS EN 206 [Ref 5.N].

2.31 Chloride class for other ancillary concrete mixes except GEN1 shall be Cl 0,40 in accordance with BS EN 206 [Ref 5.N], except for CEM I-SR 0, CEM I-SR 3.

2.32 Chloride class for ancillary concrete mixes containing CEM I-SR 0, CEM I-SR 3 shall be Cl 0,2 in accordance with BS EN 206 [Ref 5.N].

2.33 The total acid soluble sulfate content of the concrete mix expressed as SO_4 shall not exceed 6 % by mass of cement, unless otherwise stated in CC 495/WSR/002.

SI.2.33 The maximum total acid soluble sulfate content expressed as SO_4 of the ancillary concrete mix by mass of cement shall be [select one from: 4.0, 4.5, 5.0, 5.5] .

2.34 Consistence of designated concrete mix shall be slump class S2 or S3 in accordance with BS EN 206 [Ref 5.N], unless otherwise stated in CC 495/WSR/002.

Requirements for suppliers of designated concrete for ancillary purposes

2.35 Designated concrete for ancillary purposes shall only be supplied by organisations holding current and valid registration to a product certification scheme compliant with this document.

2.36 The following Documentation shall be submitted for designated concrete for ancillary purposes prior to the commencement of the concreting works: concrete supplier certificate of registration to the product certification scheme.

2.37 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to certificates of concrete supplier registration to a product certification scheme.

2.38 Suppliers of designated concrete for ancillary purposes shall operate a quality management system in accordance with Section 5 of GC 101 [Ref 10.N].

Requirements of certification schemes for assessing conformity of designated concrete products

2.39 Product certification schemes for designated concrete products supplied for ancillary purposes shall have the same features as listed for designed concrete product certification schemes in "Concreting of structural concrete" in Section 6 of CC 482 [Ref 30.N].

Requirements for production of designated concretes for ancillary purposes

2.40 Production control of designated concrete supplied for ancillary purposes shall be in accordance with Clause 9 of BS EN 206 [Ref 5.N]and Annex A of BS 8500-2 [Ref 7.N].

2.41 Requirements for continuous surveillance of production control for designated concretes shall be in accordance with Annex C of BS EN 206 [Ref 5.N].

Requirements for conformity control of designated concrete supplied for ancillary purposes

2.42 Requirements for conformity control of designated concrete supplied for ancillary purposes shall be as for designed concrete in clause 8 of BS

EN 206 [Ref 5.N]but using the minimum compressive strength class equivalent to the designated concrete used.

2.43 Table 7 of BS 8500-2 [Ref 7.N] shall be used to select equivalent minimum compressive strength class for conformity control of designated concretes for ancillary purposes.

2.44 Designated concrete supplied for ancillary purposes shall be assessed for conformity with BS 8500-2 [Ref 7.N]in accordance with Section 11 of GC 101 [Ref 10.N].

2.45 Designated concrete supplied for ancillary purposes shall be controlled to the requirements in Table 29 of BS EN 206 [Ref 5.N] for the specified performance characteristics.

2.46 Designated concrete for ancillary purposes shall only be supplied from concrete static and/or mobile batching plants holding current plant-specific certificates of conformity with a product certification scheme compliant with this document.

2.47 The following Documentation shall be submitted for designated concrete for ancillary purposes prior to the commencement of the concreting works: current concrete static/mobile batching plant certificates of conformity with the product certification scheme.

2.48 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to certificates of conformity with the product certification scheme.

2.49 Product conformity control of designated concrete supplied for ancillary purposes shall be compliant with Clause 6.2 of BS 8500-2 [Ref 7.N].

2.50 The designated concrete supplied shall meet the following performance characteristics: ..

1. at least the minimum strength class associated with the specified concrete designation in BS 8500-2 [Ref 7.N];

2. at least the minimum cement or combination content recommended in BS 8500-2 [Ref 7.N]for the required concrete designation and maximum aggregate size;

3. the specified slump consistence;

2.51 The requirements for "Product certification schemes" in Section 11 of GC 101 [Ref 10.N] shall apply to designated concrete supplied for ancillary purposes.

Verification requirements for ancillary concrete product

2.52 Verification shall be undertaken for total chloride content of the ancillary concrete mix by calculation in accordance with BS 8500-2 [Ref 7.N].

2.53 The frequency of calculating the total chloride content of the ancillary concrete shall be once per mix.

2.54 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to calculating the total chloride content of the ancillary concrete mix.

