REPUBLIC OF LEBANON

Ministry of Public Health

COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

CONSTRUCTION OF
AKKAR – ONE DAY SURGERY
GOVERNEMENTAL HOSPITAL - SAHLEH

VOLUME 2-1 SPECIFICATIONS

ARCHITECTURAL AND STRUCTURAL WORKS

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SPECIFICATIONS

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DIVISION 1

PARTICULAR REQUIREMENTS

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Division 1

PARTICULAR REQUIREMENTS

1. SUMMARY OF WORKS

A. Scope

This Specification covers the construction, completion and remedy defects maintenance of the Akkar – “One Day Surgery” Governmental Hospital, which is to be provided as shown on the drawings and as detailed in the Contract Documents.

B. Performance and standards

The performance required of materials and products and the standards to be complied with are specified in subsequent sections of the Specifications.

C. Related Items

Mechanical and Electrical Coordination.

D. Description of the project

The project consists in the Rehabilitation of the works of Sector 2 as shown and described on the drawings:

1. Building comprising:
   - Basement
   - Ground floor
   - First Floor
   - Roof and upper roof.

2. External Works including Main gate, Fence and Guard House.

2. MECHANICAL AND ELECTRICAL COORDINATION

A. Scope

1- This section specifies the Contractor's responsibilities in coordinating the Mechanical, HVAC and Electrical Works.

2- The Contractor shall ensure that the Mechanical, HVAC and Electrical Works are carried out in proper sequence having regard to the progress of the work, and that the necessary provision is made for locating, routing, supporting and fixing the engineering services, providing the necessary holes, chases and access for them, and in all respects fully integrating them with the building fabrics.

B. Performance and standards

The Contractor shall obtain all necessary approval from the Engineer before starting any connection works of the Infrastructures.

3. CONTRACTOR'S TEMPORARY FACILITIES

A. The Contractor shall be responsible for and shall make his own arrangements in respect of all temporary facilities required by him for the execution of the Works including but not limited to:

- Necessary land and site offices (min 50 m²) for the Contractor’s use and the use of his Sub-Contractors
- Yards and stores
- Sheds & hard standings,
- access roads and fencing

and the like together with all necessary services,

- water supply, drainage, sewerage, electricity, power, communications, first aid, fire protection and other facilities.

B. The Engineer's approval is to be obtained for the intended sitting of all spoil heaps, Temporary Works and services.

C. Temporary Works are to be constructed to recognized standards and codes of practice so that they are fit for their purpose. Drawings and details of proposed Temporary Works are to be provided by the Contractor if requested by the Engineer.

4. SAFETY, HEALTH AND ENVIRONMENTAL REGULATIONS

The Contractor shall comply with all the requirements of the CDR "Safety, Health and Environmental Regulations" included in Appendix I to the Conditions of Contract.

In the event of any contradiction between these Specifications and the Safety, Health and Environmental Regulations the requirements of the latter shall govern.

5. TEMPORARY FIRST AID FACILITIES

The Contractor shall make his own arrangements for treatment of casualties on the Site in such first-aid units as may be considered necessary and shall provide an adequate number of first-aid units and personnel suitably trained in first-aid treatment, and shall provide for the removal in ambulances of injured or sick persons to hospitals or to their place of residence.

6. TEMPORARY SIGN BOARDS

The Contractor shall provide and erect at locations agreed with the Engineer one signboard 3.00 x 1.20m , consist of painted galvanized steel frames, painted steel sheets and reinforced concrete base, indicating such particulars as names of Employer, Engineer and Contractor, project name, execution period, etc., all to the approval of the Engineer. The signboard shall be erected within two (2) weeks from commencement and shall be removed upon completion of Works.

7. CONSTRUCTION PROGRAMME

The Contractor shall prepare a Construction Programme showing the order and method in which he proposes to execute the works and the dates upon which the various elements, trades and sections of the works will be started and completed including dates for submittal and approval of shop drawings and samples; for procurement and delivery of materials and equipment; for construction, installation, inspection, testing and commissioning.

The project shall be subdivided into phases and parts to be approved by the Engineer and to be compatible with the programme of work.

A. The Construction Programme shall be in the form of Computerized Network Precedence Diagrams incorporating activities for all work to be performed by the Contractor, his Sub-Contractors and other Contractors to be employed in or about the site, supported by computer analysis and schedules and prepared in accordance with the principles of Critical Path Method (CPM) programming showing at least 300 activities.

The Construction Programme shall be the latest version of PRIMAVERA project planner or other approved software.

B. The Construction Programme shall be prepared by a qualified Network Analysis Engineer in collaboration with the Contractor. The Network Analysis Engineer shall be approved by the Engineer and shall be skilled and experienced in construction programming of the kind specified for this project. The Network Analysis Engineer shall provide the Engineer an access to the Engineer's database for loading into the Engineer's computer, whether by means of floppy diskettes or dataline communications.

C. The network diagrams shall be clearly and accurately presented with work activities relating to specific locations or levels grouped for ease of reference. Each work activity shall have the following information shown in the diagram:

- Activity number.
- Concise description of the work.
- Specification reference or trade code.

- Location of work or area code.
- Duration in calendar days.

D. Computer Analysis

1- In addition to the network diagrams the Contractor shall submit the following computer analysis output:
    - Activity Status Report.
    - Master Working Report: chronological listing by early start of all activities and milestones.
    - Milestone Report: Chronological listing by early start of all milestones.
    - Contractor Reports; individual reports, sorted chronologically by early start, for each Contractor. These reports will only have the early start and early finish dates for distribution to Contractors.
    - Material Procurement Report: based on the early start Construction Programme, for all material items. This report shall include dates for submittal, approval release for ordering/fabrication, shipping and delivery to site.
    - Shop Drawings and Samples Reports: This schedule shall detail the dates for submission and approval of shop drawings and samples required by the Contract Documents, including those required from Contractors shall make due allowance for reasonable time of processing of shop drawings by the Engineer.
    - Manpower Report: a listing of all activities displaying estimated crew sizes and manpower requirements for each activity.
    - Current Status Report: a listing of actual start and finish dates, activities already started and completed and percentage completion of activities still in progress.
    - Cash Flow Report: showing projected monthly and cumulative expenditure.

2- The activity status report shall have the following minimum data for each activity:
    - Activity number.
    - Concise description of the work.
    - Specification reference or trade code.
    - Location of work or area code.
    - Duration in calendar days.
    - Early start date (calendar).
    - Early finish date (calendar).
    - Late start date (calendar).
    - Late finish date (calendar).
    - Total float (calendar days).
    - Estimate crew size.
    - Percentage completion.
    - Remaining duration in calendar days.

E. Supporting Data

1- The Contractor shall also prepare and submit in narrative form the number mentioned supporting data with the submittal of his Construction Programme. Any changes in this information shall be submitted with successive updates and revision.

- The proposed number of working days per week.
- The holidays, and other non-working days (except Sundays) observed during the duration of the Contract (by date).
- The planned number of shifts per day.
- The number of hours per shift.
- The planned usage of major construction plant and equipment on the site, on a monthly basis.
- The planned procurement and delivery of local and imported materials.
- The average weekly manpower usage for each trade to be employed for the works.
- The productivity rates for each major work sequence or for any specific activities required by the Engineer.
- Explanation of all changes in logic, durations, manpower, plant and equipment.
- Actual start and finish dates of activities already completed, and percentage completion of activities still in progress.

F. Forty five (45) Day Programme

At monthly intervals, the Contractor shall submit a separate programme developed from the approved Construction Programme covering a period of forty five calendar days and denoting the Contractor's and Sub-Contractor's daily work activities and their interrelationship with the work of other Contractors, if any.

G. Construction Programme Revisions and Updates

1- Once the initial Construction Programme is submitted and approved by the Engineer, the Network analysis Engineer shall perform monthly updates in collaboration with the Contractor. The update will follow a visit to the job site where in the presence of the Engineer, the Network Analysis Engineer and the Contractor will record the actual starts and percentages complete and, using this data, update the computer analysis. The updated analysis will be accompanied by a narrative report containing the supporting data referred to herein before, which shall indicate the necessary action dates and requirements for material, labour and plant acquisition. The narrative report shall also focus upon the construction progress and shall particularly note conditions that may delay progress of the work. In the event of such delays, the Contractor shall describe actions proposed to overcome the adverse conditions to maintain the planned Construction Programme.

2- Site progress meetings attended by the Engineer, the Contractor, the Network Analysis Engineer and the principal Sub-Contractors, will be held monthly immediately following the monthly site visit referred to in the previous paragraph, specifically to review the progress of the work. At this meeting the latest update of the last approved Construction Programme will be examined with reference to the records made during the said site visit in order to verify the following:

- Actual start and finish dates of activities completed during the period since the previous update or revision.
- Remaining durations and percentage of completion for all activities in progress.
- Logic, time and cost data for variation order work that will be incorporated into the Construction Programme.
- Contractor's measures to rectify delays from the planned dates.

3- The Contractor shall perform the work in accordance with the latest approved Construction Programme. If any work is found not to be on programme during any regular review of the work, the Contractor shall immediately advise the Engineer in writing of action proposed to bring the work on programme. The Contractor shall thereupon prepare and submit a revised Construction Programme indicating such action, together with a list of revisions to programme logic. Correction and updating of the Programme will be done as often as necessary until the project is on Programme.

4- Within five (5) working days after receipt of a notice from the Engineer, the Contractor shall submit a revised Construction Programme for any of the following reasons:

- When delays in completion of any activity or group of activities indicates a slippage of the Contract completion date or a Milestone date by fourteen (14) calendar days or ten percent (10%) of the remaining duration of the Contract period, whichever is less.
- When delays in submittals or deliveries or work stoppage area encountered which make replanning of the work necessary.
- When the Programme does not represent the actual execution and progress of the work being performed in the field.
- Where a change in the work sequence is proposed or has been instituted by the Contractor. Any such change should not, in any case, be made without the Engineer's approval.
- Where the issue of a change order or other instruction would significantly effect the programme and/or progress of the works.

5- In the event the Contractor requests an extension of time for completion of the works or requests an extension to the specifies milestone dates, he shall furnish such justification and supporting data as the Engineer may deem necessary for the evaluation thereof. Submission of proper substantiation based on revised activity logic, durations and costs is obligatory with any such request.

6- Float belongs to the project and must be used in the best interest of completing the project on time. Accordingly, any existing float shall be used to the maximum extent possible to offset unexpected delays which occur in connection with the Contractor's work, acts of God, and authorized variations in the scope of the work.

H. Programme Submittal Procedures and Requirements

1- Submittal of the initial Construction Programme for approval shall be in accordance with the following procedure:

- The Contractor shall submit his initial Construction Programme, in four copies and one digital, within 3 weeks of the date of signing of the Contract. Such initial Construction Programme shall include the following completed documents:
  - Network Precedence Diagram showing the sequence and interdependence of all items of work required under the Contract and Milestone dates.
  - All the computer analysis reports required under this Contract.

2- After approval of the Contractor's initial Construction Programme, all subsequent revision and monthly update submittals shall comprise the following:

- Two (2) prints of the Network Diagrams from the last approved Construction Programme, suitably marked up in red ink to show all revisions, and signed by the Contractor and all Sub-Contractors.
- Two (2) copies of the updated Activity Status Report.
- Two (2) copies of all supporting data.
- Two (2) copies of the updated master working report.

3- Revisions and monthly updates to the Construction Programme shall be submitted within five (5) working days of the data date for inputting revised/updated information to create the revision/updated computer analysis. The data date for the first monthly update shall be one month after approval by the Engineer of the Contractor's initial Construction Programme, and successive data dates shall be at monthly intervals. The said data date should coincide with the date of the site progress meeting at which time the records of progress are verified.

4- Each programme submitted shall be signed by all principal Sub-Contractors and Nominated Sub-Contractors before being submitted to the Engineer thereby confirming that they have reviewed the said programme. If any Sub-Contractor has reservations regarding his ability to comply with the requirements of the programme to which he has appended his signature, the Contractor shall instruct the Sub-Contractor to list such reservations in writing and a copy thereof shall be submitted to the Engineer with the programme submittal for his information. No reservation by any Sub-Contractor, nor the fact of informing the Engineer in respect thereof, shall relieve the Contractor of his responsibilities under the Contract in the times prescribed therein.

8. SHOP DRAWINGS AND SAMPLES

Shop drawings shall establish actual details of manufactured or fabricated item and of work to be executed; they shall clearly identify materials, dimensions, thicknesses, components, attachments, relation with adjoining work and spaces, and all other pertinent information. Shop drawings shall be based on the actual existing remeasured structure and shall clarify and amplify the design drawings and other design requirements and shall, subject to the Engineer's approval, incorporate minor changes in design or construction as may be necessary or otherwise desirable to suit the requirements of the work. Where the Contract Documents require the Contractor to submit samples, the same shall satisfactorily establish that the quality, construction, workmanship, finish, colour, pattern and any other characteristics of the material or equipment to be provided, are in conformance with the Contract requirements and to the Engineer's reasonable satisfaction.

A. The Contractor shall prepare, review, coordinate and submit to the Engineer for his approval (7 days to 14 days) such shop drawings and samples as are required by the Contract Documents or as may be required by the Engineer during the course of the works and the Engineer shall correct , approve or reject the shop drawings and samples and resubmit to the Contractor during 14 days.

B. At the time of making his submission, the Contractor shall inform the Engineer in writing of any deviation between shop drawings/samples being submitted and the requirements stipulated or reasonably implied by the Contract Documents.

C. By submitting shop drawings and samples the Contractor thereby represents that he has determined and verified all dimensions, relations to existing work, coordination with work to be installed later, coordination with information in previously submitted shop drawings and has verified their compliance with all the requirements of the Contract Documents. The accuracy of all such information is the responsibility of the Contractor and in reviewing shop drawings and samples the Engineer shall be entitled to rely upon the Contractor's representation that such information is correct and accurate. The Contractor shall be responsible for and shall make any alterations in the work due to discrepancies, errors or omissions in the shop drawings and samples supplied by him whether or not such shop drawings and samples have been approved by the Engineer, provided that such discrepancies, errors or omissions are not due to inaccurate information or particulars furnished in writing to the Contractor by the Engineer. The Contractor shall be responsible for the correct locations of his work, irrespective of approval by the Engineer, and shall pay all costs and expenses incurred by others due to improper location of his work.

D. Sub-Contractors shall submit their shop drawings and samples through the Contractor who shall review and coordinate with his own and other Sub-Contractor's drawings and/or samples before submitting to the Engineer. The Contractor shall be responsible in all respects for his Sub-Contractor's shop drawings and samples as if they were his own.

