DIVISION 4

MASONRY

BUILDING WORK

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MASONRY

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SECTION 04200

MASONRY

PART 1: GENERAL

1.01 SCOPE OF WORK

A Furnish all labor, materials, equipment and incidentals required to construct all masonry work as shown and as specified herein.

B The work under this Section is limited to the Concrete Reinforcement Section and, with the exception of items embedded in concrete, is to be installed under this section.

C The work under this section includes, but is not necessarily limited to, the following:

1. Blockwork
2. Masonry joint reinforcement, ties, and anchors
3. Buildings-in required precast components

1.02 RELATED WORK NOT INCLUDED

A Other sections directly related to work covered in this section include the following:

1. Section 03300 - Concrete.
2. Section 03600 - Grout.
3. Section 05500 - Miscellaneous Metal
4. Section 07005 - Waterproofing and Dampproofing.
5. Section 07900 - Caulking.

1.03 SUBMITTALS

A Submit to the Engineer, as provided in the Submittals Section, sample of block, joint reinforcing, dovetail anchors, slots, blocks fixing ties, cavity trays, and proprietary cavity closures.

B Resubmit as required until acceptable.

C Before commencing with the laying of any architectural masonry, construct on the Site, where directed by the Engineer, one sample exterior wall panel, minimum dimension, 2 meters by 1.3 meters of block showing type and tooling of mortar and bond, block fixing ties, and movement joint for the Engineer's review. Reconstruct until acceptable. Sample panels shall remain in place for the duration of the masonry work.

Remove sample panel at the completion of the work as directed by the Engineer.

D Certificates: Before commencing work submit agreement from manufacturers of blocks that movement joints are located at positions recommended by them.

1.04 MATERIAL DELIVERY, HANDLING AND STORAGE

A General: deliver store and handle in accordance with manufacturer's recommendations.

B Transport: Transport materials in cool containers and do not allow to stand in sun: especially ensure that metal barrows and containers and boards for mortar and mortar materials are cool.

C Storage: keep blocks dry at all times; store on prepared areas free from clinker or ashes or sulphate bearing soils; cover block stacks and sand piles with tarpaulins; allow air circulation.

D Storage: Store cement and lime above ground in dry structures and use in order of delivery.

1.05 PROTECTION OF MATERIALS

A All masonry materials for the work of this Section shall be delivered stored and handled so as to preclude damage of any nature. Manufactured materials, such as cement and lime, shall be delivered and stored in their original containers, plainly marked with identification of material and maker. Materials in broken containers, or in packages showing water marks or other evidence of damage, shall not be used and shall be removed from the Site.

B All masonry shall be shipped stacked with hay or straw protection or other suitable protective device and shall be similarly stacked off the ground on the site. Masonry shall be unloaded with suitable equipment or manually in manner to prevent damage. Masonry units shall not be dumped from trucks. In addition, all masonry stored on the site shall be protected from the weather and staining with the use of tarpaulins or other covering acceptable to the Engineer.

1.06 PROJECT ENVIRONMENTAL CONDITIONS

A Work in Adverse Weather: Except where precautions are taken to maintain materials and ambient temperatures above 4°C do not mix mortar or lay blocks or dpc material when temperature on falling thermometer reaches 4°C or until temperature on ascending thermometer in shade reaches 4°C.

B Take all necessary measures to ensure that block laying continues without interruption during adverse weather.

C Hot Weather Work: take all necessary steps to keep mortar and blocks and dpc and other materials cool including:

1 Do not mix mortar or lay units while shade temperature is above 40°C in a rising thermometer or above 43°C on a falling thermometer.

2 Do not allow temperature of fresh mixed mortar to exceed 30°C. Take suitable measures to ensure this.

D Contractor is deemed to have allowed in his Tender for all steps necessary for compliance with above.

1.07 ADJUSTMENT AND CLEANING OF COMPLETED WORK

A Clean off mortar splashes and other stains from wall surfaces by scrubbing and washing down with clean water. Do not use acids.

