IN SITU CONCRETE

British Museum – Number 38 Russell Square

	24.8.18	Tender	AL	LK
Rev	**Date**	**Reason for Issue**	**By**	**Checked**

Our Ref: Job N°1756/702 **August 2018**
Alan Baxter Ltd

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1.00 GENERAL

Where this specification conflicts with the relevant British Standard, the requirements of this specification take priority.

1.01 CONCRETE AND CONSTITUENT MATERIALS to comply with BS 8500-2: unless otherwise specified.

1.02 RATES: include in the rates for all concrete work for samples, testing and submissions which are specified but are not covered separately by a priceable item or provisional sum.

1.03 WORKMANSHIP to comply with BS EN 13670 (Execution class 2) unless otherwise specified.

1.04 AGGREGATES: where appearance is important do not use aggregates which contain surface-marring materials such as pyrites or particles of coal.

1.05 SULPHATE CONTENT OF MIXES: the total sulphate content of the constituents of each mix, expressed as SO_3, must not exceed 4% by weight of the cement in the mix.

1.06 TYPES OF MIXES: Table 1 sets out minimum requirements for the mixes to be used for each area.

1.07 REINFORCEMENT DETAILING: unless advised otherwise prepare reinforcement detailing drawings sufficient to allow all reinforcement to be scheduled and fixed. Prepare bending schedules. Reinforcement detailing to be carried out based on design intent drawings which will be supplied 10 to 12 weeks before the concrete is programmed to be poured.

1.08 CO-ORDINATION:

a) Agree with the Contract Administrator (C.A.) a programme for the preparation of the reinforcement drawings.

b) Make allowances in the programme for bending and delivery periods for reinforcement.

c) Make allowances in the programme for submission of drawings, response thereto and re-submission of drawings prior to commencement of procurement of reinforcement.

d) Time to be allowed from receipt of any drawing by C.A. to response to be 14 days.

e) Submit sufficient copies of final drawings and schedules, including 2 copies to the C.A., for distribution to all parties a minimum of 2 weeks before fixing reinforcement.

1.09 REINFORCEMENT DETAILS AND SCHEDULES: Submission of drawings to the C.A. or any other party will not in any way relieve the contractor of their sole responsibility for the accuracy of any information contained on the drawings.

TABLE 1 CONCRETES

Concrete	Application	Type	Designation	Max Aggregate Size mm	RCA*[1] Permitted up to 20%	Identity Testing Required	Cement or Combination*[2]	Min. Cement Content	Max. Cement Content	Max. w/c Ratio
A	R.C.-internal superstructure	Designated	RC 32/40	20	No	Yes	IIB-V, IIIA			
B	R.C.-substructure	Designated	FND 2	20	No	Yes	IIA-V, IIB-V, IIA-V+SR, IIB-V+SR, IIIA, IIIA+SR			
C	R.C.-car park slabs, walls, columns	Designed	C 32/40	20	No	Yes	(As mix A)	360	420	0.45
D	Blinding	Designated	GEN 1	20	Yes	No	(As mix A)			
E	Mass concrete foundations and trench fill	Designated	FND 2	20	No	Yes	(As mix B)			
F	Pipe bedding, surrounds and manhole surrounds	Designated	FND 2	20	No	Yes	(As mix B)			
G	Haunching for kerbs	Designated	GEN 1	20	Yes	No	(As mix A)			
Other		Designed								

Notes:
1. Determine the consistence class appropriate for each part of the works to suit construction requirements
2. Determine any restrictions on cements or combinations to be used to suit construction requirements.
3. Chloride classes: for reinforced concrete: cl 0.40
   for concrete type C: cl 0.30
   for prestressed or post-tensioned concrete: cl 0.10

*[1] RCA = Recycled Concrete Aggregate (less than 1% non-concrete material)

*[2] Maximum 50% GGBS replacement

2.00 DESIGN: BATCHING AND MIXING

2.01 MANUFACTURE: composition of mixes and production of concrete to be in accordance with BS 8500-2.

2.02 READY-MIXED CONCRETE shall be used and must be supplied by a plant which holds a current accredited third party certification meeting the requirements of U.K.A.S. (United Kingdom Accreditation Service). Each concrete must be obtained from only one source. Confirm name and address of depot(s) to C.A. before any concrete is delivered. Delivery tickets giving information as BS 8500-2 must be retained for inspection. C.A. must be permitted to visit depot at any time to view batching of concrete. Do not add water to concrete on site.