E. Neither the fabrication of prefabricated items, nor the ordering of any work, materials or equipment, nor the execution of any work on site, shall commence until shop drawings and samples, relevant to the said items, work, etc., and required by the specifications, have been submitted and approved in writing by the Engineer.

F. Shop drawings to be prepared by the Contractor and by his Sub-Contractors for structural, architectural and electro-mechanical works, shall be prepared on the site to facilitate proper liaison and coordination between trades and so as to allow the Engineer ready access for review during the preparation process.

G. Shop drawings and samples shall be prepared after site dimensions have been taken. Shop drawings shall be prepared on reproducible transparencies, and using metric units of measurement.

H. Shop drawings shall describe accurately the method of fabrication, installation, applied finishes, types and sizes of all members and fixings, and shall, where applicable, indicate methods of marking components for site erection. Shop drawings shall be to scales approved by the Engineer.

J. The Contractor shall verify all dimensions and field conditions and shall check and coordinate the shop drawings and samples required in connection with a particular trade or section of the works with the requirements of other trades or section related thereto.

K. In order to ensure proper coordination, shop drawings and samples for each system or element of work shall be submitted in a single package. The Engineer may require in writing that all relevant part of a system or element be submitted before any component item is approved.

L. Except for finish, pattern, colour and other matters in respect of which the Engineer's decision is required in accordance with the Contract Documents, the Engineer's review and approval of shop drawings and samples submitted by the Contractor is for general conformance with the design concept and specifications and shall not relieve the Contractor from responsibility for any deviation from, or errors or omissions in respect of the requirements of the Contract Documents, unless the Contractor has informed the Engineer in writing of specific deviations and the Engineer has given written approval thereto.

M. The Contractor shall make any corrections or amendments required by the Engineer's review of shop drawings and samples and shall resubmit until the "APPROVED" status is achieved. All such corrections or amendments shall be clearly indicated on the resubmitted drawings by the use of revision numbers in circles or triangles, or other method approved by the Engineer.

N. The Contractor shall direct specific attention in writing or resubmitted shop drawings and samples to revisions other than the corrections requested by the Engineer or previous submissions. Unless such written notice has been given, approval of a resubmitted shop drawing or sample shall not constitute approval of any changes not requested on the prior submission.

P. In the event of written rejection by the Engineer to a particular material of sample, the Contractor shall submit within fourteen (14) calendar days of such rejection, samples of three alternative materials for the Engineer's approval and the Engineer shall reject or approve all or any of these materials within fourteen (14) days of their submission. This procedure shall be repeated until such time as a sample of material is approved by the Engineer. Failure on the part of the Contractor to obtain the Engineer's approval, which shall not be withheld unreasonably, to all or any one sample or material shall in no way relieve the Contractor of his liabilities and obligations under the Contract.

Q. The Engineer may at any time call upon the Contractor to submit samples of any material used or to be used in the work, including those specified in the Contract by "Brand Name", for comparison with the specification and/or approved sample. Should any such sample fail to meet the requirements of the specification and/or standard of the accepted sample, then all materials from which the sample has been taken shall be removed from the site immediately and all work executed incorporating such material shall be cut out and made good to the satisfaction of the Engineer all at the expense of the Contractor.

R. No acceptance or approval by the Engineer or any shop drawing or sample submission made by the Contractor, nor any notes, comments, stipulations, requests for clarifications, etc., made by the Engineer upon such submissions during his review and approval thereof, shall constitute an authorization to any variation in the Contract Price or to any extra Time for Completion of the Works.

9. ENGINEER'S REPRESENTATIVE REVIEW OF SUBMITTALS

1- The Engineer's Representative will process the submission and indicate the appropriate action on the submission and the transmittal.

2- The Engineer's Representative will process transmittals in the following sequence:

a. Date Received
Date arriving in the Engineer's Representative office.

b. Date Return
Date leaving the Engineer's Representative office to the Contractor.

c. To/Date
Name of Engineer to whom submission is sent for review and date leaving the Engineer's Representative office.

d. From/Date
Name of Engineer reviewing submission and date arriving in the Engineer's Representative office.

e. Action
Indicate action taken on submission.

f. Distribution
Number of copies distributed and type of material distributed (sepia, print, brochure or sample, etc.).

g. Engineer's and Engineer's Representative Remarks
Note major deviations from the Engineer's Contract Documents or reasons for resubmit if there are not notes on the material submitted.

10. ADJOINING PROPERTIES (IF APPLICABLE)

The Contractor shall prevent damage to existing buildings fences, walls, if any and other properties on the Site or adjacent there to which are to remain in position during execution of the Works. All precautions are to be taken by the Contractor to prevent damage to adjoining property, including ground movements, subsidence, loss of support, movement cracks, etc, as a result of the execution of the Works. Any such damage shall be made good by the Contractor to the satisfaction of the owners of the affected property.

11. SUBMITTALS OF RECORDS

The Contractor shall submit to the Engineer in formats agreed with the Engineer the following records:

- Labour Record each week showing the daily number types and designations of staff and labour;
- Equipment Record each week showing the daily number types and designations of the Contractor's equipment;
- Work Record daily showing the activities and work locations actually carried out and relevant quantities;
- Materials and Plant Record each week showing the type, quantity and designation of all materials and Plant delivered to the Site;
- Weather Record weekly showing daily weather conditions of temperature, humidity, rainfall and winds;
- Monthly Progress Report monthly showing programme; progress; activities carried out and planned,; and any relevant project-related matter;
- Monthly financial report showing actual and projected cash flow.
- Photographs at monthly intervals to show statue of the work taken from 10 approved locations as minimum, 3 prints of 16x20 cm of each photograph monthly.

12. SITE MEETINGS

The Engineer's Representative will hold site meetings with the Contractor at intervals not exceeding 2 weeks to discuss project-related matters. Minutes will be recorded and distributed by the Engineer's Representative to all attendees.

13. ASSISTANCE TO THE ENGINEER'S REPRESENTATIVE

The Contractor shall provide to the Engineer's Representative and his staff at all times during the continuance of the Contract all necessary tools, instruments, labour and assistance in the execution of his and their duties as the Engineer's Representative may require.

14. SITE SURVEYS AND RECORDS

The Contractor shall prepare and maintain documentary records of existing topographic surveys of the Site, sub-surface investigations and all other condition surveys prior to commencement of the work and at all stages during execution. Such surveys and records shall be made available for review as the Engineer may require.

15. LIMIT OF PROJECT

A. The Contractor is fully and entirely responsible to set out the exact limits of the project by legal and authorized surveyors (من دوائر المساحة) in accordance with the expropriation decrees and limits of adjoining properties.

B. Any conflict in the limits with private properties, whether it is raised during or after the execution and completion of the work, shall remain the full and entire responsibility of the Contractor, and he shall assume all consequences resulting from this conflict.

C. The cost of this work shall be deemed to be included in the total price, and will be deducted if not instructed by the Engineer.

16. SUB-SURFACE INVESTIGATIONS (Refer to the attached Specifications).

A. The Contractor shall carry out all additional sub-surface soil investigations and tests to determine the nature and characteristics of soil strata, bearing capacities, water table and other data required for the execution of the Works on the Site, for the Contractor's construction operations and for ascertaining the adequacy of sub-surface conditions below foundations and structures.

B. Such investigations and tests shall be performed in accordance with recognized standards and procedures and conducted at the locations and in the manner approved by the Engineer.

C. The cost of this work shall be deemed to be included in the total price, and will be deducted if not instructed by the Engineer.

17. CODES AND STANDARDS

A. Reference to codes and standards in the Contractor Documents shall be deemed to include the latest edition or issue except when specifically indicated.

B. Where codes or standards are not specifically mentioned in the Contract Documents, work, material, Plant, equipment, performance, tests, manufacture, installation, etc..., shall conform as a minimum to acceptable relevant national or international codes and standards.

C. If the Contractor proposes to adopt codes or standards other than those particularly specified, he shall submit to the Engineer complete data with respect to such codes or standards including detailed list of differences between those proposed and specified and a confirmation that the proposed codes and standards meet, as a minimum those specified. The decision of the Employer and the Engineer in respect of such proposals shall be final.

18. BRAND NAMES

Where brand names, manufactures' or suppliers' names or catalogue numbers or types are mentioned in the Contract Documents, such are for guidance on quality, function, size,

design, and working space requirements and the Contractor may offer any equivalent or superior model or make subject to the approval of the Engineer.

19. MATERIALS, PLANT AND EQUIPMENT

A. All materials, Plant and equipment incorporated or to be incorporated in the works shall be the best of their respective kind, obtained from reputed suppliers and manufacturers and shall be in accordance with the requirements of the Contract Documents. Materials and Plant shall be suitable for long and trouble-free service and suitable for the intended purpose.

B. Defective materials or Plant or those damaged in the course of manufacture, transport, storage, installation, testing or operation shall not be used in the Works and shall be replaced or, subject to the Engineer's approval, repaired in a satisfactory manner to meet the requirements of the Contract Documents.

C. In the choice of materials and Plant due regard shall be given to the conditions to which such materials and Plant may be exposed during their service life.

D. The Contractor shall, when required submit to the Engineer for review detailed description of all procedures of manufacture, calibration, quality control criteria, testing, examination, performance, etc., in connection with materials, Plant or equipment. The Contractor shall make available to the Engineer upon request detailed production schedules of all materials Plant and equipment to be incorporated in the Works.

E. Where and to the extent that materials, products and workmanship are not fully specified they shall be of a standard appropriate to the Works and suitable for the intended purpose stated in or reasonably inferred from the Contract Documents and in accordance with recognized current standards of good practice.

F. All the material and equipment used in the project for the various works shall be as per general and technical specifications, drawings, list of approved materials and B.O.Q. or approved equal. In case of equal materials and equipment are proposed, the Contractor to submit all supported document from relevant authorities justifying the equivalent quality and technical performance.

The approval of the Engineer for the proposed materials or equipment shall be within fourteen (14 days) from the date of submission of these materials by the Engineer.

20. CONTRACTOR'S DESIGN AND ENGINEERING DATA, DRAWINGS, PRODUCT DATA AND SAMPLES

A. The Engineer may supplement the Contract Drawings with further drawings and instructions in accordance with the Conditions of Contract, as he deems necessary.

B. The Contractor shall prepare all other drawings required for Temporary Works and for fabrication and coordination of trades, all shop drawings and other drawings and documents required under the Contract, in addition to drawings and data for work to be designed by the Contractor. (refer to paragraph 10).

C. The Contractor shall provide and maintain qualified personnel for the coordination, control and development of the detailed construction design of the works. The Contractor is required to develop, where necessary, the Engineer's design intent by providing the detail drawings and data to enable the execution of the works.

D. By submitting design and engineering data, drawings, product data and samples, the Contractor represents that he has determined and verified all aspects of the submittals and that he has checked and coordinated the information contained therein with the requirements of the works and the Contract Documents.

E. Submission and approval of the design and engineering data, drawings, product data and samples shall precede the commencement of any work to which they relate. No portion of the Permanent Works shall be executed other than in accordance with approved submittals.

21. AS BUILT DRAWINGS

The Contractor shall prepare complete "as built" drawings of the Works and submit to the Engineer for approval. Upon approval or incorporation by the Contractor of any modifications requested by the Engineer, one copy and one CD of all "as built" drawings shall be submitted by the Contractor upon completion of the Works.

22. CERTIFICATES BY AN INTERNATIONAL INSPECTION OFFICE

The Contractor shall, as required by the Engineer, submit manufacturers' test certificates for materials and Plant intended to be incorporated in the Works. Such certificates shall, to the extent prescribed by the Engineer, be endorsed for authenticity by a recognized international office employed by the Contractor and approved by the Engineer. All manufacturers' test certificates shall be in the English or French language.

23. TEMPORARY SITE & OFFICE FACILITIES FOR THE ENGINEER AND / OR EMPLOYER

A. All facilities provided for the Engineer's and / or the Employer's staff by the Contractor shall remain available until the end of the Defects Liability Period or until such earlier time as the Engineer may instruct.

B. Representative Site Offices

B.1. Office

The Contractor shall provide for site of the project prefabricated portable or demountable offices for the exclusive use of the Engineers and/or the Employer's staff, comprising:

- 2 offices size of each approximately 3m x 4m
- 1 meeting room for 6 persons.
- 1 secretary's room approximately 2m x 2m
- 1 kitchen approximately 2m x 2m
- 1 toilet
- 1 store

- entrance area with space for desk

The offices are to be of proprietary manufacture, with hard-wearing, easy to clean surfaces and robust and secure fittings. The Contractor shall submit full details to the Engineer's Representatives for approval before delivery to the Site.

B.2. Office Furniture and Equipment

B.2.1. Each office shall contain :

- 1 desk with lockable drawers and chairs
- 1 lockable steel filling cabinets
- 1 plan chest with minimum of five drawers
- 1 waste paper baskets

and, in addition, the following shall be provided for the site :

- 1 secretary's desk and swivel chair
- 4 office chairs
- 2 scientific calculators
- 1 photocopying machine

all consumables for photocopying machine and computer pinboards and shelves

B.2.2. Conference Room Furniture and Equipment

This shall contain:

- 1 conference table
- 6 chairs
- 2 pinboards

B.2.3. Kitchen Furniture and Equipment

This shall include:

- 1 refrigerator 12 cubic foot capacity
- 1 water filter and cooler
- 2 electric boiling rings
- 1 stainless steel sink and drain
- 1 heat resistant work tops
- 1 set of storage cupboards
- 2 dozen set of crockery and cutlery

together with all necessary consumables for making beverages for the duration of the Contract.

B.2.4. Store Room Furniture and Equipment

This shall include :

- shelving units
- drawing hangers and racks.

B.2.5. Toilet Furniture and Equipment

This shall include:

- 1 W-C suite with toilet roll holder
- 1 wash basin with mirror
- 1 towel rail
- 1 soap dispenser

together with all necessary consumables.

B.2.6. 2 Laptops latest models and specifications loaded with a modem and internet connection

B.2.7. Services and Utilities

The Contractor shall provide and maintain the following for the Site Office:

- electric lighting and power
- heating and air conditioning
- water supply
- sanitary system
- drainage system
- fire fighting appliances
- 2 portable cellular phone (including cost of all local calls).
- one dedicated facsimile service (including cost of all transmissions)
- cleaning and rubbish disposal
- general labour attendance including provision of one full time janitor/tea boy
- full time secretary
- security and guards

B.2.8. Vehicles for use by the Engineer and/or Employer

The Contractor shall provide and maintain for the duration of the Contract the following new vehicles with air conditioning for the exclusive use of the Engineer's Representative and his staff and shall supply all fuel and lubricants; repair and maintain the vehicles to keep them in good roadworthy condition at all times; comprehensively insure each vehicle for any driver at all times; and replace with identical vehicle any vehicle removed for repair or for any other reason.