1.08 PROTECTION DURING PROGRESS OF WORKS

A Protect work from damage by heat, rain and frost. When humidity is less than 50% and wind speed exceeds 4m/second provide shelter for wet mortar for at least 24 hours after mixing to avoid dehydration.

B In any period of interruption and in hot weather protect from damage; use approved coverings that extend down both sides of exposed walls to cover work done in previous 24 hours and permit free air flow and prevent heat build up.

C Prevent all blocks from becoming wet.

1.09 PROTECTION OF COMPLETED WORK

A Keep completed wall clean and protect from staining.

PART 2: PRODUCTS

2.01 MATERIALS - GENERAL

A Aggregates-General: Obtain from sources approved by the engineer.

2.02 MATERIALS - BLOCKS

A Concrete Blocks Except as otherwise described, provide blocks complying in all respects with BS 6073: Part 1 in accordance with Blockwork Schedule. Where a described size differs from that in BS all other provisions of BS apply, manufactured from ordinary Portland cement to ASTM C150, Type I and natural aggregates to ASTM C-33, and shall meet the following compressive strengh classes:

1 - Hollow blocks: 30 kg/cm^2 of gross area

2 - Solid blocks: 35 kg/cm^2

B Do not use tongued and grooved blocks without the Engineer's permission.

C Surfaces of blocks that are to receive plaster or render to be suitably textured and capable of receiving plaster or tender without addition of bonding measures.

D Blocks must be dry and properly cured when delivered to site.

2.03 MATERIALS - TIES

A Cavity Walls: Use approved galvanized vertical twist type wall ties complying with the requirements of BS 1243, or others having at least equivalent strength and stiffness, all in accordance with the minimum spacing and embodiment requirements of BS 5628 Pt. 1.

B Double Leaf (Collar Jointed Walls) : Use approved galvanized flat metal wall ties in accordance with the requirements of BS 5628 Pt1 clause 29.5 and the requirements of BS 1243.

C Single Skin Walls: Use approval galvanized ties in accordance with the requirements of BS 1243 & BS 5628.

2.04 MATERIALS - MOVEMENT JOINTS

A Movement Joint Sealant: Movement joint sealant shall be suitable for the purpose intended & used in accordance with manufacturers instructions.

B Movement Joint Filler: For vertical joints, shall be expanded polystyrene.

C Suitable ties provisions to be made for transfer of lateral shear across all movement joints.

D Sleeved sliding ties to be used to laterally support tops of blockwork walls to ensure no vertical load is transferred from the structural elements on to the blockwork walls.

E For all movement joint spacing refer to architect drawings and the manufactures specification.

2.05 MORTAR MATERIALS

A Portland cement shall conform to ASTM C150, Type I for mortar above ground.

B Lime for Brick masonry mortar shall be hydrated, conforming to ASTM C207, Type S, non air-entrained.

C Sand shall be clean, durable particles, free from injurious amounts of organic matter. The sand shall conform to the limits of ASTM C144.

D Water shall be free from injurious amounts of oils, acids, alkalis or organic matter, and shall be clean and fresh.

E White Cement: to BS 12.

F Coloured Mortar: shall obtain its colour from pigments complying with BS 1014 and colour of mortar shall be approved by the Engineer as part of a sample panel.

G Admixtures: do not use admixtures, other than plasticiesers, without prior approval. Do not use calcium chloride or any admixtures containing calcium chloride.

H Plasticisers: to BS 4887 or ASTM C494 Type A.

2.06 MORTAR MIXES

A Mortar for block shall be one part Portland cement, two parts lime and 8parts sand, where block is reinforced lime should not be used.

B Mortar for brick shall conform to ASTM C270, Type S. Provide test data as required to substantiate strength requirements of 130 kg/cm^2 at 28 days. Ingredients shall be accurately measured by volume in boxes especially constructed for the purpose by the Contractor. Measurement by shovel will not be allowed. Measure materials in a damp, loose condition.