2.03 EVIDENCE OF SUITABILITY: for each designed concrete, before making concrete for use in the works and whenever a change in the materials or mix proportions is proposed, submit to C.A.:

a) Details of proposed quantities of each ingredient per cubic metre of compacted concrete and proposed workability.

b) Either existing data or details of appropriate tests on trial mixes to show that the proposed constituent materials and method of manufacture will produce concrete of the required quality, which will not segregate or bleed and will be capable of being fully compacted.

2.04 EVIDENCE OF SUITABILITY: for all concretes, submit to C.A. details of each concrete proposed to be used in the works as set out in Clause 7.2 of BS EN 206-1 and Clause 5.2 of BS 8500-1.

2.05 WATER CONTENT of concrete must be carefully controlled and adjusted to allow for moisture content of aggregates to give consistent quality and workability, and to ensure that any specified water/cement ratio is not exceeded.

2.06 ENRICHMENT OF MIX: the aggregate/cement ratio may be reduced by up to 10% for the first layer of concrete in walls and columns. Do not alter the water/cement ratio. Inform C.A. or submit proposals before placing.

2.07 ADMIXTURES: no admixtures other than normal water-reducing admixtures to BS EN 934 will be permitted and only for high consistence class concretes. Submit full details of proposed admixtures (if any) to C.A. at tender stage. Ensure that admixtures are compatible with all other materials.

2.08 CONSISTENCE: Contractor to determine the consistence class appropriate for each part of the works. Submit proposed consistence classes for each part of the work to C.A. at tender stage.

3.00 TESTING OF CONCRETE

3.01 IDENTITY TESTING: sampling, testing and compliance of concrete to be in accordance with BS EN 206, Annex B unless otherwise specified.

3.02 COMPLETE CORRELATED RECORDS must be maintained for each mix type, including:

a) Composition of the concretes tested.

b) All sampling and site tests.

c) Identification marks or numbers of all specimens tested in the laboratory.

d) The location of the part(s) of the structure represented by each sample.

e) The location in the structure of the batch from which each sample is taken.

f) The recorded value of slump for the batch from which the sample is taken.

3.03 VISUAL ASSESSMENT: carry out a visual assessment of every batch of concrete delivered to the works. If any batch appears unsuitable:-

a) Do not place in the works unless and until appropriate tests have ensured compliance with this specification.

b) Inform C.A. as soon as possible.

3.04 IDENTITY TESTING OF CONSISTENCE: before placing concrete delivered to site carry out slump test on each load in accordance with BS EN 12350-2. Carry out additional tests if requested by C.A. Reject any sample which does not comply with the limits in BS 8500-1, Annex B. Dispose of concrete off site.

3.05 IDENTITY TESTING - TEST CUBES

a) RATE OF SAMPLING: one set of cubes to be taken for every 50 m^3 of concrete poured per day, but not less than one set for each day of use. This applies to each different concrete used unless otherwise agreed with C.A. A set consists of 3 cubes; 1 to be tested at 7 days, 1 at 28 days, and 1 spare for testing if required by C.A.

b) CUBE SIZE: cubes to be 150mm.

c) TEST LABORATORY: all testing of cubes to be carried out by one UKAS Accredited laboratory independent from the concrete supplier. Submit the name of the selected laboratory to C.A. as soon as possible and in any case before making any concrete for use in the works.

d) TEST REPORTS: 2 copies of reports to be dispatched by the testing house to C.A. within one day of completion of each test. Keep a complete set of results on site.

e) CUBE TEST REPORTS must include at least the following:

Test laboratory and name of person responsible for testing.
Title of project.
Identification mark or number.
Date of casting.
Concrete designation.
Method of making cubes.
Curing place and conditions.
Date of receipt by laboratory.
Condition on receipt by laboratory, i.e. dryness, compaction, damage.
Actual or checked nominal dimensions.
Weight and density.
Date of test.
Age when tested.
Confirmation of testing in accordance with BS 1881.
Load at failure.
Compressive strength.
Type of fracture.
Date of despatch of report to C.A.

f) BROKEN CUBES: keep separately the pieces of each cube which fails to meet the compliance requirements for individual results. Obtain agreement of C.A. before discarding.

g) FAILURES: if a particular concrete mix fails to achieve specified criteria or to pass specified test, inform C.A. without delay and submit:

a) confirmation of the validity of the test results, and/or

b) proposals for further tests to assess the strength of the concrete in the structure, as set out in BS 6089, and/or

c) proposals for rectification.

Obtain C.A.'s agreement of all such evidence and proposals before proceeding. The C.A. may issue instructions for the work to be stopped or delayed until reasons for the failure have been established, possible consequences assessed, and appropriate preventative and remedial measures taken.

3.06 FAILURES: wherever the specified sampling, testing and acceptance criteria are not met (even if the work is eventually accepted), all consequential investigations, additional testing, instructions and remedial measures:

a) will be at the expense of the Contractor, and

b) will not be considered as grounds for extension of time.

4.00 PLACING AND COMPACTING

4.01 CONSTRUCTION/SEQUENCE/TIMING REQUIREMENTS: determine the requirements and submit to the C.A.

4.02 CLEANING: at time of placing ensure that all surfaces on which concrete is to be placed are clean, with no debris, tying wire clippings, fastenings or free water.

4.03 INSPECTION: inform C.A. at least 24 hours before each pour of concrete to allow inspection of reinforcement and surfaces against which concrete is to be placed.

4.04 TRANSPORTING:

a) Transport concrete to avoid contamination, segregation, loss of ingredients, excessive evaporation and loss of workability. Cover concrete during heavy rain.

b) Clean transporting equipment immediately after use and whenever cement or aggregate is changed, and remove free water.

c) Use suitable stools, walkways and barrow runs for traffic over reinforcement and freshly placed concrete.

4.05 COLD WEATHER: the temperature of concrete at time of placing must be not less than 5°C. Do not place against frozen or frost covered surfaces.

4.06 COLD WEATHER: the shade air temperature at time of placing, must be not less than 1°C rising or 3°C falling, measured on a thermometer sited appropriately to the works.

4.07 PLACING:

a) Record time, date and location of all concrete pours.

b) Place concrete while it is sufficiently plastic for full compaction. Addition of water or retempering of concretes will not be permitted.

c) Place concrete in final position in one continuous operation up to construction joint.

d) Do not discharge concrete from an excessive height or through reinforcement or other obstructions in a way which may cause uneven dispersal, segregation or loss of ingredients. Use suitable chutes or trunking to place concrete where necessary.

e) Place in layers no thicker than can be effectively compacted with the equipment being used.

f) Do not use vibrators to make concrete flow horizontally into position, except where necessary to achieve full compaction under void formers and cast-in accessories and at vertical joints.

g) Where concrete is to be cast against a waterlogged stratum, take measures to remove the ground water and prevent any flow of water during the placing and setting of the concrete which could be detrimental to the quality of the concrete and prevent full compaction.

4.08 POUR SIZE: maximum pour area for slabs to be 200 m^2, and maximum pour volume to be 60 m^3 generally. Maximum pour size for wall construction to be 20 m^2 with a maximum horizontal dimension of 7.5 m. Submit marked up drawings showing positions of proposed construction joints at least 2 weeks before pouring. Retain copies on site for reference.

4.09 COMPACT all concrete to full depth to ensure full compaction (until air bubbles cease to appear on the top surface), especially around reinforcement, cast-in accessories, into corners of formwork and at joints. Ensure amalgamation with previous batches, but do not damage adjacent partly-hardened concrete. Use mechanical vibration except for mass concrete footing and blinding.