- 1 No. Four Wheel Drive Vehicles (6 cylinders).

A competent driver, employed by the Contractor for attendance during normal working hours. The vehicles are to remain in the possession of the Engineer's Representative and his staff after normal working hours.

24. CLEANING

A. Scope

1- Execute day to day cleaning, during progress of the work, and at completion of the work.

2- If the Contractor fails to clean up during construction or at the completion of the work, the Employer may do so and the cost thereof shall be charged to the Contractor.

B. Disposal requirements

Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.

C. Materials

1- Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

2- Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

D. Execution during construction

1- Execute day to day cleaning to keep the work, the site and adjacent properties free from accumulations of waste material, rubbish and windblown debris, resulting from construction operations.

2- Provide on-site containers for the collection of waste materials, debris and rubbish.

3- Remove waste materials, debris and rubbish from the site on a daily basis and dispose of at legal disposal areas away from the site.

E. Dust control

1- Clean interior spaces to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

2- Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

F. Final cleaning

1- Employ skilled workmen for final cleaning.

2- Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.

3- Wash and shine glazing and mirrors.

4- Polish glossy surfaces to a clear shine.

5- Vacuum clean interior of buildings, including HVAC ducts.

6- Hand dust, clean and polish shelving and cabinets.

7- Wax and polish finish floors.

8- Clean all hardware.

9- Clean all fixtures.

10- Comply with all special cleaning instructions contained in the specifications.

11- Ventilating Systems

i. Clean permanent filters and replace disposable filters if units were operated during construction.

ii. Clean ducts, blowers and coils if units were operated without filters during construction.

12- Remove temporary services, construction equipment, tools and facilities, mock-ups, temporary structures, surplus materials, debris and rubbish from Employer's Property.

13- Put site in neat, orderly condition, ready for use. Leave roof areas, pipe spaces, and other spaces clean and free from debris. Clean to normal "Clean" condition for a first-class building cleaning and maintenance programme.

14- Broom clean exterior paved surfaced; rake clean other surfaces of the grounds.

15- Prior to final completion, or Employer occupancy, conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that the entire work is clean.

25. WARRANTIES AND BONDS

A. Scope

1- This section describes the Contractor's responsibility in respect of warranties, guarantees and bonds.

2- The Contractor shall ensure that he receives from manufacturers and suppliers all available warranties, guarantees and bonds that are normally offered with the product, fully completed and documented to assure the whole of the benefits which they offer.

3- All warranties, guarantees and bonds shall run for the stipulated period commencing at the date of the completion of the Contract.

4- Warranties for all mechanical, electrical, waterproofing and other works shall be as called for in the Conditions of Contract.

26. PROTECTION AND MAKING GOOD

A. Scope

1- The Contractor shall protect all completed Works from damage until the completion of the Works to the approval of the Engineer.

2- Should the Contractor allow any Works to be damaged he shall at his expense make good or replace, as required by the Engineer, to the approval of the Engineer.

3- Completed floors shall be secured and protected and uncontrolled access shall be prohibited.

27. MEASUREMENT AND PAYMENT

A. Unless otherwise measured separately in the Bill of Quantities, no separate payment shall be made for any of the requirements specified in this section and all costs and expenses in respect of such requirements shall be deemed to be included in the Contractor's rates and prices for other work measured in the Bill of Quantities.

28. BILL OF QUANTITIES

The Works shall be measured and paid for only against the Pay Items prescribed in the Bill of Quantities. Any work required to be performed or executed by the Contractor in accordance with the Contract Documents, but for which no specific Pay Item is designated in the Bill of Quantities, shall be performed or executed by the Contractor and the price thereof shall be deemed to be included in the Contract Price and the rates and prices inserted by the Contractor against other Pay Items in the Bill of Quantities.

Chapter 2
TECHNICAL SPECIFICATIONS

For drilling, in place testing, sampling
Coring and laboratory testing of samples.

PART I : SCOPE OF WORKS

The work consists of a soil geotechnical survey of the of the Akkar – "One Day Surgery" Governmental Hospital located in Sahleh, in order to make accurate recommendations for the calculations, and the construction of the foundations of the buildings to be erected in this area as shown in the attached Master plan

1. General

1.1 The Work consists of drilling, in place testing, sampling, coring and laboratory testing of soil and conglomerate or rock samples for the works of the Project.

The testings shall be performed according to ASTM and BS Standards.

2. Extend of Work

2.1 The Work to be carried out in the field comprises the following:

I. Drilling at points shown on the attached master plan, to depths of 15 meters.

2.2 The drilling operations will consist of the following:

I. The provision of all necessary equipment, technicians and labour for boring, driving of casing, standard penetration testing, sampling in soil and eventually coring in conglomerates or rock.
II. Boring in unconsolidated formation at all boring locations, with or without driving of casing as required by the soil conditions, by means of power augers or rotary drilling equipment.
III. Performing standard penetration tests in all non-cohesive soil formations, and very soft cohesive soils, at 1.5 meter intervals in depth, and at all changes of strata and obtaining representative but disturbed samples of the soils thus tested.
IV. Coring in conglomerates and in rock and obtaining continuous samples of same.
V. The preparation of complete borings logs for each drilling location, indicating the method of drilling, the type and thickness of all strata

penetrated, the depth of all in-place testing and sampling, the position of the ground water table, the cavities, and all other pertinent information.

VI. The proper packing, labeling and delivery of all samples to the testing laboratory.

3. Site supervision

3.1 The work will be supervised by the Engineer's Representative from whom the contractor's site Representative or Foreman shall take instructions concerning the boring sampling, in-situ testing, coring, protecting, handling and libeling of samples, and all aspects of the work generally.

3.2 The contractor shall arrange for the whole of the work to be under the control of a full-time experienced foreman trained in this type of work, and competent to supervise the operation of sinking the bore-holes, carrying out in-situ tests, taking sealing and packing samples, and preparing proper and informative boring out instruction given to him by the Engineer's Representative.

4. Boring equipment and methods.

4.1 Bore-holes shall be located in the field as indicated on the drawings and as directed by the Engineer's Representative. The contractor shall be responsible of fixing the boring locations on the ground, determining their surface elevations with respect to benchmarks designated by the Engineer's Representative, and preserving their locations until the completion of the drilling operations.

4.2 Bore-holes in all loose materials shall be lined unless otherwise directed, and the diameter of the casing shall be such as enable undisturbed tube samples of up to 76mm.

4.3 At all times during the sinking of the bore-holes, the Contractor's Forman shall note the description, the strength and the structural characteristics of the soils or rocks encountered, and shall set the soils from each boring in wooden boxes with partitions properly labeled in the order in which they were recovered, so that they may be inspected by the Engineer's Representative.

5. Standard penetration testing.

5.1 At each bore-hole the Contractor shall carry out standard penetration tests in all non-cohesive formations at intervals of 1.5 meters in depth throughout the thickness of such strata.

5.2 Standard penetration tests shall also be carried out in a cohesive stratum which proves to be too soft for an undisturbed sample to be covered.

6. Sampling.

6.1 The utmost care shall be taken to ensure that samples are truly representative. Should any sample be rejected by the Engineer's Representative for any reason connected with the boring or sampling technique or equipment used, the Contractor shall take an additional sample at his own cost.

6.2 All samples shall be carefully handled, labeled, packed and sent to the laboratory immediately completion of each boring.

6.3 A representative but disturbed sample shall be taken at each depth at which a standard penetration test performed and shall be preserved in a properly labeled and sealed sample jar.

7. Coring

7.1 Continuous cores shall be obtained in all conglomerates or rock strata by means of single tube or double tube core barrels with diamond or carbide tips as required and as approved by the Engineer’s Representative. The diameter of the cores shall be at least 50 mm.

7.2 A record shall be kept of the time-rate of coring, and the percentage of core recovery shall be observed and noted.

7.3 The cores shall be preserved in properly labeled wooden boxes in the order of their extraction, and sent to the laboratory for testing.

PART II : LABORATORY TESTS & REPORT

1. General

1.1 All laboratory tests shall be carried out in a fully equipped soils and materials testing laboratory approved by the Engineer.

1.2 On completion of each bore-hole, the Contractor shall prepare the necessary type of tests to be carried out on each sample and core.

2. Type of tests

2.1 The laboratory shall be equipped with all necessary apparatus to carry out the following tests under qualified supervision:

- Sieve and hydrometer analyses (including natural moisture content)
- Liquid and plastic limits and plasticity index
- Unconfined compression (uniaxial compressive strength for rock).
- Dry and bulk densities of cemented and cohesive soil.
- PH value
- Sulfate and chloride content.

3. Report

3.1 The Contractor shall accompany the boring logs and laboratory test results by a comprehensive technical report including conclusions and recommendations of the type of foundation which is most adopted to the soil qualities resulting from the site investigations. This report shall include the following data :

- General view of geographic and type of soil forming the site.
- Soil bearing capacity which will be adopted under each block shown on master plan with the method calculation, for static and dynamic loads.
- Recommended lateral earth pressure coefficients.
- Excavation type, slopes for temporary excavation and protective measures.
- Evaluation of the excavated materials (possibility of re-using excavated materials)
- Give official informations concerning the climatic conditions (temperature, wind).
- Type of soil for the earthquake spectrum definition according to ASCE-7-05.
- Unit weight of soil
- Moisture content
- Angle of friction
- Cohesion
- Modules of elasticity
- Poisson ratio
- Modulus of subgrade reaction
- Study of soil settlement and differential settlement.
- Water table
- Cavities presence.

The report shall be prepared by a highly qualified specialist agreed by the Engineer.

The Contractor shall handle to the Owner 2 copies of this report.

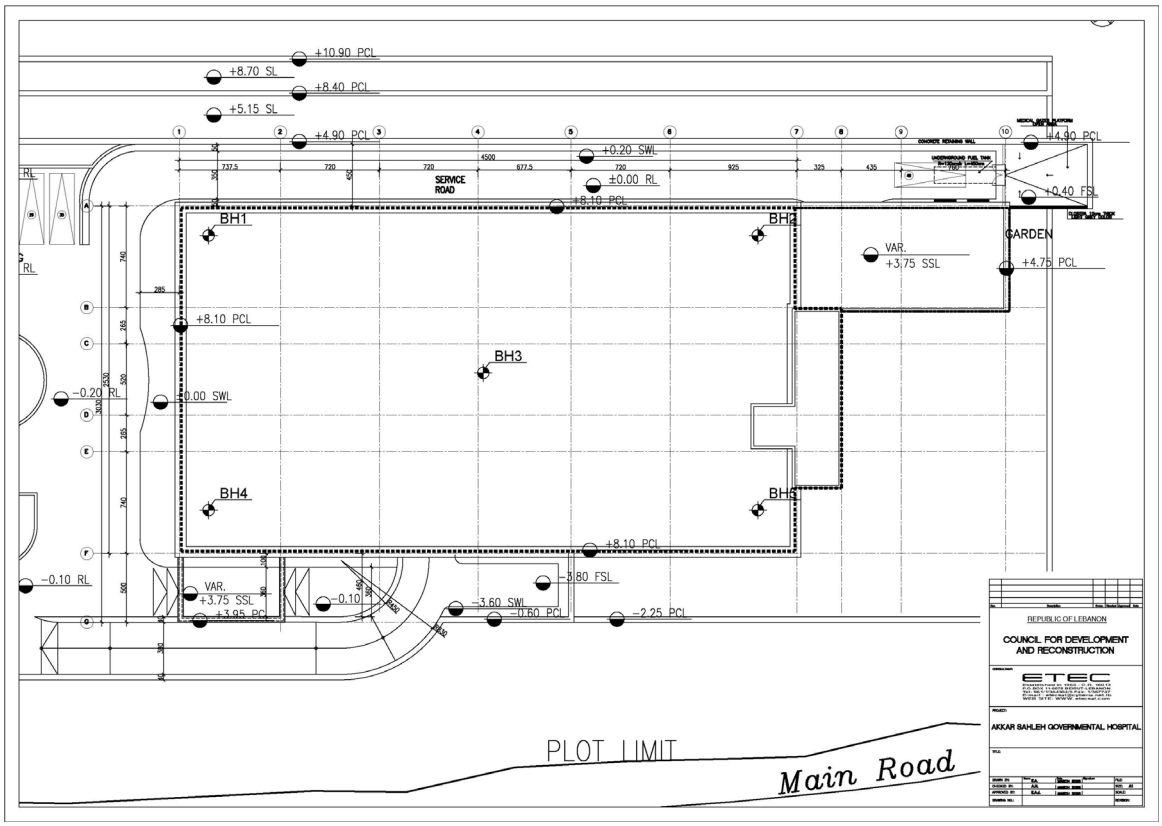
Chapter 3

BILL OF QUANTITIES
&
UNIT COSTS SCHEDULES

Chapter 3

BILL OF QUANTITIES
&
UNIT COSTS SCHEDULES

Item	Description	Unit	Quantity	Unit Rate USD	Total Cost USD
A.	Mobilization / demobilization of a truck- mounted drill rig.	Lump sum	1		
B.	Drilling 5 boreholes to depth (15m) as shown on the attached drawing each below surface, with SPT in cohesionless soils and continuous coring in consolidated material (marl, rock ...)	lm	5 × 15		
C.	In-situ pressure meter tests to determine strength and deformation characteristics.				
D.	Supply and installation of a standpipe piezometer				
E.	Laboratory Tests				
	- Determination of water content	U			
	- Sieve analysis	U			
	- Atterberg Limits	U			
	- Unconfined compressive strength including bulk density and determination of Young's elastic tangent modulus.	U			
	- Consolidation test on cohesive samples	U			
	- Unconsolidated Undrained Triaxial test (UU-set of three) on cohesive samples	U			
	- Direct Shear Test on cohesionless soils	U			
	- Chemical tests on soil samples for : (Chloride, Sulphates, Carbonates and pH).	U			
F.	Analysis with reporting and recommendations	Lump Sum			
	Total				


+10.90 PCL
+8.70 SL
+8.40 PCL
+5.15 SL
+4.90 PCL
+0.20 SWL
±0.00 RL
+8.10 PCL
+4.90 PCL
+0.40 FSL
SERVICE ROAD
BH1
BH2
BH3
BH4
BH5
VAR.
+3.75 SSL
GARDEN
+4.75 PCL
+8.10 PCL
-0.20 RL
0.00 SWL
-0.10 RL
VAR.
+3.75 SSL
+3.95 PCL
-0.10
-3.60 SWL
-17.60 PCL
-3.80 FSL
-2.25 PCL
+8.10 PCL
PLOT LIMIT
Main Road
REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION
AKKAR SAHLEH GOVERNMENTAL HOSPITAL

DIVISION 2

SITE WORK

DIVISION 2

SCOPE OF WORK

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2.	DESCRIPTION OF THE WORKS	S-2-1 36/206

SITE WORK

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02500	ASPHALITIC CONCRETE PAVING	S-2-1 43/206

SCOPE OF WORK

1. THE WORK

The purpose of the project is Akkar – one day surgery Governmental Hospital.- Sahleh.