2.55 Verification shall be undertaken for total acid soluble sulfate of the ancillary concrete mix by calculation.

2.56 The frequency of calculation of total acid soluble sulfate of the ancillary concrete shall be once per mix.

2.57 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to calculating the total soluble sulfate of the ancillary concrete mix.

2.58 Verification for total acid soluble sulfate content of the ancillary concrete mix shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

2.59 The following Documentation shall be submitted for ancillary concrete mixes prior to the commencement of placement of ancillary concrete: laboratory test report.

2.60 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to laboratory test report for ancillary concrete mixes.

Installation requirements for ancillary concrete

2.61 Concreting of ancillary concrete shall comply with Section 8 of BS EN 13670 [Ref 9.N]as amended and complemented by this document.

2.62 Temperature of fresh ancillary concrete between start of mixing and placing shall not exceed 30^{o}C.

2.63 Curing of concrete for ancillary purposes shall be class 2 in accordance with BS EN 13670 [Ref 9.N].

Formwork and surface finishes of ancillary concrete

2.64 Formwork for ancillary concrete shall be in accordance with BS EN 13670 [Ref 9.N].

2.65 Formwork used for supporting fresh ancillary concrete shall remain in place for two days or until concrete strength is at least 5 MPa whichever is later.

2.66 Surface finishes on compacted ancillary concrete shall be in accordance with table 2.66, unless otherwise stated in CC 495/WSR/002.

Table 2.66 Surface finish on compacted ancillary concrete			
Buried surfaces below finished ground	Class of finish on buried surface	Exposed surfaces above or below finished ground	Class of finish on exposed surface
Unformed surfaces	U1	Unformed inverts or benching in chambers	U3
Formed surfaces	F1	All other unformed surfaces	U2
		Formed surfaces	F2

2.67 Surface finishes on ancillary concrete shall be as specified in CC 495/WSR/002.

Surface finishes on ancillary concrete			
Ancillary concrete element	**Surface of ancillary concrete element to be finished**	**Unformed surface finish**	**Formed surface finish**
(a)	(b)	(c)	(d)

a) Enter a unique reference, to ancillary concrete element requiring a different finish.

b) Enter a unique reference, to which surface requires different finish.

c) Enter a value, from options U1, U2, U3, U4, N/A, to unformed surface finish.

d) Enter a value, from options F1, F2, F3, F4, N/A, to formed surface finish.

Verification requirements for installation of ancillary concrete

Identity testing of ancillary concrete

2.68 Verification shall be undertaken for temperature of fresh concrete for ancillary purposes by measuring in accordance with BS 8500-2 [Ref 7.N].

2.69 The frequency of measuring concrete temperature shall be every batch of ancillary concrete.

2.70 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to temperature of fresh concrete.

2.71 Verification shall be undertaken for slump consistence of fresh ancillary concrete in accordance with BS EN 12350-2 [Ref 34.N], where specified by the contract.

2.72 The frequency of slump consistence shall be every batch of ancillary concrete.

2.73 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to slump consistence.

2.74 Verification shall be undertaken for air content of air-entrained fresh ancillary concrete in accordance with BS EN 12350-7 [Ref 31.N], where specified by the contract.

2.75 The frequency of air content testing shall be every batch of ancillary concrete unless otherwise stated in CC 495/WSR/002.

SI.2.75 The frequency of air content testing shall be [enter free text].

2.76 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to air content testing.

2.77 Verification for minimum air content of fresh concrete shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

3. Porous No Fines Concrete

General requirements for porous no fines concrete product

3.1 Porous no fines concrete shall be a prescribed concrete complying with BS 8500-2 [Ref 7.N].

3.2 The ratio of aggregate to cement for porous no fines concrete shall be 8:1 by volume or 10:1 by mass.

3.3 Water cement ratio of porous no fines concrete shall be less than 0.45.

3.4 The water-cement ratio used for porous no fines concrete shall ensure the grout is cohesive enough to coat and stay coated to the aggregate.

3.5 The chloride content class for porous no fines concrete shall be Cl 0.40.

3.6 Aggregates for porous no fines concrete shall be saturated surface dry in accordance with BS EN 1097-6 [Ref 40.N]when cement is added to the mix.

3.7 The density of hardened porous no fines concrete shall be less than 1830 kg/m^3.

Requirements for constituent materials of porous no fines concrete

Cement for porous no fines concrete

3.8 Cement for porous no-fines concrete shall be compliant with BS EN 197-1 [Ref 3.N].

3.9 The Cement for porous no fines concrete shall meet the performance characteristics as stated in table 3.12.

3.10 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to cement for porous no-fines concrete.