4.10 VIBRATORS: inform C.A. of the number and type of vibrators to be used. Provide standby vibrators. Do not use external vibrators without approval from the C.A. in writing.

4.11 KICKERS: the reinforcement has been detailed to suit a finished kicker height of:

a) 75mm generally.

b) 150mm where waterbars are used.

4.12 KICKERS: where waterbars are used, cast kickers monolithically with slab. Other kickers, where practical, are to be cast monolithically with the underlying construction unless otherwise shown on the drawings.

5.00 CURING AND PROTECTING

5.01 CURING: determine proposed curing periods and submit details of proposal for curing of concrete to C.A. in writing at least 2 weeks before placing of concrete for that section of work.

5.02 CURING: prevent surface evaporation from concrete throughout the curing period(s) by:

a) Retaining formwork in position and, if necessary, covering exposed surfaces immediately after striking, and

b) Covering top surfaces of fresh concrete immediately after completion of placing and compacting each bay, removing covering only to permit any finishing operations and replacing immediately thereafter.

Maintain detailed records of location and timing of casting of individual batches, removal of formwork and removal of coverings. Keep on site, available for inspection.

5.03 COVERING for curing may be suitable impervious sheet materials or a suitable curing compound and:

a) Must be effective in preventing evaporation of water from the concrete, particular attention being paid to sealing at edges and junctions.

b) Must not disfigure permanently exposed surfaces.

c) Must not affect the satisfactory bond of subsequent construction and finishes.

d) Must not increase the risk of frost damage.

5.04 MINIMUM CURING PERIODS, in days:

	Concrete surfaces which will be exposed to frost or chemical attack. Concrete wearing surface floors and pavements.		Other structural concrete surfaces	
	CEM II	CEM III	CEM II	CEM III
1) Dry, sunny weather Drying winds	$\frac{240}{t+10}$	$\frac{280}{t+10}$	$\frac{140}{t+10}$	$\frac{160}{t+10}$
2) Other weather conditions	$\frac{170}{t+10}$	$\frac{200}{t+10}$	$\frac{70}{t+10}$	$\frac{80}{t+10}$

t = the average number of degrees centigrade air temperature during the curing period.

5.05 COLD WEATHER: Maintain temperature of concrete above 5°C for the appropriate period of days given below:

Specified compressive strength grade (cube)	CEM II	CEM III
20 or less	7	9
25	4.5	6
30	3	4
35	2.5	3.5
40	2	3
45 and over	1.75	2.5

* For other cements or combinations, submit proposals to C.A. in writing at least 2 weeks prior to the commencement of that part of the works.

5.06 PROTECTION: prevent damage to concrete, including:

a) Surfaces generally: from rain, indentation and physical damage.

b) Surfaces to be exposed in the finished work: from dirt, rust marks and other disfiguration.

c) Immature concrete: from thermal shock, physical shock, overloading, movement and vibration.

6.00 WORKED FINISHES ON IN SITU CONCRETE

To be read in conjunction with Preliminaries and General Conditions.

6.01 TIMING: carry out all finishing operations at optimum times in relation to the setting and hardening of the concrete. Do not wet surfaces of concrete to assist surface working. Do not sprinkle cement onto surface.

6.02 TAMPED FINISH: tamp surface with edge of a board or beam to give an even texture of parallel ribs.

6.03 FINE TAMPED FINISH: tamp surface with edge of a board or beam to give an even texture of parallel ribs of not more than 5mm height.

6.04 WOOD FLOATED FINISH: use a wood float to give an even slightly coarse texture with no ridges or steps.

6.05 SMOOTH FLOATED FINISH: use a hand float to give an even surface with no ridges or steps.

6.06 POWER FLOAT FINISH: use a power float to give an even surface with no ridges or steps.

6.07 TROWELLED FINISH to receive applied floor finishes:

1) Float concrete to an even surface with no ridges or steps, then immediately commence curing as specified.