C Mortar for frames and elsewhere as required shall be one part portland cement, one part sand.

PART 3: EXECUTION

3.01 MORTAR

A Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5 minutes, approximately 2 minutes of which shall be for mixing the dry materials and not less than 3 minutes for continuing the mixing after the water has been added. Where hydrated lime is used for mortar requiring a lime content, the Contractor will have the option of using the dry-mix method or first converting the hydrated lime into a putty.

Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementitious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

B Mortar boxes shall cleaned out at the end of each day's work, and all tools shall be kept clean. Mortar that has begun to set shall not be used.

3.02 MASONRY - INSTALLATION

A All block shall be laid in full beds of mortar with shoved joints and with all joints shushed solidly in each course. Block shall be damp when laid. All block shall be laid up from an outside scaffold and shall be carried up simultaneously at an approximate level. Bricks receiving minor handling defects, if allowed to be used, shall be used in surfaces to be plastered.

B All masonry shall be laid a full bed of mortar, applied to shells only. Butter the vertical joint of unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well-compacted vertical mortar joint for the full shell thickness. Units shall set with all cells in a vertical position. The moisture content of the units when laid shall not exceed 35 percent of the total absorption as determined by laboratory test.

C All masonry shall be laid in stretcher (running) bond. Fill all joints with mortar dense and neat. Joints shall be 10 mm wide with all joints uniform.

D Sizes shall be as specified and called for on the drawings, and the space between face and the backup material shall be shushed full of mortar.

E Coordinate with the work of installing pressed metal frames. Fill frames fully with mortar.

F All masonry slots, chases, or openings required for the proper installation of the work of other sections shall be constructed as indicated on the drawings or in accordance with information furnished before the work is started at the points affected. No chase shall cut into any wall constructed of hollow units after it is built, except as directed and acceptable to the Engineer.

G Build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, precast concrete and ties, electrical panel boxes, sleeves vents, grilles, anchors, grounds, and electric conduits and fixtures. Cooperate with other trades whose work is to be coordinated with the work under this section.

H All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar.

I All ties and reinforcing for masonry shall be furnished and installed under this section.

J Space ties as follows:

To columns (Abutting or not exceeding 450 mm centres vertically, pasing walls) placing on each side of any movement joint.

To Edge Beams not exceeding 450 centres horizontally in one row along face of edge beam at each floor level.

To Openings and at Vertical provide additional ties within 150 mm of Movement joints edges at not exceeding 450 mm vertical centres.

K Install vertical masonry reinforcement where indicated on the drawings or specified herein.

L Aluminium: Any aluminium surface that will be in contact with block or mortar is to be painted with black bitumen coating solution to BS 3416

Type 1. Ensure that protective coating is adequate and if not arrange of a further coat of bitumen to be applied.

M Concrete Blocks: Protect and keep dry at all times.

N Concrete Blocks: Where items requiring strong solid fixings are to be fixed to blockwork e.g. radiators hanging cupboards provide solid (100%) blocks of fixing bricks to receive fixings

O Block Nibs Against Steel or Concrete: Where nibs less than 200mm in length occur against steel or concrete surfaces tie nibs to, steel or concrete using dovetail anchors at not exceeding 230 mm vertical centres placed in vertical metal slots cast in concrete, or shot fired into steel.

P Reinforcement: Where length of an internal partition wall exceeds 5m in unbroken length provide continuous horizontal reinforcement in each alternative course of blockwork: bed on and surround with mortar and keep back 12 mm from faces. Provide for.

Q Non-Load Bearing Walls: Tie across control joints with strips of expanded metal mesh or 6 mm rod mesh placed across joint in alternate courses. Provide at least 25 mm of cover to all metal.

R Metal in Walls: All metal in external walls to be hot-dip galvanized. Part 1 including preliminary and site tests at 7 days and 28 day. Arrange for copies of test report to be sent directly on to the Engineer from laboratory within 7 days of completion of test.