2. DESCRIPTION OF THE WORKS

The extent of the works pertaining to the Construction of Akkar – one day surgery Governmental Hospital.- Sahleh project include the following main elements:

- Excavation and earthwork
- Concrete work
- Architectural work
- All associated electrical and mechanical work

Division 2

SITE WORK

EXCAVATION & EARTHWORK (02200)

A. Scope

These works shall consist of all excavation in any material for basement, retaining walls of all types, and for other major or minor structures; and including all necessary clearing and grubbing; bailing; drainage, pumping, sheeting; temporary shoring and cribbing; construction of temporary cofferdams or cribs; and disposal of all excavated material and backfilling with suitable approved material; all as and were shown on the Drawings.

1. These works shall also include the removal of those portions of existing structures below ground which would in any way obstruct or interfere with construction of new structures
2. The Contractor will be deemed to have satisfied himself, at the time of tendering, as to the type and nature of soils and rock that will be encountered in structural excavations.

B. Performance and Standards

1. All materials and workmanship shall comply with the latest edition of relevant British Standards and with the Specification. In particular the recommendations of BS 6031 shall be complied with.

2. Relevant Standards
   Testing of Soils : in accordance with BS 1377.
   Earthworks : in accordance with BS 6031.

C. Related Items

Regulatory Requirements	01060
Cast-In-Place Concrete	03300

D. Submittals

1. The Contractor shall, before commencing any excavation, survey and level the whole of the site, and shall prepare plans and sections accordingly. The plans and sections shall, when finally and mutually agreed, be signed by both the Engineer and the Contractor as truly representing the configurations of the site in question before the commencement of excavation

   Items included are :
   - Details of plant and equipment
   - Proposed sequence of works
   - Proposals for ensuring stability of excavations
   - Proposals for maintaining excavation free of standing water.
   - Plans and sections of type and method proposed for piling to be approved by the Engineer

2. Temporary support system

   a. When a temporary support system is required to protect the existing building, adjacent property or to protect the public during construction, the Contractor's design for such support system shall be submitted for approval prior to commencing its construction.

   b. All temporary systems shall be designed with adequate factors of safety to serve with minimal maintenance, for the duration of its intended use, and shall include adequate safety provisions to protect the public from construction activities.

   c. Notwithstanding any approval of temporary support systems, the Contractor shall be solely responsible for the adequacy of their design and construction and for maintenance and all necessary safety precautions associated therewith.

E. Product Handling

1. Disposal of excavated material

   The Contractor shall remove soil from excavation and shall place it at a dumping point designated (or approved) by the Engineer which may be in embankments in temporary heaps or in permanent soil tips, according to the quality of the material, the need of it for filling and other circumstances, as directed by the Engineer.

2. Explosives :

   The use of explosives is forbidden.

F. Materials

1. Definition and classification of earthworks materials

   – The Engineer will determine the classification of excavation and earthworks materials in accordance with the definitions hereinafter.

   – "Suitable material" shall comprise all material which in the opinion of the Engineer is acceptable for use in the Works.

   – "Unsuitable Material" shall mean other than suitable material and shall not be accepted for use in the works.

   – "Rock" shall mean any hard natural or artificial material requiring the use of blasting or other special machines or tools for its removal, but excluding individual masses less than $0.1m^3$ in trenches and $0.2m^3$ in general excavation.

G. Workmanship

1. Site and Sub-soil Conditions

   The Contractor shall be fully responsible for ascertaining all site and sub-soil conditions affecting the excavations and earthworks. These shall include but not be limited to information concerning the nature of the ground and periods of rainfall.

The Contractor shall satisfy himself that the existing ground levels as indicated on the drawings are correct and shall bring to the attention of the Engineer any levels considered to be in error before disturbing the affected ground.

2. Methods

    1. The methods adopted for the excavation and earthworks shall be determined by the Contractor.
    2. The Contractor shall carry out the work in whatever material may be encountered and shall use such methods and provide and operate such plant and equipment as may be necessary to deal with every class of material.
    3. The use of explosives is forbidden.
    4. The Contractor shall notify the Engineer a sufficient time in advance of the beginning of any excavation so that the Engineer may, where necessary, survey and record the cross sectional elevations and measurements of the existing ground and existing structures affected by the proposed structure. Any materials removed or excavated before these measurements have been taken and approved by the Engineer will not be paid for.
    5. All excavation in whatever material may be met, for reducing level shall be carried out to the lines and levels shown on the drawings or to such lines and levels as ordered by the Engineer.
    6. Where excavation to rock foundation is required, the excavation shall proceed in such a manner as to allow the solid rock to be exposed and prepared in horizontal beds or properly serrated for receiving the concrete. All loose and disintegrated rock and thin strata shall be removed.
    7. When unstable material or other unsuitable material is encountered below foundation elevation, the Contractor shall excavate such material and replace it with suitable backfill material or concrete as directed by the Engineer.
    8. The foundation shall be excavated in accordance with the dimensions as shown on the drawings and shall be of sufficient size to permit the placing width and lengths of the footings.
    9. If temporary works are required for maintaining the excavation dry, the Contractor shall be responsible for the design and execution of the Works. The proposed design shall be submitted to the Engineer for approval, however, such approval does not relieve the Contractor of his sole responsibility in this regard.
    10. The Contractor must notify the Engineer of any sign of failure or cracks within or around the excavation immediately when such signs are noticed.

3. Dimensions

    1. The excavation shall be carried to the elevations shown on the Drawings or as established by the Engineer. Borings and soil tests made during design and actual investigation of the completed foundation excavations shall be utilised by the Engineer to determine final depth. No concrete shall be placed prior to approval of the excavation pit.

2. In the event of excavations being made larger than the sizes shown on the drawings or as instructed by the Consultant, the Contractor shall fill in the excavated void to the correct profile using material as specified hereinafter or as directed by the Engineer.

3. Foundation pits or trenches shall be sufficient size and provide minimum sufficient working space to permit construction of structures or structure footings of the full width and length shown on the Drawings.

4. Where footings are to be constructed using formwork, the excavations shall generally not extend more than 500 mm beyond the maximum dimension on each side of the proposed footing unless additional working space is clearly required and approved by the Engineer. Any unauthorised over-width of excavation beyond the lateral limits shown on the drawings or approved by the Engineer shall be backfilled with selected fill or lean concrete as directed by the Engineer.

5. Where footings are to be located, in or adjacent to firm, original ground and where formwork is not required or ordered, any unauthorised over-depth excavation below the approved elevation of base of footing shall be backfilled with blinding concrete.

4. Protection of Personnel etc …

1. The Contractor shall take such precautions as are necessary to ensure the protection of personnel on or adjacent to the site and the maintenance and protection of any adjacent property, structures or roads.

2. In areas where the excavation is adjacent to public roads and walkways, the Contractor shall erect all necessary barricades, barriers, enclosed walkways, and warning signs necessary to restrict the exposure of the public to the excavation.

3. The Contractor shall take all necessary precautions, including shoring or otherwise, to protect employees in the excavation and on the ground above. The Engineer will not enter excavated areas to approve the foundation and further Works until he deems the areas to be safe.

4. The Contractor shall take all necessary precautions specially for shoring existing concrete works (footings, columns , walls, tie beams, etc,…) and shall be responsible for the safety of this works, approval of the Contractor's support system shall not relief the contractor from his responsibility in this regard.

5. The Contractor shall be solely responsible for the safety at all times of all foundation and trench whether supported or otherwise. Approval of the Contractor's support system or omission of a support system for any excavations shall not relief the Contractor from his sole responsibility in this regard.

5. Stability

The Contractor shall ensure the stability of all excavations and Earthworks by the provision of suitable side slopes, shoring or such other means as may be necessary. Should any slips, falls or settlement occur they shall be made good by the Contractor using methods and materials approved by the Engineer.

Where shoring is used for the sides of excavations, it shall be removed as work proceeds except where instructed otherwise by the Engineer.

Before commencing any excavation or earthwork the Contractor shall if requested submit his proposals for ensuring its stability and obtain the Engineer's approval.

6. Maintaining excavation and earthworks free from water.

   The Contractor shall arrange the rapid disposal of water shed onto or entering the excavations or earthworks from any source at any time during the construction.

   In pumping out excavations the Contractor shall ensure the stability of all structures, excavations and earthworks.

7. Excavation of cuttings

   The sloping sides of cuttings shall be cleared of all rock fragments which move when prised with a crow-bar.

   Where in the slopes of cuttings layers of rock and soft material alternate and the Engineer considers that the slope, immediately after dressing, will not permanently withstand the effects of weather, the Contractor shall excavate any insecure material to an approved depth and build up the resulting spaces with concrete or masonry using rock similar to the adjoining natural rock so as to ensure solid face.

8. Backfilling and compacting

   1. The Contractor shall obtain approval for his proposed method and rate of placing of backfill, before backfilling commences.
   2. Backfill materials shall be uniformly graded granular material, capable of being compacted to required compaction, and having adequate permeability to permit free drainage through it. Backfill material shall also conform to the following:
      - Minimum D10 value 1 mm
      - Maximum Plasticity Index 10%
   3. In case excavated material is not sufficient to backfill or shall prove unsuitable, filling material shall be imported to the site from a source approved by the Engineer, at the Contractor's expenses.
   4. Backfill material shall not be placed against any structure until approval is given. Unless otherwise shown on the Drawings Structures shall be backfilled to the same requirements as specified for the same embankment.
   5. Backfill shall be placed in level layers for the full width of the excavated area until the elevation of the original ground or surrounding embankment is reached. Backfill next to walls or in other confined areas, shall be compacted by approved hand or portable equipment.
   6. Each successive layer of backfill shall contain only sufficient material to ensure proper compaction and in no case shall be greater than 250 mm thickness (before compaction). The moisture content of the backfill shall be uniform and within the moisture range designated.
   7. Additional water to be added during placement of backfill material to achieve required compaction shall be fresh water or brackish water approved by the Engineer.

8. Minimum tests required during backfilling operations to verify material are:
   - One Proctor test
   - One Gradation of materials and at change of material or its source
   - One Plasticity Index and field density for all compacted layers.

9. Structures shall not be subject to the pressures of backfilling or to live loads until the 28-day strength of the concrete has been reached, unless a shorter period is approved in special circumstances where the load is sufficiently small as not to constitute a risk of any damage to the structure in the opinion of the Engineer. If approved this period may be extended if subnormal curing conditions exist.

10. Backfill under ground slabs, paving, etc. … shall be free from organic and other unsatisfactory material such as rocks exceeding 70mm. The Backfill shall be thoroughly compacted by wetting the material to the optimum moisture content and rolling with a vibratory roller to the satisfaction of the Engineer.
    Westergaard tests on final layer of backfill, are to be carried out
    and result should be not less than 30 Mpa/m.

11. Backfill around retaining walls shall be completed to the level as shown on the Drawings or as directed by the Engineer.
    Care shall be exercised to prevent forward movement of the wall.

ASPHALTIC CONCRETE PAVING (02500)

A. Scope

This section covers asphaltic concrete paving as shown on the drawings and as specified by the Engineer.

B. Performance and Standards

All materials shall be to the satisfaction of the Engineer.

C. Materials

Asphalt work shall be as follows:

Fine aggregate sub-base course (max. 4mm) thickness as shown on drawing.

Prime coat medium curing not liquid asphalt - (1.0-1.5 kg/m^2).

Tack coat asphalt emulsion - (0.2-0.6 kg/m^2).

Asphalt aggregate (80mm thick) minimum as shown on drawings.

D. Workmanship

Proof roll the fine aggregate and do all necessary rolling and compacting where needed to obtain firm, even subgrade surface. Proof roll subgrade to seek out any soft or pumping soil by making at least four (4) perpendicular passes with a static compactor weighting at least 9.1 metric tons. Fill and consolidated depressed areas. Remove incompatible material, replace with new fill and compact.

Verify frames for manholes, drain inlets and other such units within areas to be paved, are at their proper elevation. Adjust frames as required to match paving. Provide temporary closures over openings until completion of rolling operations. Remove closures at completion of the work. Set covers to grade, flush with the surface of adjoining pavement surface.

Install fine aggregate where needed or as directed by the Engineer in a single lift of the thickness indicated on drawing.

Roll from edge of surface gradually proceeding toward center, with a static compactor weighting at least 9.1 metric tons.

Compact to maximum dry density until a uniform, firm, sound surface has been established complying with the lines, grades, elevations and cross-sections required. Moisture may be added to aggregate materials to provide workability and aid compaction.

Undercut and remove all unsuitable materials and replace fine aggregate areas into which mud has been "pumped" with new aggregate to the full depth and in accordance with applicable Specifications, prior to placing overlying materials.

Fine aggregate may be used as wearing surfaces during the construction period. If so used remove and replace damaged portions and clean entire surface to the satisfaction of the Engineer prior to placing overlying materials.

Apply prime coats to cleaned contact surfaces of Portland Cement concrete item such as curbs, edges of pavement, gutters, manholes, drains and other structures in thin uniform coatings prior to placing asphaltic concrete materials against these items.

Allow prime coats to dry and cure as required.

Place in one lift and compact to maximum dry density until a uniformly-smooth, hard surface has been established, complying with the lines, grades, elevations, and cross sections required.

Place, spread, and strike off the asphalt mixture on a properly prepared and conditioned surface. Inaccessible and small areas may be placed by hand. Place in one lift and compact to maximum dry density until a uniformly smooth, hard surface has been established, complying with the lines, grades, elevations, and cross sections required.

Place materials in strips not less than 3m wide where practical. After the first strip has been placed and rolled, place all succeeding strips an extend rolling to overlap previous strips. complete base for a section before placing surface course materials.

Carefully make joints between old and new pavements, and between successive day's work, to ensure a continuous bond between adjoining work. construct joints to have the same texture, density and smoothness as other sections of the asphalt course.

Begin rolling operations when the asphalt concrete mixture will bear the weight of the roller without excessive displacement. compact areas inaccessible to rollers with vibrating plate compactors.

Perform breakdown, second and finish rolling until the asphalt concrete mixture has been compacted to the required surface density and smoothness. Continue rolling until all roller marks are eliminated. Provide a smooth compacted surface true to thickness and elevations required.

After final rolling, do not permit vehicular traffic on the pavement until it has cooled and hardened, and in no case sooner than 8 hours.

