4 UNIT MASONRY

4.1 GENERAL

4.1.1 Scope

1 This Part specifies clay and concrete masonry units.

2 Related Parts and Sections are as follows:

This Section
Part 1 ..... General
Part 2 ..... Mortar And Grout
Part 3 ..... Accessories
Part 5 ..... Masonry Laying

Section 1 General
Section 5 Concrete
Section 15 Thermal Insulation of Buildings

4.1.2 References

1 The following standards are referred to in this Part:

ASTM C270..... Standard Specification for Mortar for Unit Masonry

ASTM C979 / C979M Standard Specification for Pigments for Integrally Colored Concrete

ASTM C1364..... Standard Specification for Architectural Cast Stone

BS 187 ..... Calcium silicate bricks

BS 1217 ..... Cast stone

BS 6073-2 ..... Precast concrete masonry units. Guide for specifying precast concrete masonry units

EN 771 ..... Specification for masonry units

EN 771-1 ..... Specification for masonry units - Part 1: Clay masonry units

EN 771-2 ..... Specification for masonry units - Part 2: Calcium silicate masonry units

EN 771-3 ..... Specification for masonry units - Part 3: Aggregate concrete masonry units (Dense and lightweight aggregates)

EN 771-4 ..... Specification for masonry units - Part 4: Autoclaved aerated concrete masonry units

EN 771-5 ..... Specification for masonry units - Part 5: Manufactured stone masonry units

EN 771-6 ..... Specification for masonry units - Part 6: Natural stone masonry units

EN 772 …… .. Methods of test for masonry units.

EN 772-1 …… .... Methods of test for masonry units - Part 1: Determination of compressive strength

EN 772-2 ..... Methods of test for masonry units - Part 2: Determination of percentage area of voids in aggregate concrete masonry units (by paper indentation)

EN 772-11 ..... Methods of test for masonry units - Part 11: Determination of water absorption of aggregate concrete, autoclaved aerated concrete, manufactured stone and natural stone masonry units due to capillary action and the initial rate of water absorption of clay masonry units

EN 772-13… ..... Methods of test for masonry units - Part 13: Determination of net and gross dry density of masonry units (except for natural stone)

EN 772-16 ..... Methods of test for masonry units - Part 16: Determination of dimensions

EN 998-2 ..... Specification for mortar for masonry - Part 2: Masonry mortar

EN 1745 ..... Masonry and masonry products — Methods for determining thermal properties

EN 12878 ..... Pigments for the colouring of building materials based on cement and/or lime. Specifications and methods of test

EN 13501-1 ..... Fire classification of construction products and building elements - Part 1: Classification using data from reaction to fire tests

BSI PD 6678 ..... Guide to the specification of masonry mortar

4.1.3 Definitions:

1 Aggregate: granular material used in construction and may be natural, manufactured or recycled.

2 Natural aggregate: aggregate from mineral sources which has been subjected to nothing more than mechanical processing.

3 Manufactured aggregate: aggregate of mineral origin resulting from an industrial process involving thermal or other modification.

4 Recycled aggregate: aggregate resulting from the processing of inorganic material previously used in construction.

5 Lightweight aggregate: natural, manufactured or recycled aggregate having a particle density not exceeding 2,000 kg/m^3 or a loose bulk density not exceeding 1,200 kg/m^3.

4.2 CLAY MASONRY UNITS

4.2.1 Clay Bricks

1 A clay brick is a masonry unit not exceeding 290 mm in length and 115 mm in height.

2 Semi-solid bricks are bricks having up to 25 % holes or cavities of their gross volume.

3 Cellular bricks contain the same voids as hollow bricks but with the cavities closed at one end.

4 Clay bricks to conform to the requirement of EN 771-1.

4.2.2 Clay Blocks

1 A clay block is a masonry unit which exceeds in any of its normal dimensions the maximum dimensions given for clay bricks in Clause 4.2.1-1.