3.03 CLEANING

A All holes in exposed masonry shall be pointed, and defective joints shall be cut out and repointed with mortar of same color as that of the original and adjoining work.

B Exposed masonry shall be protected against staining by wall coverings, and excess mortar shall be wiped off the surface as the work progresses.

C All exposed masonry shall be thoroughly cleaned. Before applying any cleaning agent to the entire wall, it shall be applied to a sample wall area of approximately 2 square meters in a location approved by the Engineer. Use only those cleaning agents recommended by the brick manufacturer. No further cleaning work may proceed until the sample area is acceptable to the Engineer, after which time the same cleaning materials and method shall be used on the remaining wall area.

3.04 FIELD QUALITY CONTROL

A Tests: take samples of fresh or hardened mortars when directed, and submit to approved testing laboratory for testing of compressive strength to BS 5628: Part 1 including preliminary and site tests at 7 days and 28 days. Arrange for copies of test report to be sent directly o to the Engineer from laboratory within 7 days of completion of test.

B Testing solid concrete blocks: ten blocks from each batch are to be selected by the engineer for testing for compressive strength. Results are to be as follows:

Individual block	not less than 30 kg/cm2
Average of 10 blocks	not less than 35 kg/cm2

C Testing hollow concrete blocks: ten blocks from each batch are to be selected by the Engineer for testing for compressive strength. Results are to be as follows:

Individual block	not less than 25 kg/cm2 of gross area
Average of 10 blocks	not less than 30 kg/cm2 of gross area

End of Section

SECTION 04400

NATURAL STONE SLAB CLADDING

PART 1: GENERAL

1.01 SCOPE OF WORKS

A Work to be done under this section includes, but is not limited to, the following items including all labor, materials, equipment and incidental to Extents of interior and exterior stonework as indicated on the drawings and as specified herein.

1. Exterior and Interior stone and granite includes the following:

   a. Wall and Column Facing.

   b. Soffits.

1.02 RELATED WORK

A Other sections directly related to work covered in this section include the following:

1. Section 03300.

1.03 QUALITY ASSURANCE

A Obtain stone from quarry with consistent colour range and texture throughout the works.

B Fabrication of stone shall be carried out by operatives or sub-contractor which has successfully fabricated stone similar to the quality specified for a period of not less than 5 years and is equipped to provide the quantity shown.

C Stone shall match appearance of agreed samples held by the Engineer.

D Job Mock-up: Prior to installation of stonework, provide sample panels of stonework indicated with proposed range of colour, texture and workmanship to be expected in completed work, and to size directed by the Engineer. Build mock-up at site, as directed, using stone, anchors, jointing, insulation and waterproofing as applicable as shown and specified in accordance with final shop drawing.

E Obtain the Engineer`s acceptance of visual qualities of sample panels before start of stonework. Replace unsatisfactory mock-up work, as directed, until acceptable to the Engineer. Retain sample panels during construction as a standard for judging completed sronework. Do not alter, move or destroy mock-up until work is completed.

F Allowable Installed Tolerances:

1- Variations from Plumb: For surfaces of columns and walls as well as for arrises, external corners, joints and other conspicuous lines do not exceed 6 mm in any story, or in 6.0m maximum, nor 12 mm in 12.0m or more.

2- Variation in level: For grades shown on lintels, stools, horizontal joints and other conspicuous lines do not exceed 6 mm in 6. mm in 6.0m maximum nor 12 mm in 12.0 m or more.

3- Variation in linear Building line: For positions shown in plan and related portion of columns, and wall facing, do not exceed 12 mm in any bay or 6.0 m maximum, nor 12 mm in 12.0 m or more.

4- Variations in Cross-Sectional dimensions: For columns and thickness of walls from dimension shown, do not exceed minus 3 mm, nor plus 3 mm.