Protect newly placed material from traffic by barricades or other suitable methods.

E. Lane Markings

Provide indicated painted lines and marking 100mm wide for asphaltic concrete paving and other paving works placed under this contract. Include where indicated:

1. Parking spaces
2. Arrows and car numbers
3. Other markings if indicated.

DIVISION 3

CONCRETE WORK

DIVISION 3

CONCRETE WORK

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Division 3

CONCRETE WORK

BASIC CONCRETE MATERIALS AND METHODS (03050)

A. Scope

This section specifies Concrete mixes for all Concrete Work shown on the drawings.

The works of this division shall be executed in accordance with the Conditions of Contract, the Specifications, the General Requirements, the Drawings and the Bills of quantities.

B. Performance and Standards

All materials shall conform to relevant British Standards, whether referred to in this section or not, and shall be to the complete satisfaction of the Engineer.

C. Related Items

Concrete Forms and accessories	03100
Concrete Reinforcement	03200
Cast-in-place Concrete	03300
Masonry Mortar	04100

The design bearing capacity of the soil is considered 1.75 kg/cm², refer to structural drawings. The Contractor must verify that the excavation levels shown on the drawing will verify this assumption.

D. Submittals

The Contractor shall follow the requirements in section 03300 Clause D regarding preparation of trial mixes, testing, and other submittals.

E. Product Handling

Storage and handling of materials shall be in accordance with the requirements of section 03300 Clause E.

F. Materials

Concrete mixes and materials shall be in accordance with the requirements below, and shall conform with the relevant items specified in section 03300 Cast-in-place Concrete.

CONCRETE FORMS AND ACCESSORIES (03100)

A. Scope

1. This section specifies formwork for all Concrete Work indicated as in-situ Concrete on the drawings.
2. Items included are design and construction of formwork, stability, surface finish achieved, cleaning, cast-in fixings and striking times.

B. Performance and Standards

1. Formwork shall be constructed to maintain the correct positions, shape, profile and surface finish of the Concrete in accordance with the following standards and this Specifications.
2. Formwork shall satisfy the requirements and comply with the recommendations of BS8110: Part 1 and BS 5606 except where lack of fit is critical and/or where specified tolerances are shown on the drawings.

C. Related Items

Cast-in-Place Concrete 03300.

D. Submittals

1. The Contractor shall carry out tests on concrete cubes to determine when formwork may be struck in accordance with G7.
2. The Contractor shall prepare trial panels for formwork, when required by the Engineer in accordance with G8.
3. Electrical, mechanical and plumbing reservation, coordination drawings before concreting.

E. Product Handling

The formwork shall be so handled and erected that the concrete shall not suffer due to defects or damage to the formwork.

F. Materials

1. Ordinary Formwork
   This shall be obtained by the use of properly designed formwork or moulds of closely jointed sawn boards. The surface shall be free from voids, honey combing or other large blemishes.
2. Fairface Formwork
   This finish shall be obtained by the use of properly designed forms of closely jointed plywood boards with tie rods chamfer, grooves as detailed on the drawings. Alternatively, steel or other suitable materials maybe used for the forms. The surface shall be free from voids, honeycombing or other large blemishes. The surface shall then be improved by carefully removing all fins and other projections, thoroughly washing down.

3. Chamfers and grooves
The chamfers and grooves shall be obtained by wrought hardwood fillet of size and location indicated on the drawings.

4. Form ties
The ties for securing forms for fairface plywood works shall be tie screws with removable plastic cones and removable bolts. When forms are removed, no metal shall be closer than 40mm from the concrete surface.

5. Form coating
Form coating shall be of a type which does not import any stain to concrete nor interface with the adhesive of any finish, sealant, waterproofing material applied to any concrete surface and which has been approved by the Engineer.

G. Workmanship

1. Design and Construction
The design and construction of formwork shall be carried out by competent persons, taking due account of the surface finish required.
The formwork shall be sufficiently rigid and tight to prevent loss of grout or mortar from the concrete at all stages and for the appropriate method of placing and compacting.
Formwork (including supports) shall be sufficiently rigid to maintain the forms in their correct position, shape and profile within the limits of the dimensional tolerances specified in Table 293 of BS 5606. The supports shall be designed to withstand the worst combination of self-weight, formwork weight, formwork forces, reinforcement weight, wet concrete weight, construction and wind loads, together with all incidental dynamic effects caused by placing, vibrating and compacting the concrete.
The Contractor shall make allowance for any settlement or deflection of formwork that is likely to arise during construction, so that the hardened concrete conforms accurately to the specified line and level.
The formwork shall be so arranged as to be readily dismantled and removable from the cast concrete without shock, disturbance or damage. Where necessary, the formwork shall be so arranged that the soffit form, properly supported on props only, can be retained in position for such period as may be required by maturing Conditions or Specification.

2. Form lining
The type and treatment of any lining (plywood, metal, plastics etc.) to the forms shall be appropriate to the concrete finish required.

3. Cleaning and Treatment of Forms
All rubbish shall be removed from the interior of the forms in contact with the concrete. Forms shall be clean and treated with a suitable release agent, where applicable .

4. Projecting Reinforcement, Fixing Devices
Where holes are needed in forms to accommodate projecting reinforcement or fixing devices, care shall be taken to prevent loss of grout when concreting or damage when demoulding.

5. Cast-In Fixings
Allowance shall be made to accommodate cast-in fixings as shown on the drawings or where directed by the Engineer.

6. Release Agents

Release agents for formwork shall be to the approval of the Engineer. Only one agent shall be used throughout the entire area. Release contact with reinforcement shall be avoided.

7. Striking of Formwork

a. General

The removal shall be done in such a manner as not to damage the concrete, and shall take place at times to suit the requirements for its curing and to prevent restraint that may arise from elastic shortening, shrinkage or creep.

b. Striking Period

The minimum periods before striking formwork, shall be as follows :

	Ordinary Portland Cement Concrete
– Sides of columns, walls and beams	2 days
– Soffits of slabs	10 days
– Soffits of beams	14 days
– Props to beams	21 days
– Props to slabs	15 days

8. Trials panels for formwork

When required by the Engineer the Contractor shall prepare, prior to concreting, a sample panel of size and surface texture to be agreed by the Engineer. The panel shall contain reinforcement fixed to represent the most congested part of the work. The panel shall be filled with the proposed concrete mix compacted by the method to be used in the work. As soon as practicable after compaction, the side forms shall be removed to enable the Engineer to check the surface finish and compaction achieved.

9. Forms

Where forms are used, the Contractor shall take all necessary measures to ensure that concrete does not suffer damage from excessive thermal movement in forms exposed to the sun.

10. Spraying

All surfaces of formwork which will be in contact with concrete, and all reinforcement, shall be damped with a fine spray of water immediately prior to concreting.

11. Tolerances

The surfaces and limits of all concrete members after the formwork has been struck shall not vary from the dimensions shown on the detailed drawings by more than the tolerance given below, unless shown otherwise.

Special care must be given to obtain accurate cross-section and thickness where members abut in the same plane.

The Engineer may order the Contractor to cut back, make good or cut out at his own expense in situ concrete which does not conform to the above tolerances.

To avoid undue delay and expense, the dimensions of all members shall be checked on removing the formwork and the Engineer informed immediately or any discrepancies.

- Variation for plumb :
  - In the lines and surfaces of columns, walls and in arrises :
    In any 3m of length : 5 mm
    For exposed corner columns, control-joint grooves and other conspicuous lines :
    In any 6m of length : 5 mm

- Variation from the level or from the grades specified in the Contract Documents :
  - In exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines :
    In any bay or in 6m of length : 5 mm
    Maximum for the entire length : 10 mm

- Variation of the linear building lines from established position in plan and related position of columns and partitions :
  In any bay : 10 mm
  In any 6m of length : 10 mm
  Maximum for the entire length : 20 mm

- Variation of the sizes and location of sleeves, floor openings : 5 mm

- Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls :
  Minus (-) : 6 mm
  Plus (+) : 10 mm

CONCRETE REINFORCEMENT (03200)

A. Scope

These works shall consist of the supply and fixing of the unstressed steel bars, wires, mesh and mats for the reinforcement of concrete in accordance with the Drawings and Specification.

B. Performance and standards

Steel reinforcement shall comply with the requirements of whichever of the following standard specifications is applicable :

BS 4449	Hot rolled steel bars (mild steel)
BS 4461	Cold worked deformed steel bars (high yield steel)
BS 4483	Steel Fabric
BS 4466	Bending dimensions and scheduling of bars for the reinforcement of concrete.
BS 4482	Welded steel wire fabric

C. Related items

Cast-in-Place Concrete 03300.

D. Submittals

1. Certification and identification

a. Three copies of a mil test report shall be supplied to the Engineer for each lot of billet steel reinforcement supplied for use on the project. The mill test report shall be sworn to by a person having legal authority to bind the manufacturer and shall show the following information :
   - The process or processes used in the manufacture of the steel from which the bars were rolled.
   - Identification of each heat of open-hearth, basic oxygen, or electric furnace and/or each lot of acid bessemer steel from which the bars were rolled.

b. The bars in each lot shall be legibly tagged by the manufacturer and/or fabricator before being offered for inspection. The tag shall show the manufacturer's test number and lot number or other designation that will identify the material with the certificate issued for that lot of steel.

2. Inspection and sampling
The sampling and testing of reinforcement bars may be made at the source of supply when the quantity to be shipped or other conditions warrant such procedure. Bars not inspected and sampled before shipment will be inspected and sampled after arrival at the site.

E. Product handling

1. Storage

a. Reinforcement shall be stored clear of the ground on platforms, skids or other supports and be protected against contamination by dirt, grease, oil etc. at all times. If directed by the Engineer, the Contractor shall provide cover to the reinforcement

b. Reinforcement of different grades and different diameters shall be stored separately and marked to facilitate inspection and checking.

c. Reinforcing steel shall be protected at all times from damage. All reinforcement shall be from detrimental dirt, loose mill scale, scaly rust, paint, grease, oil or other foreign substance. There shall be no evidence of pitting or visual flaw in the test specimen or on the sheared ends of the bars.

d. Rust shall be removed by wire brushing or, if directed by the Engineer, by sand blasting. Light rust without visible sign of peeling need not to be removed.

F. Materials

1. Reinforcement
Hot rolled mild steel bars and hot rolled high yield bars shall comply with the requirements of BS 4449 and shall have minimum yielding strength of 2400kg/cm^2 for mild steel or grade 40 steel, and of 4200kg/cm^2 for high yield bars type 2 deformation of complying with ASTM A615 grade 60 steel. Brittle reinforcement shall not be used on site.
Any deviation in the above strength of reinforcement shall not accepted.

2. Bar supports
Spacer blocks with cast in tie wire may be used with the agreement of the Engineer for support of the bottom layer of reinforcement in slab on ground, foundation, ribs and beams with surface finish, only. The blocks shall be of minimum size and made from cement, sand and small aggregate mix.

3. Tie wire
Tie wire shall be annealed iron wire not less than No 16 gauge.

G. Workmanship

1. Cutting and bending

a. Cutting and bending of reinforcement shall be based on an approved bar bending schedule.

b. Reinforcement shall be cut in specialist cutting machines or cold cut by hand only. Cutting with oxyacetylene torch is strictly forbidden.

c. Bars shall be bent to the following bend diameters :

Bar Diameter, d.	Mild Steel	High Yield Steel
Up to 25 mm	3 d	5 d

d. All reinforcement shall be bent at the temperature range of 5 degrees C and 100 degrees C. Bending by heating, if approved by the Engineer, shall be carried out in such a manner to impair the physical and mechanical characteristics of the bar.

e. The straight bar length for a hook of 180 degrees shall be not less than 12 times the bar diameter or 60 mm whichever is the larger.

f. The straight bar length of a hook of 90 degrees shall be not less than 12 times the bar diameter.

g. The straight bar length after hook in stirrups shall be 6 times the bar diameter or 60 mm whichever is the larger.

h. Cold worked bars and hot rolled high yield bars shall not be re-bent or straightened once having been bent. Where it is necessary to bend mild steel

bars projecting from the concrete, the bend diameter shall comply the requirements of item c above.

j. If bending of the bar in accordance with this specification causes the bar to crack, the bar shall be rejected, irrespective of any prior approval that may have been given, and removed from the Site.

k. Bars shall be cut and bent to the following tolerances :

Bar length (mm)	Tolerance
Up to 1000	5
1000 - 2000	+5, -10
Above 2000	+5, -25

l. No adjustment to bar length after bending will be permitted.

2. Fixing

a. Reinforcement shall be placed and maintained in the position shown on the Drawings. Unless agreed otherwise by the Engineer, all bar intersections shall be securely tied together with the ends of the wire turned into the main body of the concrete. 1.2 mm diameter stainless steel wire shall be used for in situ members having exposed soffits. 1.6 mm diameter soft annealed iron wire shall be used elsewhere.

b. The correct cover to reinforcement on all exposed faces of concrete shall be maintained by using approved proprietary spacers. Where instructed by the Engineer the adequacy of such spacers shall be demonstrated by site trials.

c. Concrete cover blocks, where permitted by the Engineer, shall be approved dimensions and designed so that they will not overturn when the concrete is placed. They shall be made with 10 mm maximum size aggregate and the mix proportion shall be such as to produce the same strength as the adjacent concrete. Tying wire shall be cast in the blocks for subsequent tying to the reinforcement.

d. Wherever it is necessary for the Contractor to splice reinforcement at positions other than those shown on the Drawings, the approval of the Engineer shall be sought and obtained before the reinforcement is placed. Splices shall be staggered where possible and shall be designed to develop the strength of the bar without exceeding the allowable unit bond stress.

e. Proprietary mechanical splicing devices shall be used only with prior approval of the Engineer in writing. They shall be able to withstand without any slippage a force of not less than 1.25 times the characteristics yield stress of the smaller bar spliced multiplied by the cross-sectional area of the smaller bar. The ties, links or stirrups connecting the bars shall be taut so that the bars are properly braced. The inside of their curved parts shall be in contact with the bars around which they fit.

f. Reinforcement which is left projecting temporarily from concrete shall not be bent out of position, or otherwise deformed or displaced.

g. Welding of reinforcement bars shall not be allowed.

h. Where galvanizing or epoxy coating is required to be applied to the reinforcement, specific instructions will be given by the Engineer taking into account the particular design conditions which apply.

Ends of bars which are left projecting for any period exceeding 4 weeks shall be painted with a heavy coat of neat cement grout which shall be removed prior to continuation of concreting.

3. Surface condition
Reinforcement shall be inspected and approved by the Engineer before the concrete is placed, reinforcement shall be clean, free from mill, oil, paint, retarders, loose rust, loose mill scale, grease, etc …. Such approval will not relieve the Contractor of his responsibilities in connection with the work.