3.11 Cement for porous no fines concrete shall be any one cement type listed in table 3.12 as defined in BS 8500-2 [Ref 7.N], Table 1.

3.12 Cement shall be in accordance with performance requirements for the characteristics shown in table 3.12.

Table 3.12 Performance requirements for cement used in porous no fines concrete	
Characteristic	Performance requirement

Common cement constituents and composition	Any one cement type from CEM I, CEM II/A-S, CEM II/A-V, CEM II/A-L or CEM II /A-LL or equivalent combination.
Compressive strength	Standard strength class of cement from BS EN 197-1 [Ref 3.N]needed to achieve a strength of porous no fines concrete >10 MPa at 28 days.
Chloride content	< 0.10%

Aggregates for porous no fines concrete

3.13 Aggregate for porous no fines concrete shall be compliant with BS EN 12620 [Ref 2.N].

3.14 The Aggregate shall meet the performance characteristics as stated in table 3.16.

3.15 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to aggregate for porous no fines concrete.

3.16 The aggregate for porous no fines concrete shall be in accordance with performance requirements for the characteristics shown in table 3.16.

Table 3.16 Essential characteristic and performance requirements for aggregates used in porous no fines concrete

Essential characteristic	Sub-set of characteristics	Performance requirement
Particle shape, size and density	Aggregate size	Single size coarse aggregate designations 32/45 or 20/40
Particle shape, size and density	Grading	Category G_c85/20
Particle shape, size and density	Shape	Flakiness index category FI_{15}
Resistance to fragmentation/crushing	Resistance to fragmentation of coarse aggregate	Flakiness index category FI_{15}
Composition/content	Chlorides	Declared value

3.17 Aggregate type for porous no fines concrete shall be gravel or crushed rock.

3.18 Recycled aggregates shall not be used in porous no fines concrete.

Water for mixing porous no fines concrete

3.19 Water for mixing porous no fines concrete shall be compliant with BS EN 1008 [Ref 14.N].

3.20 Water for mixing porous no fines concrete shall not be sourced from the sea, estuaries nor tidal rivers.

Product verification requirements for porous no fines concrete

Trial mixes of porous no fines concrete

3.21 Verification shall be undertaken for water/cement ratio of porous no fines concrete by trial mix.

3.22 The frequency of water cement ratio shall be once for every no fines concrete mix used.

3.23 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to water cement ratio of porous no fines concrete.

3.24 Verification shall be undertaken for total chloride content of the porous no fines concrete mix by calculation in accordance with BS 8500-2 [Ref 7.N].

3.25 The frequency of calculating the total chloride of porous no fines concrete shall be once per mix.

3.26 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to calculating the total chloride of porous no fines concrete mix.

3.27 Verification shall be undertaken for hardened density of porous no fines concrete by trial mix.

3.28 The frequency of hardened density measurement shall be once for every no fines concrete mix used.

3.29 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to hardened density of porous no fines concrete.

3.30 The following Documentation shall be submitted for trial of constituent proportions of porous no fines concrete prior to the commencement of installation of porous no fines concrete: Report of trial including results of water cement ratio used, total chloride content and hardened density achieved and conclusion.

3.31 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to report of trial of constituent proportions for porous no fines concrete.

Installation requirements for porous no fines concrete

3.32 Cement grout shall fully coat all aggregate particles.

3.33 Freshly mixed porous no-fines concrete shall have a uniform colour and consistency.

3.34 Porous no-fines concrete shall be placed and compacted while grout coating of aggregate is still wet.

3.35 Porous no-fines concrete shall be compacted by hand after placement.

Installation verification requirements for porous no fines concrete

Adequacy of grout coating to porous no fines concrete supplied

3.36 Verification shall be undertaken for adequacy of grout coating to aggregate of fresh porous no fines concrete supplied to site by visual examination with photographic records.

3.37 The frequency of visually examining the adequacy of grout coating to aggregate with photographic record shall be one spot sample as defined in BS EN 12350-1 [Ref 33.N]comprising at least 10 litres of porous no fines concrete taken from every batch supplied.

3.38 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to visually examination of the adequacy of grout coating to aggregate with photographic record.

3.39 The following Documentation for porous no fines concrete supplied to site shall be submitted as continuous records: photographic evidence that grout adequately coats all aggregate particles.

3.40 The requirements of "Records" in Section 3 of GC 101 [Ref 10.N] shall apply to photographic records of porous no fines concrete supplied to site.