2) Hand or power trowel to give a uniform smooth surface, free from trowel marks and other blemishes, and suitable to receive the specified flooring material.

3) Resume specified curing without delay.

4) Adequately protect the surface from construction traffic.

5) If, because of inadequate finishing or protection, the surface of the concrete is not suitable to receive the specified flooring material, it must be made good by application of a smoothing compound by and to the satisfaction of the flooring sub-contractor. Allow for the cost of any such making good.

6.08 BRUSHED FINISH: smooth float concrete surface then brush with a stiff brush to give a uniformly marked dense surface. The brush-marks shall be parallel to the short dimension of the bay. A 100mm wide margin around the edge of each bay shall be trowelled smooth with a steel float. The trowelled margin shall have a pencil round arris.

7.00 JOINTS IN IN SITU CONCRETE

To be read in conjunction with Preliminaries and General Conditions.

7.01 ACCURACY: all joints to be accurately located, straight and well-arranged, and truly vertical or horizontal or parallel with the setting out lines of the building.

7.02 LOCATION OF MOVEMENT JOINTS: see Engineer's drawings. Joints to be kept free of hard material throughout construction period. The joints are to be sealed as soon as is practicable.

7.03 LOCATION OF CONSTRUCTION JOINTS: where not coincident with movement joints, and where not shown on the drawings, submit marked-up copies of drawings showing positions of proposed construction joints. Retain copies on site for reference.

7.04 JOINTS IN CONCRETE EXPOSED TO VIEW: additional to those of the designer, will not be permitted.

7.05 FORMED JOINTS: construct using rigid, grout-tight side forms or stop ends designed to accommodate projecting bars or fabric without temporary bending or displacement.

7.06 FORMED JOINTS in concrete wearing surface floors:

a) Forms to be square-edged with a steel top surface and in good condition.

b) Compact thoroughly at edges to give level, closely abutted joints with no lipping.

7.07 CONSTRUCTION JOINTS:

a) Prepare surface of joint to leave a thoroughly roughened exposed aggregate finish. Do not damage the aggregate or the formed edges of the concrete.

b) Surface to be clean and damp when fresh concrete is placed against it.

7.08 SHEET COMPRESSIBLE JOINT FILLERS:

Material:	Closed cell polyethylene
Thickness:	Refer to drawings
Manufacturer:	Grace Construction Products.
Reference:	Aerofil 2

Material:	Expanded polystyrene
Thickness:	Refer to drawings
Manufacturer:	Jablite
Reference:	Claymaster Compressible Filler

See drawings for the location of each filler.

7.09 PREFORMED SEALING STRIPS:

Material:	Closed cell polyethylene
Size:	20 x 20mm
Manufacturer:	Grace Construction Products
Reference:	Aerofil 1

7.10 SEALANT:

Manufacturer: Grace Construction Products
Vertical joints - Ref: Vertiseal
Horizontal joints - Ref: Paraseal

Backing strip, bond breaker and primer: types recommended by the sealant manufacturer.

Preparation and application to be strictly as manufacturer's recommendations.

Joints must be thoroughly clean, dry and free from frost, oil and loose material. Vigorously wire brush or grit blast the joint faces and clean out with compressed air.

Prime faces of joint and allow to dry.

Where exposed to view mask edges of joint with tape before priming and remove immediately after sealing.

Apply sealant ensuring maximum adhesion to sides of joint and a neat, smooth and clean finish.

7.11 PREFORMED FLEXIBLE WATERSTOPS in the ground:

Material:	PVC
Size:	As shown on drawings
Manufacturer:	Grace Construction Products
Reference:	240 mm Heavy Duty “Grou-tite” Serviseal
	240 mm Expansion Serviseal
	320 mm Kicker Serviseal

All joints to be butt welded and junction pieces to be pre-fabricated by the manufacturer.