4. Spraying
All reinforcement shall be damped with a fine spray of clean water immediately prior to concreting.

5. Testing of reinforcement
Tensile tests providing information on elastic limit, ultimate strength and stress-strain curve will be required from each delivery of reinforcement and measurements will also be required of cross section area of bars. The Contractor shall allow for three bars of each size to be tested at his own cost.
When any test results do not conform to the specified standard, the reinforcement steel shall be removed from the site and the cost of subsequent testing, any remedial work and redesign shall be borne by the Contractor.

CAST-IN-PLACE CONCRETE (03300)

A. Scope

These works shall consist of the specifications for concrete materials including sampling, testing and storage of such materials, concrete strength requirements, concrete testing procedures and requirements, and job mixes.

Expansion and contraction joints and waterstop shall be included as indicated on the drawings. Notwithstanding this, waterstops shall be used in all joints in water retaining concrete structure and joints in waterproof concrete.

The works of this division shall be executed in accordance with the Conditions of Contract, the Specifications, the General Requirements, the Drawings and the Bills of quantities.

B. Performance and standards

In this contract, reference is made to standards, codes of practice and specifications issued by international Bodies and organizations, hereinafter referred to by the following abbreviations.

ACI	(American concrete Institute)
ASTM	(American Society for testing Materials)
BS	(British Standards)

These references shall in every case be deemed to include the latest edition or issue of such standards, referred to in the specifications.

C. Related items

Basic Concrete Materials and methods	03050
Concrete Forms and accessories	03100
Concrete Reinforcement	03200
Precast Concrete	03400

D. Submittals

The Contractor is required to supply the Engineer with full details of the aggregate, water, sand, cement, admixture to be used for structural concrete. He shall also make and submit trial mixes as instructed by the Engineer.

The Contractor shall submit request for order to pour showing that all MEP reservation have already been allowed with the signature of the MEP Contracts.

E. Product handling

1. Cement
Cement shall be stored as specified herein.

2. Aggregate
Aggregate shall be stored as specified herein

3. Batching and Mixing
Cement, aggregate, water and any admixture shall be measured and mised as specified herein.

4. Ready-mixed Concrete
Ready-mixed concrete shall be handled as specified herein.

5. General
All materials for production of concrete shall be stored in such a way as to protect them from aggressive effects of the environment.

6. Transporting, placing and compacting of concrete
These operations shall consist for the placing, compacting and curing of concrete for mass and reinforced concrete structures.

6.1 Inspection

- The Contractor shall examine the substrate and conditions under which the cast-in-place concrete work shall be performed and correct any unsatisfactory conditions.
- Before placing concrete, inspect and complete the formwork installation, reinforcement and any other items required to be embedded or cast-in including openings and items related to other trades.
- The Contractor shall give the Engineer 24 hours notice of his intention to concrete any sections of the works; the Engineer shall inspect the sections prior to concreting being carried out.

6.2 Setting-out

Prior to the execution of any works the contractor shall be responsible for:

a. The accurate setting-out of the Works in relation to the original points, lines and levels of reference given by the Engineer in writing,

b. The correctness, subject as above mentioned, of the position, levels, dimensions and alignment of all parts of the Works, and

c. The provision of all necessary instruments, appliances and labour in connection with the foregoing responsibilities.

If at any time during the execution of the Works, any error appears in the position, levels, dimension or alignment of any part of the Works, the Contractor, on being required so to do by the Engineer, shall, at his own cost rectify such error to the satisfaction of the Engineer, unless such error is based on incorrect data supplied in writing by the Engineer, in which case the Engineer shall determine an addition to the Contract Price in accordance with the condition of contract and shall notify the Contractor accordingly, with a copy to the Employer.

The checking of any setting-out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the accuracy thereof and the Contractor shall carefully protect and preserve all bench-marks, sight-rails, pegs and other things in setting-out the Works.

6.3 Methods of placing the concrete

Concrete shall be placed in compliance with the practices and recommendations of ACI304, and as herein specified. No concrete shall be placed in any part of the structure unless Engineer's approval as been given. Immediately prior to placing concrete, all formwork shall be cleaned with compressed air or water, or both, as the Engineer may require, and all dirt, shavings and other foreign matter shall be removed.

Provide mechanical equipment for conveying concrete to ensure continuous flow of concrete at the placement area. Provide runways for wheeled concrete

conveying equipment from the concrete delivery point to the locations of final deposit.

Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, and other deleterious materials.

Placing concrete into Forms:

Concrete shall be deposit continuously without interruption in layers not deeper than 400 mm. if a section cannot be placed continuously provide construction joints as herein specified.

Free fall of concrete shall not exceed 1.0 meter in thin walls, 2.0 meters in other work and 250-500 mm for slabs.

Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.

Do not subject concrete to any procedure which will cause aggregation.

Concrete in structural work shall not be placed during rain, strong dust storm or when the shade temperature exceeds 35 degrees C.

When the concrete is placed, its temperature shall be nearly the same as that of the reinforcing bars, in order to avoid poor adhesion due to the different coefficients of thermal expansion of the two materials. The reinforcing bars shall, therefore, be protected from the sun (or the cold in winter) or cooled by water jets prior to the placing of the concrete, or the pouring shall start during the cooler hours of the day and be suspended when the temperature rises above thirty three degrees C.

The slopes of chutes, where used, shall not be greater than 1 vertical to 2 horizontal or smaller than 1 vertical to 3 horizontal. The slope of the chute shall be constant along its length. The capacity of the chute shall be adequate to deliver the required volume of concrete at the required rate.

Concrete in simple slab spans shall be placed in one continuous operation for each span, unless otherwise shown on the drawings or directed by the Engineer.

Concrete shall be handled, placed and compacted in such a manner that no segregation occurs, and previously placed and compacted concrete is not disturbed.

For placing big masses of concrete, retarder additives may be used in accordance with Manufacturer’s requirements, subject to the approval or request of the Engineer.

On placing in its final position, the concrete shall be carefully worked around and between all steel reinforcing bars and other embedded fittings. All concrete shall be compacted to the maximum possible degree before it commences to set.

The external surface of all concrete shall be thorongly worked during the placing by means of tools of an approved type. The working shall be such as to force all coarse aggregate from the surface and to bring mortar against the forms to procude a smooth finish, substantially free from water and air pockets, or honey comb.

Special care shall be exercised in mixing and placing of the fairface concrete to achieve perfect surface requiring no repairs or touching up after removal of the formwork.

All concrete, except when otherwise agreed by the Engineer, shall be compacted with a vibrator of adequate size and power. Immersion vibrators shall be applied in a number of places for short periods rather than in one place for a long time.

The spacing between points of application should be such that all parts of the section are equally and fully compacted, the vibrators shall be removed slowly from the compacted concrete.

During the concreting of all reinforced concrete members, a skilled and competent steel fixer shall be in attendance on each concreting team, and his duty shall be to ensure that the reinforcement and other embedded fittings are kept in their correct positions as the work proceeds.

6.4 Bonding

When placing concrete against concrete surfaces already set, such surfaces shall be bonded together as herein after described:

a. Roughen surfaces of set concrete at all joints except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly and to leave no laitance, loose particles of aggregate, or damaged concrete at the surface.

b. Prepare for bonding a fresh concrete to new concrete that has set but is not fully cured, as follows:

   1. At joints between walls and slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate, the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

   2. At joints in exposed work; at vertical joints in walls; supported slabs and other structural members; dampen, but do not saturate, the roughened and cleaned surface of set concrete and apply a coating of neat cement grout.

   3. Use neat cement grout consisting of equal parts of Portland cement and fine aggregate by weight and not more than 26 liters of water per 50 kg sack of cement. Apply with a stiff broom or brush to a minimum thickness of 1.5 mm.
      Deposit fresh concrete before cement grout has attained its initial set.

   4. In lieu of neat cement grout, bonding grout may be a commercial bonding agent. Apply to cleaned concrete surfaces in accordance with the printed instruction of the bonding material manufacturer.

c. Prepare for bonding of fresh concrete to full-cured hardened concrete or existing concrete by using an epoxy-resin adhesive binder, as follows:

   1. Handle and store epoxy-resin adhesive binder in compliance with the manufacturer's printed instruction, including safety precautions.

   2. Mix the epoxy-resin adhesive binder in the proportions recommended by the manufacturer, carefully following directions for safety of personnel.

   3. Before depositing fresh concrete, thoroughly roughen and clean hardened concrete surfaces and coat with epoxy-resin grout not less than 1.5 mm thick. Place fresh concrete while the epoxy resin material is still tacky, without removing the in-place grout coat.

6.5 Pumping

a. The use of pumps will only be allowed after they have been carefully checked and approved by the Engineer. Only low pressure piston type pumps, which will work with a water/cement ratio of not more than sixty five

hundredths (0.65), will be allowed. Using superplasticisers to facilitate pumping for low water/cement ratios is allowed subject to Engineer's review and approval.

b. The internal diameter of delivery pipe of the pump shall be not less than 3 times the maximum aggregate size. The pipes shall not rest on any part of the formwork; they shall be supported independently and securely and be readily accessible so that sections can easily be detached to remove any blockage.

c. Before approving the use of a pump, the Engineer shall verify that the Contractor has sufficiently reinforced the concrete placing team and the equipment for placing and vibrating the concrete.

6.6 Compacting

General

a. The vibration of the concrete can be considered completed when a thin layer of cement group appears on the surface and when no more air bulbes indicating the presence of voids within the concrete, appear on the surface. At the same time, there must not be too much vibration or this will produce segregation.

b. Vibration may be of types :
   - Internal
   - External

c. Internal vibration shall be executed in all sections which are sufficiently large to permit the insertion and manipulation of immersion vibrators previously approved by the Engineer, in accordance with the following recommended practices:

   1. The concrete shall be placed in horizontal layers not thicker than fifty centimeters.
   2. The vibrator shall be inserted vertically into the concrete to its full length such as to reach the bottom of the freshly placed layer.
   3. The distance between two successive insertions shall not exceed five times the diameter of the vibrator itself.
   4. The vibrator shall not rest on or against either the formwork of the main reinforcing bars.

d. External form vibrators shall be used for external vibration when it is impossible to use internal vibrators.

6.7 Pocker vibrators

The type and size of poker vibrators shall suit the pour size, density of reinforcement and member dimensions. Unless otherwise authorized by the Engineer.

F. Materials

1. Classification of concrete mixes

The class of concrete shall be as specified in (03050) Basic concrete materials and methods.

2. Constituent materials of structural concrete

a. Cement

Cement shall be obtained from approved manufacturer in their original sealed and branded bags or containers, They shall comply with BS12 or ASTM150 type 1.

Each consignment of cement shall be accompanied by a manufacturer's certificate stating standard and date of manufacturing. If such certificate is not made available or if the Engineer considers that the Manufacturer's tests are inadequate, samples for acceptance test shall be taken from different consignments and tested by the Engineer in accordance with BS 4550 in fineness, chemical composition, crushing strength, and setting time at the Contractor's expense.

All batches and consignments that fail to pass the required cement quality tests shall be removed from the site immediately and shall not be used in the Works.

Only one type or brand of cement shall be used in any one structural member. Mixing of types of brands will not be permitted.

All cement shall be subject to approval and shipments of cement shall be accompanied by a manufacturer's Certificate of Guarantee and/or laboratory test certificate. Approval of any cement sample shall not relieve the Contractor of the responsibility to fabricate concrete of the specified strength.

When tests at the factory of field tests subsequent to the original approval tests show that the cement does not comply with the Specifications, the entire consignment from which the sample was taken shall be rejected and the Contractor shall immediately remove the rejected material from the Site and replace it with cement which meets the required Specifications.

Each delivery, which comes from another source than the previous tested one, shall be tested before delivery to Site. If the source does not change, routine tests shall be carried out for each 500 Tons delivered.

Whenever low alkali cement is specified the total alkali content estimated as sodium oxide equivalent, shall not exceed 0.60% by weight.

If no local test certificate is available, the Contractor shall obtain from each proposed manufacturer a typical sample of cement which shall be fully and independently tested in accordance with the appropriate standard and the results submitted for approval. Primary and secondary sources of the required cements shall be given. All costs associated with the testing shall be allowed for by the Contractor.

Details shall also be submitted of the manufacturer's name and address of producing works, manufacturer's description of cement type and brand name and standards to which compliance is guaranteed.

The manufacturer's bulk average test certificate for each consignment of cement shall be submitted, showing the results for chemical composition and physical properties determined in accordance with the relevant standard. Samples shall be taken for each consignment of cement and tested as directed by the Engineer in an approved independent laboratory, at the cost of the Contractor.

Where bulk cement deliveries are proposed, the Contractor shall provide all information required by the Engineer concerning off-site storage and loading arrangements and shall provide reasonable facilities for the Engineer to inspect these arrangements for approval purposes. Consignments shall be used in the order in which they are delivered.

Sacked cement shall be stored in shed or room having a floor raised off the ground and having walls and roof that will ensure effective protection against weather, including damp air and hot sun. Each batch shall be stacked separately and be easily identifiable and used in the order of delivery. No cement shall be used which have been manufactured more than nine (9) months prior to its proposed use on site.

Cement remaining in bulk storage at the mill, prior to shipment, for more than 6 months or cement stored in bags in local storage by the Contractor or a vendor for more than 3 months after shipment from the mill, may be re-tested before use and will be rejected if it fails to meet any of the requirements of these Specifications.

b. Aggregates

1. Aggregates shall comply with BS 882 and be mechanically graded and washed if necessary to produce a dense concrete free from voids and workable without excess of water.

   Coarse aggregates shall be of a maximum size suitable for the particular member consistent with workability and the spacing of the reinforcement. The Engineer may give instructions to the Contractor regarding the maximum size of the coarse aggregates, but such instructions will not relieve the Contractor of his responsibility to obtain the strengths specified.

2. Potential aggregate sources shall be examined and particular attention shall be paid to the following aspects of the deposits and the actual or proposed extraction and production arrangements:

   a. Name, location, local national grid reference, type of deposit, potential variability, methods of extraction.

   b. Methods and degree of control exercised over extraction.

   c. Processing methods, types of plant, number of processing stages, standards of maintenance and process control, producer's laboratory facilities and technical staffing.

   d. Stockpiling arrangements, loading and supply arrangements.

   e. Potential variations in end-products due to variations inherent in the deposit and in the existing methods of extraction, processing and stockpiling.

   f. Possible modifications to existing extraction, processing, storage and handling arrangements, and to supervision arrangements to reduce end-product variations.

   g. Possible requirements for supplementary processing on site.

   h. Photographs shall be provided of each of the proposed new sources and related production arrangements. The source photographs should preferably include low level (helicopter) aerial phonographs and close-ups of working faces.