4.2.3 Classification of Clay Masonry Units

1 Units shall be classified as follows:

(a) non-load-bearing blocks
(b) blocks produced for use in non-load-bearing walls
(c) load-bearing blocks
(d) blocks produced for use in load-bearing walls.

4.2.4 Requirements of Clay Masonry Units

1 Clay masonry units shall be of a uniform shape, free from surface cracks which decrease its properties. Its outer surface shall be serrated to increase the bonding force with the mortar. It should be well burnt, of a uniform texture and free from pebbles of lime.

2 The dimensions of the clay masonry blocks for walls to be as given in Table 4.1.

Table 4.1
Dimensions of Clay Masonry Blocks

Nominal Dimensions (mm)			Actual Dimensions (mm)		
Length	Width	Height	Length	Width	Height
300	100	200	290	100	190
300	150	200	290	150	190
300	200	200	290	200	190
400	100	200	390	100	190
400	150	200	390	150	190
400	200	200	390	200	190

3 The tolerance in the actual dimensions of the blocks shall be ±4 %, provided that the difference between the largest actual dimension and the smallest one in the same consignment does not exceed 5 % as shown in Table 4.2.

Table 4.2
Dimensional tolerance

Dimension	Size (mm)	Permissible size (mm)		Permissible difference between largest actual size and smallest one in one (consignment)
		Largest	Smallest	
Length	390	406	375	20
	290	302	278	15
Width	200	208	192	10
	150	156	144	7.5
Height	190	198	182	10

4 Adjacent faces of the units are to be at right angles, and the tolerance of the squareness not to exceed 2 mm for each 100 mm length.

5 The faces should have a plain surface, and the tolerance not to exceed 5 mm from the straight line.

6 Water absorption of the units shall not exceed 25 % by weight for the individual block and 20 % by weight for the average of tested blocks.

7 The compressive strength of the units, calculated for the total area including holes shall not to be less than the limits shown in Table 4.3.

Table 4.3
Compressive Strength

Class of Block	Minimum Value for Compressive Strength of One Block		Minimum Average of the Compressive Strength	
	N/mm²	(kg/cm²)	N/mm²	(kg/cm²)
Class 6	6	(60)	7.5	(75)
Class 12	12	(120)	15	(150)

4.2.5 Marking of Clay Blocks

1 Every clay block is to be marked with the name of the manufacturer and/or his registered mark.

2 The class of block should be shown on every load-bearing block.

4.2.6 Testing of Clay Blocks

1 The following tests are to be carried out on the representative sample taken according to Clause 4.2.6-3 of this Part:

(a) appearance
(b) dimensions
(c) compressive strength
(d) water absorption (optional)

2 Appearance and dimension tests are to be carried out on the same units that are to be tested for compressive strength and water adsorption. Appearance and dimension tests are to be carried out before the other referenced tests.

3 A representative sample is to be taken from the consignment not exceeding 15,000 blocks as shown in Table 4.4. As for consignments exceeding that number, one excess block is to be taken for each 1,000 additional blocks. The sample is to be taken at random during loading or unloading by dividing the consignment into a convenient number of real or imaginary sections. From each section, a corresponding number of units are to be taken, provided that the total number of samples units is equal as shown in Table 4.4.

Table 4.4
Sample Sizes

Number of units in consignment	Number of units for each test	
	Appearance and size measurements (mandatory)	
	Compressive strength (mandatory)	Water absorption (optional)
5,000 or less	5	3
More than 5,000 and up to 10,000	10	5
More than 10,000 and up to 15,000	15	10

4 The methods of test for clay bricks shall be in accordance with the relevant provisions of EN 771-1.

4.2.7 Criteria of Technical Conformity of Clay Blocks

1 The consignment is to be accompanied with a certificate indicating its conformity with all the requirements of this standard.

2 The consignment is to be considered complying with this standard if the representative sample passes all the mandatory tests mentioned in this standard.