7.12 SELF-SEALING HYDROPHILIC RUBBER BASED WATERSTOPS:

Manufacturer:	Grace Servicised Ltd.
Reference:	ADCOR 500 S

The position of waterstops is shown on the Engineers drawings. This information is indicative only, and the contractor is to submit proposals for construction joints to C.A. prior to construction. Prepare detailed arrangement drawings showing positions and junctions of all water-stops and submit to C.A.

7.13 OTHER JOINTING MATERIALS as shown on drawings.

8.00 FORMWORK FOR IN SITU CONCRETE

To be read in conjunction with Preliminaries and General Conditions.

GENERALLY

8.01 LOADINGS: design and construct formwork to withstand worst combination of:

a) Total weight of formwork, reinforcement and concrete.

b) Construction loads including dynamic effects of placing, compacting and construction traffic.

c) Wind and snow loads.

8.02 FORMWORK: provide all necessary formwork to produce finished concrete work to required dimensions and finishes.

8.03 DETAILS: provide drawing and calculations of formwork for any sections designated by C.A.

8.04 PROPPING: provide adequate propping to prevent deflection and damage to the structure. Carry down such props to bearings strong enough to provide adequate support.

8.05 RE-PROPPING will not be permitted.

8.06 BEARINGS: prop through other decks if construction load on a particular deck exceeds:

a) the design loading, or

b) in the case of concrete decks before 28 days have elapsed from casting, a reduced loading to take into account the strength and age of the concrete. Submit proposals to C.A.

Submit details of proposed prop bearings and through-propping to C.A. Accept responsibility for cost of checking effects on structure.

8.07 CAMBERS: make adequate allowance for deflection of formwork under weight of fresh concrete.

After striking of formwork and removal of props check levels to determine extent of any residual camber and inform C.A.

8.08 WORK BELOW GROUND: vertical faces of strip footings, bases and slabs may be cast against faces of excavation, provided:

1) The faces are sufficiently accurate and stable.

2) Adequate measures are taken to prevent contamination of concrete.

Submit details of locations to C.A. prior to casting.

Faces of walls must be cast against formwork.

8.09 BLINDING: cast all reinforced concrete work at or below ground level on 50mm concrete blinding unless noted otherwise on the drawings.

8.10 FORM TIES are not permitted through basement wall construction.

8.11 STEELWORK: remove all loose mill-scale and loose rust before encasing in concrete.

CONSTRUCTION

8.11 ACCURACY: construct formwork accurately and robustly with adequate supports to produce finished concrete to the required dimensions. Formed surfaces must be free from twist and bow (other than any required cambers), all intersections, lines and angles being square, plumb and true.

8.12 JOINTS IN FORMS: construct formwork, including joints in form linings and between forms and completed work, to prevent loss of grout, using seals when necessary. Secure formwork tight against adjacent concrete to prevent formation of steps.

8.13 INSERTS, HOLES, CHASES: fix inserts or box out as required in correct positions before placing concrete. Form all holes and chases. Do not cut hardened concrete without approval.

8.14 INSERTS, HOLES, CHASES: Submit final locations and details to C.A. for approval.

8.15 FORM TIES: no metal part of any device for securing forms is to remain within the specified concrete cover.

8.16 RELEASE AGENTS: type(s) which are suitable for use with the type(s) of formwork, formed finishes and specified applied finishes. Use the same type and make throughout the entire area of any one finish. Apply evenly to form faces, from top downwards, and to horizontal surfaces last. Use the minimum amount necessary to obtain a clean release and prevent excessive local collection. Prevent release agent touching the reinforcement, hardened concrete, other materials not part of the form face, and permanent forms.

8.17 SURFACE RETARDERS: do not use.

STRIKING

8.18 RESPONSIBILITY: strike formwork without disturbing, damaging or overloading structure, and without disturbing props. Notwithstanding other clauses in this specification, the responsibility for safe removal of any part of the formwork and any support rests with the Contractor.

8.19 GUIDELINE MINIMUM PERIODS (in days) for retaining formwork in position before striking: applicable to CEM II or CEM III mixes with no admixtures as noted in the table:

Average mean of daily minimum and maximum air temperatures during the period.