3. Aggregate deposits shall be sampled and tested in an appropriate and systematic manner to assess their potential variability and to assist in determining appropriate methods of extraction and processing.

   As soon as possible after the Contract is let, the Contractor shall obtain representative samples of sufficient quantities of fine and coarse aggregates which he proposes to use for the various grades of concrete and shall arrange for their testing in accordance with BS 812.

Should any of the samples not pass the tests, the materials represented shall not be used in the Works, but other material be chosen and samples tested until satisfactory results are obtained.

4. The deposit investigation and sampling programs shall be relevant to each type of deposit and shall be devised and supervised by an experienced approved Engineering Geologist, after he has made a field reconnaissance of the potential deposit areas, or the existing workings.

5. Each size of aggregate shall be sampled at the discharge points on the production plant (i.e. conveyors or hoppers, not stockpiles) at three well spaced intervals during the course of each of three consecutive production days; these samples shall be designated “production samples”.

6. In addition, selected samples shall be taken from producer’s stockpiles to represent any readily visible variations in physical characteristics, or appearance, or materials ready for loading, these samples shall be designated “stockpiles samples”.

7. All samples shall be taken by arrangement with and in the presence of the Engineer, or his representative, and shall be tested as required below.

8. Representative portions of the above samples shall be taken for reference purposes and shall be split and retained on site by the Contractor and by the Engineer.

9. Representative samples of every consignment of fine and coarses aggregates delivered to Site shall be tested for sieve analysis, field setting tests and estimation of organic impurities in accordance with BS 812.

10. Adequate stocks of tested and approved aggregates shall be maintained on site and the capacity of the storage bins for each type and grading of aggregate shall be sufficient to hold the respective quantities required for the maximum amount of concrete which the Contractor is obliged or intends to pour in any continuous operation in one day. Stockpiles shall be built in layers of 1.50 m maximum height and segregation of the aggregates prevented. Different grades of aggregates shall be totally separated by concrete block walls.

11. Dense concrete or bituminous slabs shall be laid with sufficient falls to cover all aggregate stockpile areas or bins and shall extend to cover all surrounding areas where aggregates are likely to be discharged or handled. These areas shall be swept and kept clean all times to ensure that the aggregates are not contaminated by the adjacent ground through trafficking or otherwise, and shall be constructed with adequate drainage for surplus water.

c. Water

1. All sources of water to be used with cement whether for mixing or curing of concrete, or compaction of backfill around the concrete structures, shall be approved by the Engineer. If at any time during construction, water from an approved source becomes unsatisfactory, the Contractor shall provide satisfactory water from other mains sources.

2. Water shall be free from injurious quantities of oil, alkali, vegetable matter and salt as determined by the Engineer. The water shall be reasonably clear and shall contain not more than one quarter (0.25) percent solids by weight. Water shall comply with the requirements of BS 3148. If the specific conductance is less than 1500 micro-ohms per centimeter the total solids content requirement may be waived.

d. Water stops (if applicable)

This work shall consist of furnishing and installing water stops to waterproof construction and expansion joints as shown on the Drawings or as directed by the Engineer.

Plain rubber water stops shall be formed from a stock composed of a high grade compound made exclusively from new plantation rubber, reinforcing carbon black, zinc oxide, accelerators, anti-oxidants, and softeners. This compound shall contain not less than 72 percent by volume of new plantation rubber. The tensile strength shall be not less than 246 kgs. per sq. cm, with an elongation at breaking of 550 percent when tested in accordance with ASTM D412. The unit stresses producing 300 percent and 500 percent elongation shall be not less than 77 kg. and 206 kg, per sq.cm, respectively. The Shore Durometer indication (hardness) shall be between 55 and 65 when tested in accordance with ASTM D676. After 7 days in air at 126 degrees (plus or minus 1 degree) C or after 48 hours in oxygen at 126 degrees (plus or minus 1 degree) C both at 21 kg per sq.cm, the tensile strength and elongation shall not be less than 65 percent of the original when tested in accordance with ASTM D572.

Rubber water stops shall be installed in accordance with the details shown on the Drawings. The water stops shall be formed with an integral cross section which shall be uniform within 3 mm in width and the web thickness or bulb diameter, within plus 1.5 mm and minus 0.75 mm. No splices shall be permitted in straight strips. Strips and special connection pieces shall be well cured in a manner such that any cross section shall be dense, homogenous, and free from all porosity. All junctions in the special connection shall be full moulded. During the vulcanizing period the joints shall be securely held by suitable clamps. The material at the splices shall be dense and homogenous throughout the cross section. Field splices shall be either vulcanised, mechanical, using stainless steel parts, or made with a rubber splicing union of the same stock as the water stop, at the option of the Contractor. All finished splices shall demonstrate a tensile strength of not less than 50 percent of the unspliced material.

e. Admixtures

1. General :

The quantity and method of using admixtures shall be in accordance with the manufacturer's recommendations and in all cases shall be subject to the approval in writing of the Engineer.

In all cases the Contractor shall provide the following information for the Engineer's approval :

- The quantity to be used, in kilograms per kilogram of cement and in kilograms per cubic meter of concrete.
- The detrimental effects caused by adding a greater or lesser quantity in kilograms per cubic meter of concrete.
- The chemical name (s) of the main ingredient (s).
- Whether or not the admixture leads to the entraining of air.

The Contractor shall demonstrate the action of an admixture by means of trial mixes.

Calcium chloride :

To use of calcium chloride in any forms is prohibited.

Guidance :

Reference may be to ACI Committee 212 report " Guide for Use of Admixtures in Concrete".

2. Admixture to procedure high workability:

   Concrete for use in certain construction shall contain an approved superplasticising agent, when so directed by the Engineer. The superplasticiser shall be stored and used strictly in accordance with the manufacturer's instructions and must be fully compatible with all proposed concrete mix constituents. The optimum dosage of the additive shall be determined by site and laboratory trials to the Engineer's approval. The Contractor shall submit to the Engineer full details of his proposed mix design which must ensure that the minimum strength requirements as specified for the particular use of the concrete are achieved. Only when the Engineer has approved the proposed mix design may such a mix be used in full compliance with the Specifications.

   The Contractor's mixing and transporting plant shall be so designed that accurate metering of the superplasticising agent is possible and so that the additive may be introduced immediately before placing.

   The Contractor's rates for concrete listed in the Bill of Quantities shall include for the use of superplasticisers. Unless otherwise stated the rate shall be inclusive for compliance with the Specifications together with all necessary testing and trials for concrete containing superplasticisers.

   The Contractor shall add a powder waterproofing admixture to the sand/cement before adding water, for the concrete walls of water tank and to the approval of the Engineer.

f. Hollow concrete (Hourdi) blocks

- Before ordering and manufacturing, the Contractor shall submit samples of each type of block for approval by the Engineer.
- Hollow blocks shall be cast with 250kgs of cement per one cubic meter of sand, and shall be mechanically vibrated and properly cured.
- Hollow blocks shall be required to have a compressive strength of 60kgs/cm^2 of gross area, and shall be hard, sound free from cracks clean with well defined arises.
- Tolerance of external dimensions shall be $\pm$ 5%
- Dimensions to be as indicated on drawings
- Manufactured blocks on site shall be subjected to test. If samples from each type fail to meet requirements of compressive strengths specified / or requirements shape, sizes, etc …
- The whole of the delivery shall be removed from site and replaced at Contractor's expense.

G. Workmanship

1. Concrete Strength requirement :

a. Design mixes

Concrete shall be designed in full compliance and in accordance with ACI code.

The test cylinders from such mixes, when crushed at 7 and 28 days of age, must give the minimum preliminary test strengths specified in Table1.

Table 1 : Proportion and strength requirements

Class of concrete	Quantity of cement per m^3 of concrete	Strength within 7 days	Strength within 28 days
		Work	*Work*
B1	200	14 MPa	20 MPa
B2	200	14 MPa	20 MPa
B3	350	25 MPa	30 MPa
B4	400	28 MPa	35 MPa

N.B.: $N/mm^2 = 10\ kg/cm^2$

a. Submit to the approval of the Engineer a graph of a sieve test curve from which he should find a mix to be adapted to a curve having a maximum compactness.

b. Prepare a mix for each Class of concrete enumerated in Table 1 in accordance with BS CP 8110.

c. Quantity of cement shall be always by cubic meter of worked concrete :

Reinforced Concrete : 400kg/m^3 (B4) columns + walls

Reinforced Concrete : 350 kg/m^3 (B3) footings + slabs + beams

Blinding concrete : 200kg/m^3 (B1)

Cyclopean concrete : 200kg/m^3 (B2)

b. Trial mixes

The mixes shall be designed on the Contractor's behalf by an independent testing laboratory acceptable to the Engineer. The Contractor shall submit his designs in writing to the Engineer together with the details of the fine and coarse aggregates he proposes to use and other relevant detail and data.

Following, the Engineer's provisional agreement to the Contractor's mix, design for each quality of concrete specified, the Contractor shall arrange for full scale of trial mixes and preliminary test.

If the results of these tests are not acceptable to the Engineer, the Contractor shall arrange for the design of the mixes to be adjusted and the tests repeated until the mixes are accepted by the Engineer.

The Contractor shall not make any change in the source of nature of any agreed aggregate without first obtaining the agreement of the Engineer and shall subsequently submit preliminary samples of the aggregates to the Engineer. The Contractor shall, if required by the Engineer, prepare new designs, carry out new trial mixes and prepare further preliminary tests.

Only mixes as approved by the Engineer shall be used for all concrete works on the Site.

c. Nominal concrete mix

Concrete for use as backfilling for structural excavation shall be either no-fines concrete or cyclopean concrete as directed by the Engineer. The cement: aggregate ratio of such nominal mixes shall be not greater than 1:15 and the minimum cylinder strength at 28 days not less than 50 kg/cm^2

No-fines concrete shall comply with the grading in Table 2 and shall be mixed and laid in general conformity with this Division.

Plums used in cyclopean concrete shall consist of non-reactive broken stone spells or boulders ranging in size from 200 mm to 300 mm. They shall be free from sharp or angular edges and shall not form more than 30% of the total volume of concrete. They shall be evenly graded and shall be soaked in water prior to incorporation in the mix. Plums shall be evenly distributed in the concrete mix with a minimum cover of 100 mm.

Table 2 : Grading for no-fines concrete

Grading of aggregates Sieve Size / (mm)	% by Dry Weight Passing
90	100
40	85-100
20	0-20
10	0-5

2. Requirement for combining materials :

a. Preliminary testing

Before any grade of concrete is placed in the Works, three trial mixes of the grade shall be made to the submitted mix proportions, and from each mix six cubes shall be made, three for testing at 7 days and three at 28 days, and the results submitted to the Engineer as soon as available.

The mix proportions shall be accepted for use in the Works only if the 28 days cube strengths fulfil the following conditions:

I. The average strength of each set cube exceeds the designed mean strength, and

II. The difference between the lowest and highest strengths of any one set does not exceed 15% of the average of that set, and

III. The difference between the lowest & highest strengths of all three sets does not exceed 20% of the average of all three sets.

b. Cast-in-place concrete

1. Mixing concrete on site

All cement and aggregates shall be measured by weight in weight batching machines of an approved type. . The weight of cement and each size of aggregate, as indicated by the mechanisms employed, shall be within a tolerance of 2 per cent of the respective weights per batch agreed by the Engineer. The machines shall be checked and adjusted for accuracy at regular intervals and when so required by the Engineer.

Concrete shall be mixed in quantities required for immediate use. Concrete, which has developed initial set, shall not be used. Retempering concrete by adding water or by other means will not be permitted. Concrete that is not within the specified slump limits at the time of placement shall not be used and shall be disposed of as directed by the Engineer.

Concrete Mixers shall be approved by the Engineer. Mixers which have been out of use for more than 30 minutes shall be thoroughly cleaned before any fresh concrete is mixed.

Every concrete mixing machine shall be fitted with the proper water measuring device which the Contractor shall maintain in proper adjustment and check at such intervals as the Engineer may require. The water to be

added to the mix shall be reduced by the quality of free water contained in the aggregates which shall be determined by the Contractor and approved by the Engineer.

The concrete may be mixed at the site of the works, in a central-mix plant, or in truck mixers. The mixer shall be of an approved type and capacity.

The coarse aggregate shall first be loaded into the mixer followed by the fine aggregate. Some mix water shall be added to the mix before the cement is loaded into the mixer. Water shall be continually added throughout the mixing. Additives, if required and approved by the Engineer, shall be added according to the manufacturer's instructions. Retarders shall be added within one minute or 25% of the total mixing time whichever is the smaller.

Concrete shall be transported from the mixer to the Work Site for placing by methods and means which will prevent segregation or loss of the ingredients and which are sufficiently rapid to ensure that the concrete does not commence to set before it is compacted in it's final position.

The manufacturer's instructions shall be followed in respect of overloading the mixer and the selections of the rate of revolutions of the mixer.

To avoid segregation in the fresh concrete, the free drop height on emptying the mixer shall be not greater than 1.5 meters.

After mixing, the concrete shall be homogeneous and comply with the provisions of these Specifications. The Engineer may, if the mix fails to produce concrete of the required strength vary the mix time.

Concrete mixing shall be :

Coarse aggregate	800L
Gravel	400L
Cement	350kgs

c. Ready mixed concrete and central mixed concrete

1. General

"Ready-Mixed Concrete" and "Central-Mixed Concrete" shall consist of a mixture of cement, water and aggregate, without air entraining or water-reducing admixture. When air-entraining or water-reducing or any other type of admixture is required it shall be at the Engineer's discretion. The terms ready-mixed concrete shall include transit-mixed concrete and will be referred to hereinafter as ready-mixed concrete.

Ready-mixed concrete may be used in the construction of all works, when approved by the Engineer.

Approval of any ready mixed concrete plant will be granted only when an inspection of the plant indicates that the equipment, the method of storing and handling the materials, the production procedures, the transportation and rate of delivery of concrete from the plant to the point of use, all meet the requirements set forth herein.

Ready-mixed concrete shall be mixed and delivered to the point of use by means of one of the following combinations of operations :

1. Mixed completely in a stationary central mixing plant and the mixed concrete transported to the point of use in a truck mixer or tank agitator operating at agitator speed, or when approved by the Engineer, in non-agitating equipment (known as " central-mixed concrete").

2. Mixed completely in a truck mixer at the batching plant or while in transit (known as transit-mixed concrete).

3. Mixed completely in a truck mixer at the point of use following the addition of mixing water (known as truck-mixed concrete).

4. Permission to use ready-mixed concrete from any previously approved plant may be rescinded at any time upon failure to comply with the requirements of the specification.