3 Compressive test : the consignment will be considered complying with this standard if the following two conditions are fulfilled:

(a) each of the tested blocks meets the minimum limit of compressive strength mentioned in this standard

(b) the tested blocks meet the minimum limit of the average compressive strength mentioned in this standard.

4 Water absorption : the consignment is to be considered complying with this standard if the following two conditions are fulfilled:

(a) each tested block should meet the minimum limit of water absorption mentioned in this standard

(b) the average water absorption for the tested blocks will meet the minimum limit of the average water absorption mentioned in this standard.

5 If the tested units do not comply with the requirements of the appearance, dimension and/or absorption tests, other units may be taken for testing. If these units do not pass the test(s), the consignment is to be considered non-complying with this standard.

4.3 CALCIUM SILICATE BRICKS

4.3.1 General Requirements

1 Calcium silicate bricks are to conform to the requirements of EN 771-2.

2 The brick is to be constructed of sand consisting mainly of quartz or uncrushed siliceous gravel or crushed siliceous gravel or crushed rock or a combination of such materials.

3 Suitable pigments may be mixed into the constituents to produced bricks of the required colour.

4.4 CONCRETE MASONRY UNITS

4.4.1 Concrete Blocks

1 Blocks are to be made with cementitious material comply with section 5 part 3.

2 All blocks are to be manufactured, supplied and tested in accordance with EN 771, BS 6073-2 / EN 772.

3 Compressive Strength of concrete Blocks (Table 4-5) shall be tested in accordance with BS 6073-2 / EN 772-1.

4 Recycled Aggregates may be used to replace up to 50% of natural coarse aggregates when the average compressive strength is equal to or greater than 7.0 MPa (N/mm^2).

5 Recycled Aggregates may be used to replace up to 100% of natural aggregates (fine and coarse) when the average compressive strength is less than 7.0 MPa (N/mm^2).

6 Aggregate shall meet the following requirements:

(a) The manufacturer shall declare the materials to be used, the percentage of each material, their grading and shall be responsible for their suitability.

(b) The acid soluble sulphate, as measured by EN 1744-1, shall not exceed 0.8% by weight of aggregate.

(c) The acid soluble chloride, as measured by EN 1744-5, shall not exceed 0.2% by weight of aggregate.

7 The use of blocks shall comply with Table 4.5. The minimum compressive strength of the average of 3 blocks shall be as given in Table 4.5. The associated mortar requirements for use with different applications for blocks is also provided in Table 4.5. Details of mixes for the class of mortar specified is provided in Part 2 of this Section.

Table 4.5
Compressive Strength

Classification	Minimum Compressive Strength (N/mm^2) As per BS 6073-2		Uses for which Blocks are Suitable	Class of Mortar
Classes	Average of 3 Blocks	Lowest Individual Block		
1	7.0	5.6	External non-load bearing walls	M6
2	10.4	8.3	Load bearing walls	M6
3	17.4	14	Load bearing walls below ground	M12
4	14.0	11.2	Soakaways and manholes	M12
5	4.0	3.6	Internal non-load bearing walls	M6
5	4.0	3.6	Roof Block	M4
5	4.0	3.6	Protective skins to foundations	M6

8 Manufacturer should label or clearly define the classification or the uses of the blocks in factory.

9 Consultant or contractor should also mention the classification or the uses of the blocks in request sheet when the samples submit for testing in laboratory.

10 Blocks manufactured from sulphate resisting cement or pozzolan are to be colour coded with an identifying mark.

11 All connections between masonry walls or partitions and concrete columns or walls shall be made using steel or stainless steel ties secured to steel or stainless steel fixing channels embedded in the concrete (for external walls; stainless steel ties and channels shall be used).

12 Full Water Absorption:

The average water absorption of the tested sample shall not exceed 7% and no individual block shall have a water absorption greater than 7.5% (in accordance with CML Method 9-97).