4. Foamed Concrete for Structures

General requirements of foamed concrete for void filling

4.1 Foamed concrete used for infilling structures, other elements associated with structures (except in pavement or trench reinstatement work) or other assets shall comply with this section.

4.2 Foamed concrete used for infilling shall have minimum cube compression strength of 4 N/mm^2 at 7 days.

4.3 Foamed concrete used for infilling shall have a maximum cube compression strength of 10 N/mm^2 at 7 days..

Contractor design requirements for foamed concrete

4.4 Foamed concrete for infilling structures, other elements associated with structures or other assets shall be Contractor designed items.

4.5 The design of foamed concrete for infilling structures, other elements associated with structures or other assets shall be in accordance with CD 350 [Ref 41.N].

4.6 The requirements for "Contractor design" in Section 17 of GC 101 [Ref 10.N] shall apply to foamed concrete for infilling structures, other elements associated with structures or other assets.

4.7 The constituent materials of foamed concrete for infilling structures, structural elements or other assets shall be selected to achieve the product requirements specified in CC 495/WSR/004.

4.8 Product requirements for foamed concrete for infilling structures, structural elements or other assets shall be as specified in CC 495/WSR/004.

Product requirements for foamed concrete for infilling structures, structural elements or other assets								
ID of existing structure or description of other asset to be infilled	**Structural element or other space to be infilled**	**Drawing or model reference (s)**	**Foamed concrete mix reference**	**Characteristic 28-day strength of hardened foamed concrete**	**Foamed concrete quality DC class**	**Minimum cement content of mix**	**Maximum water/cement ratio of mix**	**Target density of hardened foamed concrete**
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)

a) Enter text, to identify existing structure or other asset to be infilled with foamed concrete.

b) Enter text, to identify structural element or other space associated with a highway asset to be infilled with foamed concrete.

c) Enter a number, to identify drawing or model where details of foamed concrete infill are shown.

d) Enter a unique reference, to identify concrete mix reference.

e) Enter a number in units of N/mm^2, to foamed concrete characteristic 28-day strength.

f) Enter a value, from options DC-1, DC-2, DC-3, DC-4, to identify DC class of foamed concrete for required design life from BRE SD-1 [Ref 24.N].

g) Enter a number in units of kg/m^3, to minimum cement content of foamed concrete mix.

h) Enter a number, to identify maximum water-cement ratio of concrete mix.

i) Enter a number in units of kg/m^3, to target density of hardened foamed concrete.

Constituent materials requirements for foamed concrete in structures

Cement for foamed concrete

4.9 Cement for foamed concrete for structures or other assets shall be compliant with BS EN 197-1 [Ref 3.N].

4.10 The cement shall meet the performance characteristics as stated in table 4.13.

4.11 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to cement for foamed concrete.

4.12 Cement for foamed concrete for infilling structures or other assets shall be any one cement type listed in table 4.13 as defined in BS 8500-2 [Ref 7.N],Table 1.

4.13 Cement for foamed concrete for infilling structures or other assets shall be in accordance with performance requirements for the characteristics shown in table 4.13.

Table 4.13 Performance requirements for cement used in foamed concrete for infilling structures	
Characteristic	Performance requirement
Common cement constituents and composition	Any one cement type from CEM I, CEM II/A, CEM II/B, CEM IV/A, CEM IV/B, or equivalent combination and sulfate-resisting Portland cements CEM I-SR 0 or CEM I-SR 3.
Compressive strength	Compressive strength class of cement required to achieve specified minimum and maximum compressive strengths at 7 days and characteristic 28-day strength of foamed for the concrete mix reference

Aggregates for foamed concrete

4.14 Aggregates for foamed concrete for infilling structures or other assets shall be compliant with BS EN 12620 [Ref 2.N].

4.15 The aggregates for foamed concrete shall meet the performance characteristics as stated in table 4.17.

4.16 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to aggregates for foamed concrete for infilling structures of other assets.

4.17 Aggregate in foamed concrete shall be in accordance with performance requirements for the characteristics shown in table 4.17.

Table 4.17 Essential characteristic and performance requirements for aggregate used in foamed concrete		
Essential characteristics	Sub-set of characteristic	Performance requirement
Particle shape, size and density	Aggregate size	All particles of the aggregate passing a 6.3 mm sieve
Particle shape, size and density	Grading	Complying with MP and FP grading limits in Table B.1 of Appendix B of BS EN 12620 [Ref 2.N]

4.18 Recycled aggregates in foamed concrete for infilling structures or other assets shall be restricted in accordance with BS 8500-2 [Ref 7.N].