5- Variations in stone dimensions, do not exceed + or – 3 mm.

1.04 SUBMITALS

A Samples

1- Stonework: Submit sets of samples not less than 400mmx250mm in size of each different type, colour, grade and finish of stonework required. Include in each set full range of exposed colour and texture to be expected in completed work.

2- Mortar: Submit samples of mortar to match colour of each type of stonework required. Replace unsatisfactory samples as directed until acceptable to the Engineer.

B Shop drawings: Submit cutting and setting out drawings showing sizes, dimensions, sections and profiles of stonework units, arrangements and provisions for jointing (Including movement and construction joints) anchoring, and fastening, supports and other necessary details for lifting devices and reception of other work. Indicate block size from base to top of wall elevations, by showing extent of each typical block size in zones, as indicated on the Employer`s drawings. Show, location of inserts (for stone anchors and supports) which are to be built into concrete anchors and supports) which are to be built into concrete or masonry. Show large size details of special features.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect stone during storage and construction against moisture, soiling, staining and physical damage.

B. Handle stone to prevent chipping, breakage, soiling or other damage. Do not use pinch or wrecking bars without protecting edges of stone with wood or other rigid materials. Lift with wide-belt type slings wherever possible; do not use wire rope or ropes containing tar or other substances which might

cause staining. If required, use wood rollers and provide cushion at end of wood slides.

C. Store stone on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and stones to distribute weight evenly and to prevent breakage or cracking of stones. Protect stored stone from weather with waterproof, non-staining covers or enclosures, but allow air to circulate around stones.

D. Protect mortar materials and stonework accessories from weather, moisture and contamination with earth and other foreign materials.

1.06 JOB CONDITIONS

A Installer must review installation procedures and coordination with other work, with contractor, and other contractors and subcontractors whose work will be affected by stonework.

B During all seasons, protect partially completed stonework when work is not in progress. Cover top of walls with strong waterproof, non-staining membrane extending at least 600 mm down both sides of walls and anchor securely in place.

C Installation Temperature limits: Do not set stone when air temperature on temperature of materials is below 7 degrees C.

PART 2: PRODUCTS

2.01 QUALITY OF STONE

A To be first quality, each type obtained from one strata, from one quarry and delivered in one shipment. Slabs are to be hard and free from cracks and other defects to surfaces and edges which may impair structural integrity, function r appearance and are to be cut square and true with clean edges and uniform in shape and thickness. Submit supplier's test results for each type of stone for the following tests, which must meet the following:

	Unit	Stone	
Weight per unit of volume	ton/m3	2.5	not less
Absorption coefficient	Wt %	3	not mor
Modules of rupture	N/mm2	6.9	not less
Abrasion resistance	%	10%	not mor

2.02 MATERIALS

A Ajlon lime stone:

To be obtained from quarries having sufficient quantities to complete the works as indicated on the drawings. The color variation shall be within the limits established on the mock-up and approved by the Engineer. Minor natural markings which are characteristic of the material which do not impair strength or appearance will be permitted.

All cladding stone shall be 40 mm thick after finishing. Corners, balustrade copings and special shapes shall be cut from the solid to the dimensions indicated on the drawings. The finish for exposed surfaces shall be fine mechanical bush hammered, as stated on the drawings. No visible saw marks shall be evident. All blocks shall be plane, square and true to sizes indicated on the drawings. Corners and special shapes shall be finished to sizes indicated on the drawings.

Generally all stone work shall be cut to size, finished and prepared for fixing in the shop.

B Fixings: 8 mm diameter steel bar 200 mm both sides net, to be fixed to backing wall by anchors, expanding bolts and sockets to avoid problems of misplaced pockets or channels.

C Mortar: to the requirements of Section 04200 of the Specification, comprising 4 parts ordinary Portland cement and 1 part sand.

Sealant for movement joints: one-part moisture cured silicone sealant to ASTM C920 or BS 5889 type A, or two-part polysulphide sealant to BS 4254.