13 Water absorption by capillarity method:

The manufacturer shall declare in g/m^2s the maximum water absorption coefficient due to capillarity action of the exposed face of the unit.(according to EN 771-3)

4.4.2 Block Dimensions

1 Block dimensions are to be measured in accordance with EN 772-2.

2 Blocks not exceeding 75 mm thick are to be solid unless otherwise directed.

3 The volume of the cavities in the block shall not exceed 50 % of the gross volume of the block. The overall dimensions and wall and web thicknesses shall comply with Table 4.6.

Table 4.6
Block Dimensions and Wall and Web Thicknesses

Coordinating (nominal) size (mm)	Work size (mm)	Minimum Thickness (mm)	
		Wall	Web
4t (max) x 2t (max) x t (≤75mm)	(4t -1) (max) x (2t -1) (max) x t (≤75)	t/2 -1 ≥19	t/2 -1 ≥19
400 x 200 x 100	390 x 190 x 100	19	19
400 x 200 x 150	390 x 190 x 150	25	25
400 x 200 x 200	390 x 190 x 200	32	30

Notes:

(a) Co-ordinating size is the size of the space allocated to the block including the joints and tolerances.

(b) Work size is the actual size for manufacture within the tolerances specified.

4 Block segments of standard blocks (Table 4.6); such as half-length block, half high block… etc. may be manufactured maintaining strength, the minimum wall and web thickness.

5 Subject to the tolerances specified in Table 4.7 and to any requirement for blocks with special faces, all surfaces should be flat and rectangular and adjacent surfaces are to be at right angles to one another with clearly defined undamaged arises.

Table 4.7
Block Tolerances

Dimensions	Work Size of Block
Length	+ 3 mm to - 5 mm
Height	+ 3 mm to - 5 mm
Thickness	± 2 mm for any measurement ± 1.5 mm for the average of 7 measurements in any one block.

6 Unless otherwise specified, all block faces are to provide a satisfactory bond for mortar, plastering or rendering.

4.4.3 Manufacture of Concrete Blocks

1 Blocks are to be manufactured in a vibrated/pressure block making machine using cement and aggregate in the proportions required to produce the minimum strengths given in Table 4.5.

2 The design of the cavities and webs in hollow blocks is to be submitted to the Engineer for approval before production commences.

3 The materials to be mixed in a mechanical mixer and placed in the block-making machine in layers not exceeding 100 mm, each layer being thoroughly vibrated and compacted before the addition of the next.

4 Immediately after manufacture the blocks are to be stacked on clean, level, non-absorbent pallets in honeycomb fashion. The pallets are to be marked with the date of production (in English and Arabic) and stored in a level curing and stacking area in such a manner that one day's production is separated from the next.

5 Blocks manufactured from mobile machines are to be cast on to a clean concrete hardstanding. Each day's production shall be easily identifiable and kept separate from the next.

6 All blocks, however manufactured, are to be immediately protected from the effects of the sun and wind by suitable moisture retaining coverings.

4.4.4 Precast Concrete Bricks

1 Precast concrete bricks are to conform to the requirements of BS 6073-2.

2 Precast concrete bricks are to be manufactured by compacting concrete under high pressure into a mould.

3 The pressure employed is to be such that a high initial strength is achieved, enabling the brick to be removed immediately, by extrusion, from the mould.

4 The cement used should be rapid hardening Portland cement and conform to the requirements Part 3 of Section 5.

5 The aggregate used to be sand or manufactured sand.

4.4.5 Lightweight Concrete Blocks

1 Precast Lightweight concrete blocks or bricks are to conform to the requirements of EN 771-3.

2 The minimum compressive strength of the average of 3 blocks shall comply with Table 4.8 and shall be tested in accordance with EN 772-1