4.19 Potash and incinerator bottom ash aggregate shall not be used in foamed concrete for infilling structures or other assets.

Admixtures for foamed concrete

4.20 Admixtures for foamed concrete for infilling structures or other assets shall be compliant with BS EN 934-2 [Ref 1.N].

4.21 The admixtures for foamed concrete shall meet the performance characteristics as stated in table 4.23.

4.22 The requirements of "Designated standards" in Section 10 of GC 101 [Ref 10.N] shall apply to admixtures for foamed concrete.

4.23 The air entraining admixtures for foamed concrete shall be in accordance with performance requirements for the essential characteristics shown in table 4.23.

Table 4.23 Essential characteristic and performance requirements for air entraining admixtures	
Essential characteristic	Performance requirement
Chloride content	≤ 0,10 % by mass
Compressive strength at 28 days	test mix ≥ 75 % of control mix

4.24 Special purpose foaming admixtures shall be compliant with BS 8443 [Ref 25.N].

4.25 The special purpose foaming admixtures shall meet the performance characteristics as stated in table 4.26.

4.26 The special purpose foaming admixtures for foamed concrete shall be in accordance with performance requirements for the characteristics shown in table 4.26.

Table 4.26 Characteristics and performance requirements for special purpose foaming admixtures			
Property	Characteristic	Test method	Performance requirement
Foaming	Initial wet density	BS 8443, Annex D	1200 to 1400 kg/m^3
Foam stability	Density after one hour standing	BS 8443, Annex D	Initial wet density +/- 100 kg/m^3
Air-dry hardened density at 7 days	Hardened density	BS 8443, Annex D	≤ 100 kg above density after one hour standing
Air dry compressive strength at 7 days	Compressive strength	BS EN 12390-3	Declared compressive strength (N/mm^2)

4.27 The following Documentation shall be submitted for special purpose foaming admixtures prior to the commencement of foamed concrete infilling: BS 8443 [Ref 25.N] Annex D Test report for stability of foamed concrete.

4.28 The requirements for "Documentation" in Section 2 of GC 101 [Ref 10.N] shall apply to the test report for stability of foamed concrete.

Other materials

4.29 Fibres shall not be used for foamed concrete for structures.

Water for mixing foamed concrete

4.30 Water for mixing foamed concrete shall be compliant with BS EN 1008 [Ref 14.N].

4.31 Water for mixing foamed concrete shall not be sourced from the sea, estuaries nor tidal rivers.

Verification requirements for foamed concrete product

Trials of designed foamed concrete mix

4.32 Verification shall be undertaken for stability of foamed concrete trial mix in accordance with Annex D of BS 8443 [Ref 25.N].

4.33 The frequency of foamed concrete stability testing shall be once per trial mix.

4.34 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to stability of foamed concrete.

4.35 The test for stability of foamed concrete described in BS 8443 [Ref 25.N], Annex D shall be carried out using the binder, aggregates and admixtures intended for the final foamed concrete mix.

4.36 Verification shall be undertaken for compressive strength of foamed concrete cubes in accordance with BS EN 12390-3 [Ref 35.N].

4.37 The frequency of foamed concrete compressive strength testing shall be once per trial mix.

4.38 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to compressive strength of foamed concrete.

4.39 Test cubes for foamed concrete shall be made in accordance BS EN 12390-1 [Ref 38.N] by placing the foamed concrete test sample in the mould without any tamping or vibration other than gently rocking the mould on a firm base.

4.40 Test cubes for foamed concrete shall be cured in accordance with BS EN 12390-2 [Ref 37.N].

Installation and installation verification requirements for foamed concrete

4.41 Fluid foamed concrete used to infill a void consisting of cuboid shape with a barrelled, plain or beam and slab soffit, and a vertical height dimension greater than 1 metre shall be installed in multiple layers with each layer placed no deeper than 1 metre within a 24 hour period.

4.42 Ventilation shall be provided where foamed concrete is placed in restricted or confined spaces to prevent the build-up of explosive gases.

4.43 The top surface of each layer of foamed concrete shall achieve the defined in situ crushing resistance and set before installing the next layer, but no sooner than 24 hours after installation of the previous layer.

Construction of test box for confirming in situ crushing resistance of hardened foamed concrete

4.44 Where foamed concrete is placed in more than 1 layer, a test box for confirming in situ crushing resistance of hardened foamed concrete shall be constructed in the open adjacent to where the void is to be infilled with foamed concrete.