Cement Mix	CEM II			CEM III		
	16°C	7°C	3°C	16°C	7°C	3°C
Vertical formwork to columns, walls and beams	1.0	1.5	1.5	1.0	2.0	2.0
Soffit forms to slabs	7.0	11.0	13.0	8.5	12.0	14.0
Props to slabs	15.5	19.0	19.0	16.0	20.0	23.0
Soffit forms to beams	15.5	19.0	20.0	16.0	20.0	23.0
Props to beams	19.0	23.0	30.0	20.0	23.0	30.0

Submit proposals to C.A. of minimum periods for concretes using admixtures or other types of cement.

8.20 MINIMUM PERIODS: alternative methods of determining minimum periods for retaining formwork in position may be submitted with tender information.

8.21 DEFECTIVE CONCRETE: after striking formwork notify C.A. immediately of any defects. Submit proposals to C.A.

8.22 RE-USE: clean, make good and store in accordance with good practice any formwork that is to be re-used.

9.00 FORMED FINISHES FOR IN SITU CONCRETE

9.01 BASIC FINISH:

a) No particular requirements, except those for alignment, cover and full compaction.

b) Making good of superficial defects will normally be permitted. Submit proposals to C.A.

9.02 ORDINARY FINISH:

a) No special formwork requirements.

b) Concrete should be thoroughly compacted and the formed surface free from major inherent blemishes and honeycombing.

c) No requirement for consistency of colour for the struck surface

d) Abrupt irregularities to be not greater than 5mm. Gradual irregularities, expressed as maximum permissible deviation from a 1m straight edge, to be not greater than 5mm.

9.03 PLAIN FINISH:

a) Produce an even finish with a sheet material (e.g. plywood), with panels arranged in a regular pattern as a feature of the surface.

b) Abrupt irregularities to be not greater than 3mm. Gradual irregularities, expressed as maximum permissible deviation from a 1m straight edge, to be not greater than 5mm.

c) Variation in colour resulting from the use of an impermeable form lining will be permitted but the surface to be free from discolouration due to contamination or grout leakage.

d) Blowholes less than 10mm in diameter and at an agreed frequency will be permitted but otherwise surface to be free from voids, honeycombing, segregation and other large defects.

e) Projecting fins are to be removed and rubbed down with a carborundum stone but otherwise the finish is to be left as struck. Making good of small defects will normally be permitted after inspection by C.A.

f) Arrisses to be ground flush.

g) Formwork tie holes to be in an approved regular pattern, filled with matching mortar to an approved sample.

Complete a sample area of the finished work, size 10 m^2, in advance of the remainder, in an agreed location, and obtain acceptance of appearance before proceeding.

10.00 REINFORCEMENT FOR IN SITU CONCRETE

To be read in conjunction with Preliminaries and General Conditions.

GENERALLY

10.01 BARS; obtain bars from a supplier who holds a valid Certificate of Approval issued under a product certification scheme operated by a third party certification body with appropriate Category 2 accreditation from the United Kingdom Accreditation Service (U.K.A.S). Provide if required by C.A.:

1) Certificate of Compliance with BS 4449.

2) Certificate of origin and compliance with equivalent or relevant BS tests.

10.02 BARS: provide if required by C.A. a test record demonstrating compliance with BS 4449, including, if requested, the rebend test.

10.03 TEST PIECES: when tests verifying compliance with BS 4449: 2005 are required, deliver test pieces selected by C.A. to an approved testing authority.

10.04 TAG clearly bundles of reinforcement with bar schedules and bar mark references.

10.05 COLD BEND TEST: apply, according to BS 4449, to samples of bars over 20mm in size.

MATERIALS

10.06 DEFORMED BAR REINFORCEMENT: To be Grade B500B in accordance with BS 8666.

10.07 STOCK STEEL: request stock steel schedule from C.A. if not included with first schedules received. Obtain stock steel prior to start of reinforcement fixing on site. Advise C.A. each month of amount of Stock Steel used. Request schedules for additional Stock Steel if required and allow sufficient time for delivery.