PART 3: EXECUTION

3.01 GENERALLY

A Design: complete the design and detailing of the work and provide for approval structural design calculation and complete information based on information provided. Drawings are to show each stone unit and type and location of each fixing.

3.02 CUTTING OF STONE

A stones are to be cut so that the bedding is appropriate to its position in the building finished dimensions of stone units including minimum thickness are to be such that the cladding, when erected, complies with the requirements for accuracy of erection

B when details on drawings show stone corner as one piece, two pieces may be used cut at 45° and glued together with approved non stain epoxy adhesive complying with ANSI A136.1 and as recommended by the Stone supplier. Provide stainless steel dowels as necessary, and joints are to be tested to ensure complete rigidity.

C In order to accommodate permissible deviations within the building structure, selected stone units must be left oversize for cutting to precise dimensions taken on site; units are to be selected and clearly identified as such on the shop drawings.

D Use a suitable bench saw for cutting on site.

3.03 INSPECTION OF STONE UNITS

A Completed units must be carefully inspected and checked for match with approved samples and compliance with the Specification before dispatch to site. Inform the Engineer at appropriate stages in production of units so that he may inspect them before delivery to site.

3.04 FIXING AND JOINTING

A Before commencing erection, survey the building structure, including any fixing inserts, and report to the Engineer immediately any inaccuracy preventing proper positioning of units.

B Accuracy of erection:

1 - average width of any joint must not deviate from average of all nominally identical joints by more than +/-20%

2 - within the length of any joint (including in-line continuations across transverse joints) the greatest width must not exceed the least width by more than 40%, any variation being evenly distributed with no sudden changes

3 - offset in elevation between nominally in-line edges across a transverse joint must not be more than 20% of the width of the transverse joint

4 - offset in plan or section between flat faces of adjacent panels across any joint must not be more than 20% of the width of that joint

5 - widths of joints must be such as to ensure that joints perform as intended and are within recommendations of joint material manufacturer

6 - finished work must have a satisfactory appearance, being square, regular, true to line, level and plane with satisfactory fit at all junctions, all to approval.

C Fixings

1 - do not exceed torque figures or shim dimensions recommended by manufacturer,

2 - grout dowel bars with fairly dry mortar or suitable epoxy or polyester mix, well tamped in,

3 - give reasonable notice to the Engineer to allow inspection to take place before covering up load bearing fixings,

4 - give reasonable notice to the Engineer, as required, of the completion of stone courses to allow inspection of restraint fixings and cavity before proceeding with the next course,

5 - anchors or ties must not be subjected to any loading until complete curing or hardening has taken place,

6 - cramp holes and mortices shall be carefully drilled or cut to avoid fracture of the stone slab,

7 - patching will not be permitted and any damaged slab shall be removed and replaced.

3.05 JOINT AND SEALANTS

A Basic joints: all joints to be flush closed type. Wood or plastic joint spacers may be used but remove and make good to match as soon as mortar has set.

B Movement joints: in addition to basic joints, the following sealant filled joints are required:

1 - horizontal movement joints at floors, to coincide with support fixings

2 - vertical movement joints at intervals to accommodate relative movement between cladding and structure

3 - structural movement joints

4 - joints between cladding and windows or doors.

C Where the width of any type of joint is not shown on the Drawings, it is to be determined by the Contractor, and is to be as small as practicable having regard to shrinkage, thermal and other movements which may be expected in the building structure and cladding.

D Application of sealants backing strip, bond breaker and primer are to be types recommended by sealant manufacturer, preparation of joint, depth of sealant and application are to be strictly as sealant manufacturer's recommendations, joint must be thoroughly clean, dry and free from oil; finely abrade and/or prime as appropriate; mask edges of joint with tape before priming and remove immediately after sealing, insert backing strip and apply sealant ensuring maximum adhesion to sides of joint and a neat, smooth and clean finish.

End of Section