4.45 The test box to confirm in situ crushing resistance of hardened foamed concrete layers shall be constructed on a 50mm deep layer of designated GEN1 blinding concrete complying with Section 2 of this document.

4.46 The test box to confirm in situ crushing resistance of hardened foamed concrete shall have internal dimensions 1000mm wide by 1000mm deep by 1000mm high.

Placing layers of foamed concrete into the in situ crushing resistance test box

4.47 A 150mm deep layer of fresh foamed concrete shall be placed into the test box without any tamping compaction or vibration concurrently with each lift of foamed concrete being placed in the void.

4.48 Foamed concrete layers in the test box corresponding to the layer being installed in the void shall comprise composite samples of foamed concrete in accordance with BS EN 12350-1 [Ref 33.N] and be taken from the concrete deliveries.

4.49 Foamed concrete shall be cured in the test box by covering top surface with a sheet of polythene.

4.50 The polythene covering of the test box shall be removed to permit testing of in situ crushing resistance of the exposed concrete surface.

Verification of fresh or hardened foamed concrete by identity testing

4.51 Identity testing for fresh or hardened foamed concrete shall be as specified in CC 495/WSR/004.

Identity testing for fresh or hardened foamed concrete					
ID of existing structure or description of other asset to be infilled	**Structural element or other space to be infilled**	**Slump flow testing of fresh foamed concrete**	**Slump flow class for fresh foamed concrete**	**Plastic density testing of fresh foamed concrete**	**Testing of hardened foamed concrete cubes**
(a)	(b)	(c)	(d)	(e)	(f)

a) Enter a unique reference, to identify existing structure or other asset to be infilled with foamed concrete.

b) Enter a unique reference, to identify structural element or other space associated with a highway asset to be infilled with foamed concrete.

c) Enter a value, from options yes, no, to identify required slump flow testing of fresh foamed concrete.

d) Enter a value, from options SF1, SF2, SF3, N/A, to identify required slump flow class of fresh foamed concrete.

e) Enter a value, from options yes, no, to identify required plastic density testing of fresh foamed concrete.

f) Enter one or more values, from options compressive strength, hardened density, none, to identify testing of hardened foamed concrete.

Identity testing to verify slump flow and plastic density of foamed concrete

4.52 Verification shall be undertaken for slump flow of fresh foamed concrete in accordance with Annex B of BS 8500-1 [Ref 6.N].

4.53 The frequency of slump flow testing of fresh foamed concrete shall be every batch of foamed concrete.

4.54 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to measurement of slump flow.

4.55 Verification shall be undertaken for plastic density of fresh foamed concrete in accordance with BS EN 12350-6 [Ref 32.N].

4.56 The frequency of plastic density testing of fresh foamed concrete shall be every batch of foamed concrete.

4.57 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to measurement of plastic density.

Identity testing to verify compressive strength and density of hardened foamed concrete

4.58 Specimens for testing compressive strength of foamed concrete shall be 150mm cubes made in accordance with BS EN 12390-2 [Ref 37.N]except without compaction or vibration.

4.59 Cube moulds for foamed concrete shall comply with BS EN 12390-1 [Ref 38.N]and be made from steel or polystyrene.

4.60 Mould release agent material used on inner surface of steel cube moulds before filling with foamed concrete shall not be oil-based.

4.61 Verification for cube compressive strength of foamed concrete shall be undertaken by an accredited testing laboratory in compliance with "Accredited laboratory" in Section 16 of GC 101 [Ref 10.N].

4.62 Verification shall be undertaken for compressive strength of foamed concrete in accordance with Annex B of BS EN 206 [Ref 5.N].

4.63 The frequency of compressive strength testing shall be one cube per 20 m^3 subject to minimum of 3 no. cubes per day and minimum total of 9 no. cubes for testing.

4.64 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to compressive strength of foamed concrete.

4.65 Verification shall be undertaken for hardened density of foamed concrete in accordance with BS EN 12390-7 [Ref 36.N].

4.66 The frequency of density testing shall be for every hardened cube specimen.

4.67 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to density of foamed concrete.

4.68 Testing for compressive strength and density of foamed concrete shall be undertaken in accordance with BS EN 12390-3 [Ref 35.N]when cube specimens are 28 days old.

4.69 3 no. cubes made with foamed concrete shall be retained for testing at 56 days if compressive strength does not meet required strength at 28 days.

Testing in situ crushing resistance of hardened foamed concrete in the test box

4.70 Verification shall be undertaken for in situ crushing resistance of each layer of foamed concrete in the test box using the in-situ crushing resistance test from Annex E of BS 8204-1 [Ref 22.N].