Table 4.8
Light weight Concrete Block Compressive Strength

Classes	Dried Net Density Individual Block (kg/m³)	Minimum Compressive Strength (N/mm²)		Minimum Cement Content (kglm³)	Packing	Recommended Colour
		Average of 3 Blocks	Lowest Individual Block			
LW 1	300 – 800	1.0	0.8	100	Pallet and Strapping	Light Red
LW 2	801 – 1200	1.5	1.3	120	Pallet and/or Strapping	Light Grey
LW 3	1201 – 1600	2.0	1.8	140	Pallet and/or Strapping	Light Brown
LW 4	1601 – 1850	4.0	3.5	160	Pallets and/or Strapping	Light Yellow

3 LW1 can be produced for thermal purpose with max thermal transmittance U= 0.57 W/m²K.

4 Thermal properties as per EN 1745 and thermal transmittance U (W/m²K) shall be declared for all classes.

5 Aggregate shall be as per section 5 part 2, and the following requirements:

(a) The Manufacturer shall declare the dried bulk density of the aggregates, and shall be in kg/m³

(b) The maximum size of the aggregate shall not exceed 16 mm.

6 The Manufacturer shall declare the density of the blocks. The density shall be determined according to EN 772-13, The mean density values of the samples tested shall not deviate by more than ± 10% from the declared values. Closer deviations may be declared.

7 The manufacturer shall declare the block dimensions according to EN 772-16, The nominal size and work size for light weight blocks shall be as mentioned in table 4-6.

8 All surfaces should be flat and rectangular and adjacent surfaces are to be at right angles to one another with clearly defined undamaged arises,

9 Dimensions tolerances shall be as mentioned in table 4-7:

10 Unless Engineer or the consultant specified, all block faces are to provide a satisfactory bond for mortar, plastering or rendering.

11 All connections between masonry walls or partitions and concrete columns or walls shall be made using steel or stainless steel ties secured to steel or stainless steel fixing channels embedded in the concrete (for external walls; stainless steel ties and channels shall be used).

12 Unless Engineer or the consultant specified the maximum water absorption coefficient, for wall be exposed to weather conditions, the manufacturer shall declare in g/m²s the maximum water absorption coefficient due to capillarity action of the exposed face of the unit (according to EN 772-11).

13 If required, reaction to fire shall be determined according to EN 13501-1, Fire classification of construction products and building elements — Part 1: Classification using data from reaction to fire tests.

14 If lightweight blocks compressive strength is less than 4 MPa are being used as wall partitions then reinforced plaster shall be used; the reinforcement material shall be either fibers or reinforcement mesh.

4.4.6 Manufacture of Lightweight Concrete Blocks

1 Blocks are to be manufactured in a vibrated/pressure block making machine using cement and aggregate in the proportions required to produce the declared strengths.

2 The design of the cavities and webs in thermal blocks shall be in accordance to EN 771-3.

3 Immediately after manufacture the blocks are to be stacked on clean, level, non-absorbent pallets.

4 The pallets are to be marked with the date of production, and stored in a level curing and stacking area in such a manner that one day's production is separated from the next.

5 All blocks, are to be immediately protected from the effects of the direct sunrays and wind.

6 Blocks manufactured shall be packed as per Table 4.8

7 The blocks could be coloured with pigment for colour identification as per Table 4.8 or as approved by the Engineer.

4.5 GLASS UNITS

4.5.1 General Requirements

1 Glazing units shall incorporate expansion-contraction thermal foam tape, sealants, flashings, and other items necessary for complete installation.

4.5.2 Submittals

1 The Contractor shall submit assembly instructions and installation drawings as required to indicate methods on construction, location and spacing of anchorage, joinery, finishes, sizes, shape, thickness of all materials and relationship to the adjoining work.

4.5.3 Material Storage and Handling

1 Material shall be stored in a dry place, off the ground, where temperature will not exceed 32 ºC handle material to prevent damage to finished surfaces. Do not install scratched or damaged components.