10.08 FABRIC REINFORCEMENT: to BS 4483, using Grade B500A bars to BS 4449.

10.09 COVER SPACERS: type(s) will adequately support the reinforcement, adequately resist displacement, not cause indentation of the formwork and made from:

Plastic (perforated for at least 25% of their area) or concrete (strength and durability to match surrounding concrete).

Submit details of proposed spacers to C.A.

10.10 TYING WIRE for use generally: annealed iron wire, 1.6mm diameter (16 swg).

10.11 MECHANICAL DAMAGE: reinforcement must not be roughly handled, dropped from a height, or subjected to shock loading or mechanical damage.

10.12 CLEANLINESS: store reinforcement clear of the ground and prevent contamination by other materials. At time of placing concrete, reinforcement to be clean and free of corrosive pitting, loose mill-scale, loose rust, ice, oil and other substances which may adversely affect the reinforcement, concrete, or bond between the two.

10.13 RUST STAINING: protect projecting reinforcement from the weather where rust staining of exposed concrete surfaces may occur. Prevent rust staining of formwork to surfaces of concrete which will be exposed to view in the finished work.

CUTTING AND BENDING

10.14 CUT AND BEND reinforcement to schedules and to BS 8666. Do not rebend bars. Do not bend when below 5°C. Steel may be warmed to not more than 100°C. Reject consignment if reinforcement shows signs of fracture. Tag bundles of reinforcement with labels to BS 8666.

10.15 GALVANIZED REINFORCEMENT: Grade B500B galvanized to BS EN ISO 1461, after cutting but before bending.

10.16 STAINLESS STEEL BAR REINFORCEMENT: to BS 6744 type 1.4301. Strength grade 500 for ribbed bar.

10.17 ADJUSTMENTS: provide on site facilities for hand bending to deal with minor adjustments.

10.18 PROJECTING REINFORCEMENT: Bars must not be bent or straightened, unless agreed with C.A.

10.19 Plain bar to BS EN 10025 will not be scheduled. This should be taken from the drawings.

FIXING

10.20 LAPS OR SPLICES: obtain instructions if details are not shown on drawings.

10.21 LAPS in secondary reinforcement to be not less than 40 diameters.

10.22 LAPS in fabric reinforcement, where not detailed, to be not less than 300mm on end and 300mm on side. Avoid a four layer build-up at corners.

10.23 ELECTROLYTIC ACTION: do not fix or place reinforcement in contact with non-ferrous metals or any dissimilar metal.

10.24 FIX REINFORCEMENT adequately, using tying wire, approved steel clips, or tack welding if permitted. Wire or clips must not encroach into the concrete cover.

10.25 TACK WELDING: do not tack weld unless authorised by C.A. and recommended by the reinforcement manufacturer, and then only to manufacturer's recommendations and to BS EN 17660.

10.26 COVER to be:

a) Not less than the nominal cover minus 5mm.

b) Where reinforcement is located in a particular direction in relation to only one face of a member, not more than the nominal cover plus:

5mm on bars up to and including 12mm size.
10mm on bars over 12mm up to and including 25mm size.
15mm on bars over 25mm size.

c) Before concreting check thoroughly that the specified cover dimensions have been obtained.

10.27 SPACERS: in addition to supports shown on drawings or schedules, provide chairs and spacers at not more than 1m centres or closer spacing as necessary to support reinforcement in position and maintain the specified cover in accordance with the Concrete Society Report CS101 "Spacers for Reinforced Concrete". Reinforcement must be fixed in position before the concrete is placed. Cover spacers to be not closer than 300mm centres and staggered on adjacent parallel bars. No tying wire or reinforcing bar is to project into the cover zone.

10.28 BARS: do not insert into placed concrete.

10.29 FORMS & FORM LININGS: do not damage when fixing reinforcement.

10.30 TANKING: do not damage when fixing reinforcement.

STRUCTURAL JOINTS:

10.31 STRUCTURAL WELDED JOINTS will not be permitted.

10.32 MECHANICAL JOINTS will not be permitted.