4.71 The frequency of in-situ crushing resistance test shall be five test measurements per layer.

4.72 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to in-situ crushing resistance test.

4.73 The depth of indentation per test shall be measured after a single drop of a 2 kg weight on the BRE screed tester in accordance with Annex E of BS 8204-1 [Ref 22.N].

4.74 Indentation measurements on foamed concrete surface shall be taken no closer than 250 mm to the edge of the test box.

4.75 The average of five measured indentations on the foamed concrete surface in the test box shall be 10 mm or less.

Testing final set of foamed concrete installed in the void

4.76 When the concrete in situ crushing resistance measured in the test box is acceptable, a fluke, Danforth style, marine anchor of minimum mass 4 kg shall be used to assess the set of foamed concrete inside the void space.

4.77 Verification shall be undertaken for the final set of poured foamed concrete top surface by using a 4 kg fluke anchor.

4.78 The frequency of force measurement by fluke anchor shall be 1 test per 30 m^2 of top surface for every foamed concrete lift except the final one.

4.79 The requirements for "Verification" in Section 14 of GC 101 [Ref 10.N] shall apply to confirmation of the foamed concrete final set.

4.80 The fluke anchor shall be dragged across the foamed concrete surface to detect if the final set has occurred.

4.81 The fluke anchor chain and line used to pull the anchor shall be inclined between 1.5 and 10 degrees above the horizontal top surface of the foamed concrete placed in the void being filled.

4.82 The fluke anchor shall be dragged across the surface of placed foamed concrete with a horizontal velocity of less than 0.25 m/s.

4.83 The set of hardening foamed concrete shall be deemed acceptable if the anchor moves freely without digging into the surface and holding the line.

Documentation requirements for identity testing of fresh and hardened foamed concrete

4.84 The following Documentation for fresh foamed concrete shall be submitted as continuous records: Report including all measurements of slump flow and plastic density testing of delivered foamed concrete.

4.85 The requirements of "Records" in Section 3 of GC 101 [Ref 10.N] shall apply to the report including all measurements of slump flow and plastic density testing.

4.86 The following Documentation shall be submitted for compressive strength and hardened density of foamed concrete prior to the commencement of infilling works completion: Laboratory report with results of compressive strength and density testing of hardened foamed concrete test specimens.

Documentation requirements for in situ crushing resistance and set of foamed concrete

4.87 The following Documentation for in situ crushing resistance of foamed concrete top surface in test box shall be submitted as continuous records: Written report of all compliant and non-compliant indentation measurements of in situ crushing resistance test using the BS 8204-1 [Ref 22.N]BRE screed tester for each layer.

4.88 The requirements of "Records" in Section 3 of GC 101 [Ref 10.N] shall apply to foamed concrete in situ crushing resistance tests in a test box.

4.89 The following Documentation for demonstrating the final set of foamed concrete top surface has occurred before the next layer of foamed concrete material is placed within the void being infilled shall be submitted as continuous records: Written report of successful and any previously unsuccessful anchor drag tests carried out on the top surface of each foamed concrete layer before the next layer of foamed concrete is placed.

4.90 The requirements of "Records" in Section 3 of GC 101 [Ref 10.N] shall apply to the written report for foamed concrete top surface final setting tests carried out within the void being infilled.

NI/5. Cored Node Markers

NI/5.1 No nationally determined section is provided.

6. Normative references

The following documents, in whole or in part, are normative references for this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

Ref.	Document
Ref 1.N	BSI. BS EN 934-2, 'Admixtures for concrete, mortar and grout. Concrete admixtures. Definitions, requirements, conformity, marking and labelling (Designated Standard - CPR)'
Ref 2.N	BSI. BS EN 12620, 'Aggregates for concrete (Designated Standard - CPR)'
Ref 3.N	BSI. BS EN 197-1, 'Cement. Composition, specifications and conformity criteria for common cements. (Designated Standard - CPR)'
Ref 4.N	BSI. BS EN 197-5, 'Cement. Portland-composite cement CEM II/C-M and Composite cement CEM VI'
Ref 5.N	BSI. BS EN 206, 'Concrete - specification, performance, production and conformity'
Ref 6.N	BSI. BS 8500-1, 'Concrete. Complementary British Standard to BS EN 206. Method of specifying and guidance for the specifier.'
Ref 7.N	BSI. BS 8500-2, 'Concrete. Complementary British Standard to BS EN 206. Specification for constituent materials and concrete.'
Ref 8.N	BSI. BS EN ISO 2039-2, 'Determination of Rockwell hardness. Rockwell hardness'
Ref 9.N	BSI. BS EN 13670, 'Execution of concrete structures'
Ref 10.N	National Highways. GC 101, 'General requirements for the Specification for Highway Works'
Ref 11.N	BSI. BS EN 572-2, 'Glass in building. Basic soda lime silicate glass products Float glass'
Ref 12.N	BSI. BS EN 12150-1, 'Glass in building. Thermally toughened soda lime silicate safety glass - Definition and description'
Ref 13.N	BSI. BS EN 1015-17, 'Methods of test for mortar for masonry. Determination of water-soluble chloride content of fresh mortars'
Ref	BSI. BS EN 1008, 'Mixing water for concrete. Specification for