2 After installation, finished surfaces shall be protected from damage caused by ensuing work.

4.5.4 Laying

1 The Contractor shall verify all applicable field dimensions and adjust as necessary to accommodate the glazed wall.

2 The glass block grid system for the wall shall be assembled and sealed in accordance with instructions furnished by the manufacturer.

3 The assembled glass block grid system frame shall be placed into a properly prepared and sized rough opening and adjust until plumb and level. The grid system shall be screwed or nailed into place utilising all predrilled holes in the nailing flange.

4 A foam tape gasket shall be adhered to each of the glass blocks according to instructions furnished by manufacturer of the glass block grid system. The glass blocks shall be carefully inserted into the grid system from the exterior side of the wall so that each block is pressed against the T-Bar and the foam tape does not roll back.

5 Sealant to completely fill the channel shall be applied around each glass block and wipe flush with the surface. The sealant shall be applied to the exterior frame corners according to instruction furnished by the grid system manufacturer.

6 All exposed surfaces of the glass block grid system shall be cleaned with a clean, soft cloth and mild hand soap using gentle rubbing action. Abrasive or solvent-type cleaner, detergents or paint removers shall not be used.

7 All labels shall be removed from the glass blocks and cleaned with a soft cloth and water.

4.6 GYPSUM UNITS

4.6.1 General Requirements

1 Blocks for claustra walls are to be manufactured and built generally in accordance with the preceding clauses for blockwork, except where otherwise noted below.

2 Blocks may be constructed of either

(a) white gypsum plaster

(b) concrete

(c) white concrete using white Portland cement and white aggregates, as described in the relevant provisions of Section 5, Concrete, or as described in the Project Documentation.

3 All blocks are to be finished with a fine finish to an approved ornamental pattern and are to be 100 m thick unless otherwise noted with slots in ends of blocks to receive reinforcement.

4 Claustra walls should be built with vertical straight joints reinforced with 12 mm mild steel reinforcing bars vertically at each straight joint pinned to structure at each end and surrounded solid with mortar.

5 Blocks are to be bedded in a mixture of white cement and sand (1:4) and struck pointed to the Engineer approval.

4.7 STONE WORK

4.7.1 General Requirements

1 Stone work includes rough cut stone, marble, limestone, granite.

2 Stone work shall be executed by an approved specialist sub-Contractor

3 Stone should be sound and free from defects which would impair strength, durability or appearance. Each species of stone is to be provided from a single quarry. Quarries and fabrication plants should be available for inspection by the Engineer.

4 All stone to be of soundness (hardness and density), texture, graining colour, tone and range matching the Engineer's sample.

5 Dielectric separator: Bituminous paint is to be used in accordance with the manufacturer's instructions and shall be approved by the Engineer.

6 Cushions: Clear plastic or neoprene, 25 by 50 mm, thickness as required.

4.7.2 Anchorage Devices

1 Anchors, dowels, cramps, plug anchors, angles, relieving anchors: Fabricated of stainless steel or non ferrous metal (e.g. bronze) complying with thickness as required to system imposed loads but not less than 5 mm.

2 Embedded items shall be of malleable iron castings or steel fabrications, thickness as required to sustain imposed loads but not less than 5 mm thick products to be stainless steel or non-ferrous. Devices embedded in concrete or masonry include the following:

(a) edge inserts with tee-shaped wedge-action slot, with askew head bolt, washer and nut

(b) dovetail anchor slots of size to receive specified anchor, filled with waterproof filler and open face sealed

(c) adjustable insert with square nut slinging in integral track.

3 Reinforcing mesh used for anchorage shall be stainless steel.

4.7.3 Mortar

1 Mortar shall comply with the relevant provisions of Part 2 of this Section. The cement used for stone work mortar shall be white Portland cement. The Class of mortar

2 Mortar for setting stone flooring, steps and treads shall be Class M12 mortar. The grout shall incorporate a waterproofing additive for wet area flooring.

3 Mortar for setting all other stone shall be Class M6 mortar. The mortar shall incorporate a waterproofing additive for wet areas and exterior stone. The mortar shall incorporate a shrinkage-reducing accelerator diluted with water in the ratio as recommended by the manufacturer.

4 Pointing mortar: shall be Class M6 mortar with a mineral colouring admixture as required to match the stone. The mortar shall incorporate a waterproof additive for exterior and wet area pointing.

4.7.4 Fabrication

1 The Contractor shall accurately cut, dress, drill, fit and finish stonework to shapes and dimension shown on the approved Shop Drawings. Exposed plane surfaces shall be made true in line and exposed curved surfaces true in radius. The thickness of the stone shown is the minimum thickness.

2 For wall facings, the Contractor shall do the following:

(a) cut exposed external corners of stone as shown

(b) ease exposed external edges where shown

(c) cut all other joints and edges square and at right angles to face, and with backs parallel to face

(d) make arises straight, sharp, true and continuous at joints

(e) cut curved stone panels true to radius as shown to produce an even, flush curved surface.

4.7.5 Installation

1 Dovetail anchor slots, wedge type inserts, and other items requiring building in to concrete or masonry work shall be furnished in sufficient time so as not to delay the progress of the work. Tie inserts shall be wired into reinforcing to prevent displacement. No forced entry anchorage device will be allowed.

2 Stone shall be set in accordance with the approved Shop Drawings, level, plumb, square and true with uniform joints, accurately aligned with grain running in the direction as approved by the Engineer unless otherwise stated elsewhere in the Project Documentation. The work shall match mock-ups.

3 Dowels, anchors and ties in shall be provided in sufficient quantity to eliminate “rattle” or loose pieces and to ensure a rigid installation. The extent of the anchorage and installation details shown are intended to indicate minimum requirements. In general, a minimum of one anchor per 0.18 m^2 is required, with additional anchorage provided where necessitated by the size, thickness and setting or shape.

4 Steel backup support shall be provided for the stone work where shown on the Project Drawings and as required to provide rigid installation. Steel support framing shall be anchored securely to the building structure.

4.7.6 Wall Cladding

1 Relieving angles shall be set as required for the proper support of stone. Before setting, the Contractor shall clean the stones and the backing. The stone shall be saturated with water before setting in mortar in order to prevent total absorption of moisture from the mortar.

2 Stone shall be set with two cushions per stone in every horizontal joint, extending full depth of the stone and to within the dimension from the face as shown. Secure with anchors, dowels, and cramps of approved construction, as required for a rigid and secure installation. Fill anchorage holes with accelerated setting mortar. Rigidly secure strap anchors to the backing.

3 Flashing materials shall be repaired to their original condition where they have been punctured by anchorage or damaged during setting.

4 Cavities shall be kept behind the facing free of mortar or other foreign material.

5 Fill and seal joints as indicated in the Project Documentation.

4.7.7 Paving and Flooring

1 The following shall be performed by the Contractor when laying paving and flooring:

(a) place reinforcing mesh in the setting bed

(b) tamp the stone into the setting bed with mallet until firmly bedded to the proper level

(c) remove stone, cover the back of the stone with wet cement and return to position on the setting bed; before applying the wet cement, wet the back of the stone to prevent major absorption of moisture from the cement

(d) use cushions and spacers to maintain uniform jointing and setting.

2 Joints shall be grouted with water and neat cement by buttering the edges of the stones as they are laid. Surplus joint cement cleaned from face of the stone immediately.

3 Where grinding is required to completely align and level joints, permit a minimum of six days of setting time to elapse before commencing grinding. Perform grinding by wet abrasion, in a manner as to retain the finish, to match the balance of stone paving, and so as to be free of depressions and grind marks. The Contractor shall exercise care to avoid damage to or soiling of adjacent work.