14.N	sampling, testing and assessing the suitability of water, including water recovered from processes in the concrete industry, as mixing water for concrete.'
Ref 15.N	BSI. BS EN 1504-1, 'Products and systems for the protection and repair of concrete structures. Definitions, requirements, quality control and evaluation of conformity. Definitions'
Ref 16.N	BSI. BS EN 12190, 'Products and systems for the protection and repair of concrete structures. Test methods. Determination of compressive strength of repair mortar'
Ref 17.N	BSI. BS EN 13412 , 'Products and systems for the protection and repair of concrete structures. Test methods. Determination of modulus of elasticity in compression '
Ref 18.N	BSI. BS EN 13057, 'Products and systems for the protection and repair of concrete structures. Test methods. Determination of resistance of capillary absorption'
Ref 19.N	BSI. BS EN 13295, 'Products and systems for the protection and repair of concrete structures. Test methods. Determination of resistance to carbonation'
Ref 20.N	BSI. BS EN 12617-4, 'Products and systems for the protection and repair of concrete structures. Test methods. Determination of shrinkage and expansion'
Ref 21.N	BSI. BS EN 1542, 'Products and systems for the protection and repair of concrete structures. Test methods. Measurement of bond strength by pull-off'
Ref 22.N	BSI. BS 8204-1, 'Screeds, bases and in situ floorings. Concrete bases and cementitious levelling screeds to receive floorings. Code of practice'
Ref 23.N	International Concrete Repair Institute. Technical Guideline 310.2R, 'Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays and Concrete Repair'
Ref 24.N	Building Research Establishment. BRE SD-1, 'Special Digest 1:2005, Third edition, Concrete in aggressive ground.'
Ref 25.N	BSI. BS 8443, 'Specification for establishing the suitability of special purpose concrete admixtures'
Ref 26.N	BSI. BS EN 10088-2, 'Stainless steels. Technical delivery conditions for sheet/plate and strip of corrosion resisting steels for general purposes'
Ref 27.N	American Society for Testing and Materials. ASTM C827, 'Standard Test Method For Change In Height At Early Ages Of Cylindrical Specimens Of Cementitious Mixtures'

Ref 28.N	American Society for Testing and Materials. ASTM C939, 'Standard Test Method For Flow Of Grout For Preplaced-Aggregate Concrete (Flow Cone Method)'
Ref 29.N	American Society for Testing and Materials. ASTM C531, 'Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes'
Ref 30.N	National Highways. CC 482 'Structural concrete'
Ref 31.N	BSI. BS EN 12350-7, 'Testing fresh concrete. Air content. Pressure methods'
Ref 32.N	BSI. BS EN 12350-6, 'Testing fresh concrete. Density'
Ref 33.N	BSI. BS EN 12350-1, 'Testing fresh concrete. Sampling and common apparatus'
Ref 34.N	BSI. BS EN 12350-2, 'Testing fresh concrete. Slump test '
Ref 35.N	BSI. BS EN 12390-3, 'Testing hardened concrete. Compressive strength of test specimens'
Ref 36.N	BSI. BS EN 12390-7, 'Testing hardened concrete. Density of hardened concrete.'
Ref 37.N	BSI. BS EN 12390-2, 'Testing hardened concrete. Making and curing specimens for strength tests'
Ref 38.N	BSI. BS EN 12390-1, 'Testing hardened concrete. Shape, dimensions and other requirements for specimens and moulds'
Ref 39.N	BSI. BS EN 1744-1, 'Tests for chemical products of aggregates. Chemical analysis'
Ref 40.N	BSI. BS EN 1097-6, 'Tests for mechanical and physical properties of aggregates. Determination of particle density and water absorption'
Ref 41.N	National Highways. CD 350, 'The design of highway structures'

London TW9 4DU ,
or email **psi@nationalarchives.gsi.gov.uk**.