4.7.8 Erection Tolerances

1 The following maximum non-cumulative erection tolerances shall be complied with:

(a)	variation from plumb	+/- 3 mm in storey height
(b)	variation from level	+/- 3 mm in any bay
(c)	variation in location	+/- 6 mm in any bay
(d)	edge alignment	1.5 mm

4.7.9 Submittals

1 Submittals shall be made in accordance with the relevant provisions of Section 1, General and the following Clauses.

2 Shop Drawings: The Contractor shall submit shop drawings of the stonework showing in detail the layout, jointing, anchors and dowels, dimensions, sizes and locations of cut-outs, adjoining work, etc. Each piece on the Shop Drawings is to correspond to the identification number on the back of each stone. The Contractor shall co-ordinate all components which are specified elsewhere (flashing, insulation) which comprise the system into this submittal. Shop Drawings shall be co-ordinated with all related trades.

3 Samples: The Contractor shall submit to the Engineer 600 x 600 mm sample panels with cross-joints to show the sealant materials of each type and finish of stone required. The samples shall show the full range of colour and texture expected in the finished work. In addition the Contractor shall submit one (1) full size sample of each type and finish, falling in the average colour and texture range. The Engineer's review and approval of the sample is to be for colour, texture and pattern only. Compliance with all other requirements is the exclusive responsibility of the Contractor.

4.7.10 Visual Mock-ups

1 Following the approval of the samples, the Contractor shall construct mock-ups for approval by the Engineer prior to installation. Mock-ups to be provided shall be as follows:

(a) wall facing: assembled to simulate the final condition, direction of graining, and indicating joint conditions, use of spacers, shims, anchorage, relieving angles, supports, and all other features of the final work

(b) flooring: samples of flooring/skirting, etc, of each type of stone work specified is to consist of a full pattern and be complete with all anchors, bedding, jointing, sealers, etc., in accordance with approved shop drawings

(c) provide mock-up for any other stonework as shown on the drawings and as required by the Engineer.

4.8 CAST STONE

4.8.1 General Requirements

1 The requirements for manufactured stone for vertical applications and for trim, including copings and sills shall comply with the relevant provisions of BS 1217 or EN 771-5 or ASTM C1364 and reconstructed masonry shall comply with the relevant provisions of EN 771-5.

2 Cast stone work is to be executed by an approved specialist subcontractor.

3 All cast stone is to be sound and free from defects which would impair strength, durability or appearance. Each type of stone is to be supplied from the same quarry. Quarries and fabrication plants are to be available for inspection by the Engineer.

4 Joint sealing compounds used with stone will conform to Section 24, Part 10.

4.8.2 Submittals

1 Samples: The Contractor shall supply cast stone sample panels, size 200 x 200 x 300 mm, for each colour and finish of stone for approval by the Engineer.

2 Shop Drawings: The Contractor shall provide drawings of cast stone work showing anchorages for the approval of the Engineer.

4.8.3 Product Delivery, Storage and Handling

1 Cast stone shall be cured for a minimum of 30 days before delivery. Each unit is to have the date of manufacture impressed in the back of the stone.

2 Cast stone shall be stored under waterproof covers on boarding clear of the ground and shall be protected from handling damage, dirt, stain, water and wind.

4.8.4 Anchorage Devices

1 Coping stones shall be anchored to the masonry with no less than two dowels to each stone. Dowels may be either 8 mm stainless steel pipe 75 mm long or 12 mm diameter stainless steel bars 75 mm long.

2 Course stones shall be anchored to the backing with one metal anchor for each 600 mm in length. Each stone shall have not less than two anchors. Anchors are to be stainless steel 4 mm x 30 mm with the end in the stone turned down 25 mm and other end turned up to 50 mm

4.9 AUTOCLAVED AERATED CONCRETE BLOCKS (AAC BLOCKS)

4.9.1 General Requirements

1 AAC masonry units shall be manufactured using hydraulic binders such as cement and/or lime combined with fine siliceous based material, cell-generating material and water and cured with high pressure steam in autoclaves.

2 AAC Blocks are to conform to the requirements of EN 771-4.

END OF PART