2. Materials

All materials used in the manufacture of ready mixed concrete shall conform to the requirements of Sub-Section “Materials” of the Specification of concrete work.

3. Equipment

Equipment shall be efficient, well maintained, and shall be of the type and number as outlined in the Contractor’s Program of Work. Transit mixers and agitator trucks shall comply with the standards specified in ASTM C94. Non-agitating equipment used for transporting concrete shall be water tight and be equipped with gates that will permit controlled discharge of concrete and, when required by the Engineer, be fitted with covers for protection against the weather.

4. Supply

Where transit mixers are used, the constituent materials shall be mixed dry in the mixer and water added directly before pour and mixed at the speed and number of turns in accordance with the manufacturer’s recommendations.

Where concrete is mixed at a central plant on or off site, the concrete may be supplied to the pourring area by agitator trucks or transit mixers which rotate at the speed specified by the manufacturers. Non agitating trucks may be used if the central plant is on site.

Time of haul shall not exceed the maximum stated of :

- Thirty minutes when air temperature is 25^{o}C or higher.
- Forty minutes when air temperature is 18^{o}C or below.
- Interpolated time between 18^{o}C and 25^{o}C.

5. Uniformity tests

Four samples of fresh concrete shall be taken, two after 15% of discharge from the truck mixer or agitator truck and two after 85% discharge and within 20 minutes. Slump and compaction factor tests shall be carried out including any other tests specified or required by the Engineer.

6. Samples

Samples for strength test shall be taken as specified in clause “Concrete Strength Requirements” of the specifications.

At least six specimens shall be prepared per sample. Three of these shall be tested 7 days and three at 28 days.

7. Control of delivery

   Driver of delivery trucks shall be provided with trip tickets, which shall be signed by a responsible member of the central plant staff, for submission to the Engineer. The ticket shall contain the following information.

   - Name and address of the Central Plant.
   - Serial number of the ticket and date
   - Truck number
   - Class and/or strength of concrete.
   - Cement content of the mix
   - Loading time
   - Slump
   - Any other type of relevant information

   The Engineer may send his representative to the central plant who may:

   - Check the batching and mixing
   - Verify loading time
   - Take a copy of the trip ticket.

   The Contractor and/or concrete supplier shall afford the Engineer and/or his good representative, without charge, all facilities necessary to take samples, conduct tests and inspect the central plant to determine whether the concrete is being furnished in accordance with the specification.

   In supplying ready-mixed concrete, the plant shall have sufficient batching and transporting capacity to ensure continuous delivery at the rate required.

   The rate of delivery of concrete during concreting operations shall provide for the proper handling, placing and finishing of concrete. If the rate of delivery does not provide a continuous concrete operation, the Engineer may suspend all or parts of further concrete work until such time as the Contractor provides sufficient additional delivery equipment which in the opinion of the Engineer, will provide for a continuous concrete operation.

d. Central mixing

   Plants for concrete shall comply with the following requirements, in addition to those set forth above:

   1. Cement

      Means provided for storing cement shall be as approved by the Engineer. The Contractor shall clean all conveyors, bins and hoppers of unapproved cement before starting to manufacture concrete for the works.

   2. Aggregate

      Coarse and fine aggregate to be used in concrete shall be kept in stockpiles and bins apart from aggregate used in other work. The Contractor shall clean all conveyors, bins and hoppers of unapproved aggregate before starting to manufacture concrete for the works.

   3. Consistency

      The Contractor shall be responsible for producing concrete that is homogeneous and complies with the provisions of these specifications.

4. Hauling

   Mixed concrete from the central-mixing plant shall be transported in truck mixers, truck agitators, non agitating trucks having special bodies or other approved containers.

5. Time of haul

   The time elapsing from the time water is added to the mix until the concrete is deposit in place shall be not greater than :

   a. For concrete produced on site and transported by means other than transit mixers or agitated trucks.
      - Thirty minutes when air temperature is 25^{o}C or higher.
      - Forty minutes when air temperature is 18^{o}C or below.
      - Interpolated time between 18^{o}C and 25^{o}C.

e. Curing

   The method of curing to be used shall be approved by the Engineer. It shall not cause any undesirable blemishes such as surface discoloration and surface roughness. Curing compounds shall not be used on construction joints and surfaces that are to receive waterproofing, paint or membranes.

3. Sampling, testing, and treatment :

a. General

   The Contractor shall allow in his tender for the cost of sampling and testing concrete and shall supply all labour, materials, equipment, including moulds and other necessary items therefore including transportation whether the test results are satisfactory or not.

   For adequate control of the concrete being poured, it will be necessary to sample the concrete at the following minimum rates :

   For concrete in critical areas designated by the Engineer, one sample per batch or per 5m3 whichever is the lesser.

b. Sampling and testing

   Samples should be selected randomly and should be taken at the point of discharge from the mixer. Each sample should be sufficient to make 6 cubes for testing.

   A minimum of three cubes must be available for the 28 days testing of any one concrete pour, and three for 7 days testings.

   Cubes shall be stored under the same conditions as the concrete in the members.

   The Samples shall be prepared, cured and tested in accordance with 1881 “Methods of Testing concrete:. The weight of each test specimen and its density shall be determined before subjecting it to the compression test and shall be stated on the Engineer.

   Throughout the concrete operations, the Contractor shall have on the job, at least one man who is trained and competent to sample concrete and prepare specimens and to take slump tests and whose name as being such has been notified in writing to the Engineer. Such a man shall be made available to perform such work as and when required by the Engineer Representative.

The Engineer reserves the right to direct from which deliveries and/or placement samples of concrete for testing shall be taken and the Contractor shall ensure that this Representative and/or employees are instructed to observe such directions.

The testing of samples shall be carried out in independent established laboratory approved by the Engineer. The results of each test certified by a person nominated by the Contractor and approved by the Engineer shall be furnished in writing in duplicate to the Engineer within 24 hours of such test.

c. Equipment

All equipment for Sampling and Testing shall be available on site.

For the purpose of storing cube samples on the Site for the 24 hours prior to removal to a laboratory, on insulated box shall be provided by the Contractor. This box shall be sufficient in size to store the number of samples likely to be taken at the same time.

The box shall be solidly constructed in timber lined with 50 mm insulating material and hardboard, on all faces including lid. Samples in the box shall be covered with a wet bag.

d. Records

The Contractor shall also keep a complete record of the work of concreting showing the time and date of placing the concrete in each portion of the work. The record shall be available for inspection at any time by the Engineer.

Each cylinder shall be clearly marked showing from which part of the structure the concrete was obtained and the mix proportions used. This information must be recorded on the report sheet. An accurate record is to be kept on site of all test cubes made, identifying them to the various parts of the work.

Each test report shall be noted by the Contractor on a set of Contract Drawings indicating clearly in red ink the part of structure to which the test report belongs. This set of Drawings shall be kept in Site Office, and should be available for inspection at all times.

e. Further tests

Irrespective of the foregoing, the Engineer reserves the right to take samples of concrete at any time during the currency of the Contract and to have same tested as specified herein, and such tests shall rank equally with tests carried out by the Contractor as specified herein. The concrete required for any such additional samples taken by the Engineer shall be supplied by the Contractor, free of charge, but the cost of testing the specimens will be borne by the Proprietor provided that concrete so tested complies with the requirements of the Specification. The cost of any test where the specimen fail to meet the requirements of this Specification shall be chargeable to the Contractor.

f. Rejection

The Engineer may, before placement, reject any batch of concrete which in his opinion does not conform with the design approved.

If information regarding concrete mixed off site is not submitted with the delivery, or if such information does not conform with the specific type of concrete required, the delivery will be rejected.

The Engineer may reject any concrete after placement because of tests results below those required under the provisions of the Specification or because of unsatisfactory finish or because of incorrect positioning or any other failure to conform to the requirements of this Specification as here-under explained:

If the strength of any cylinder tested at 28 days is less than the specified 28 days strength, or if the strength of any cylinder tested at 7 days multiplied by the average ration of 28 days to 7 days strengths for that grade of concrete as determined from the relevant mix results is less then the specified 28 days strength, than no further work shall be carried out on that part of the work containing the mix from which the cubes were taken until a full investigation into the causes has been carried out by the Contractor to the satisfaction of the Engineer. If, as a result of the investigation the Engineer decides that the concrete does not meet the requirements of this specification, then concrete will be classed as defective work.

Concrete which is rejected and concrete which fails the approved test shall be demolished or removed from the Site and replaced with concrete conforming to the requirements of this specification.

Furthermore, the Engineer may arrange for core samples to be taken and tested and/or loading tests carried out on the finished structure. Should the results of any such analysis or tests not be in accordance with the requirements of this Specification, the concrete represented by such analysis or test may be rejected and the full cost of such test, including reasonable allowance for indirect costs will be chargeable to the Contractor and will be deducted by the Proprietor from moneys due or becoming due to the Contractor pursuant to the Contractor terms of payment.

4. Construction and expansion joints

4.1 Construction joint

The member of construction joints should be kept to the minimum necessary for the execution of the work. Their location should be carefully considered and agreed by the Engineer before concrete is placed. They should normally be at right angles to the general direction of the member.

Precautions shall be taken to prevent loss of grout through the stop end. Wherever possible, stop ends for construction joints shall be removed as soon as the concrete has set, and the surface shall be brushed and washed to remove the laitance and expose the aggregates. Alternatively, this must be done by mechanical hacking. The face of the existing concrete shall be well cleaned and the concrete well consolidated against it.

Construction joints in exposed concrete surface must be positioned and formed to give minimum variation from the specified finish.

4.2 Expansion joints

Expansion joints filler shall be Polystyrene or other approved to the thickness shown on the drawings, filler shall be removed after pouring the concrete and as directed by the Engineer.

When forming movement joint, filler should be fixed firmly to first-placed concrete. If more than one strip is used within a joint, it is essential to butt the ends tightly or tape them together to prevent grout leakage.

Where flexible water stops are used, they should be fixed so as to ensure that they are not displaced from their intended position during compaction of concrete.

PRECAST CONCRETE (03400)

A. Scope

The Contractor shall furnish and install precast concrete tiles, curbstone, skirting to roof and external works as shown on the drawings.

The works of this division shall be executed in accordance with the Conditions of Contract, the Specifications, the General Requirements, the Drawings and the Bills of quantities.

B. Performance and Standards

1. Quality Control
Contractor shall institute quality control procedures for the manufacture, inspection and testing of precast units in compliance with the applicable recommendations. Furnish the Engineer for review copies of test reports and/or certification for materials and quality control testing of precast units.

C. Related Items

Cast-in-place concrete 03300

D. Submittals

1. Shop Drawings

a. The Contractor shall prepare and submit complete shop drawings of the work included herein for the Engineer's approval. Shop drawings shall include the formwork and reinforcement drawings and details showing the profiles, sizing and necessary details including the bar bending schedule, the list and the scale of the shop drawings, shall be submitted as directed and to the approval of the Engineer.

b. The Contractor shall provide layout, dimensions and identification of each structural precast unit corresponding to the sequence and procedure of installation. Indicate welded connections by Amercian Welding Society (AWS) standard symbols. Detail inserts, connections and joints, including accessories and construction at openings in precast units.

c. The contractor shall provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

d. All installed materials shall conform to the approved corresponding shop drawings.

2. Samples

a. Samples of materials proposed to be used, shall be submitted by the Contractor for Engineer's approval. Samples shall indicate finishes proposed to be used and shall be submitted on material on which they will be applied. Samples shall be submitted as directed by the Engineer.

b. All installed materials shall conform to the approved corresponding samples.

3. Product Delivery, Storage and Handling
Deliver precast concrete units to the project site in such quantities and at such times as will assure the continuity of the installation. Store units at the project site to

ensure against cracking, distortion, staining, or other physical damage and so that markings are visible. Lift and support units at the designated lift points only.

4. Job Conditions

a. Verify dimensions of supporting structures at the project site and adjust approved shop drawings to reflect actual field dimensions.

b. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work and only as acceptable to the Engineer. Maintain the general design concept as shown without increasing or decreasing sizes of members or altering profiles and alignement.

c. Provide complete design calculations and drawings prepared by a registered Engineer, if design modifications are anticipated.

d. Provide anchorage items which shall be embedded in other construction before the start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

5. Field Mock-Up

a. Field mock-up panel shall be erected on the site where directed by the Engineer.

b. Mock-up panel shall indicate the colour and finish of the precast concrete pavers.

c. The field mock-up shall be immediately revised by the Contractor during the presence of the Engineer, if the Engineer so directs. Until the field mock-up is approved by the Engineer. All installed materials shall conform to approved corresponding field mock-up. The filed mock-up shall remain intact until its removal is directed by the Engineer, and subsequenthly, shall be removed by the Contractor.

6. Measurements

The Contractor shall take all necessary measurements at the building as required to assure proper fabrication and installation of the work of this section.

7. Coordination

All work of this section shall be closely coordinated with the work of other sections whose work affects or is affected by the work specified in this section.

E. Materials

1.

a. Precast concrete tiles and curbstone and skirting sizes shall be as indicated in the Bill of Quantities, or on drawings.

b. Cement

Conforming to BS 12.

c. Aggregate (Fine and Coarse)

Conforming to BS 882 of material, colour and proportions conforming to approved sample. Aggregate shall be clean, hard, strong, durable, inert materials, free of deleterious substances.

d. Water

Clean and free from injurious amounts of oils, alkalis, organic materials, and other deleterious substances.

e. Air-Entrainment Admixture

Shall be approved by the Engineer.

f. Reinforcing Bars
Conforming to BS 4449.

g. Reinforcing Mesh
Conforming to BS 4483, 75,000 psi tensile strength.

2. Formwork

a. Provide forms and, where required, form facing materials of metal, plastic, wood or other acceptable material that is non-reactive with concrete and will produce the required fairface finished surfaces.

b. Accurately construct forms, mortar-tight, and of sufficient strength to withstand all pressures due to concrete placing operations and temperature changes. Maintain formwork to provide completed precast concrete units of the shapes, lines and dimensions indicated.

3. Connection Materials

a. Steel Plates: Structural quality, hot-rolled carbon steel, ASTM A 283, Grade C.

b. Steel Shapes: ASTM A 36.

c. Anchor bolts: ASTM A 307, low carbon steel bolts, regular hexagon nuts and carbon steel washers.

d. Finish of Steel Units: Exposed units galvanized per ASTM A 153; others painted with rust-inihibitive primer.

e. Accessories: Provide all clips, hangers and other accessories required for installation of precast units and for support of subsequent construction or finishes.

4. Grout Materials

a. Cement Grout: Portland cement, ASTM C 150, Type I, and clean natural sand, ASTM C 404.

b. Shrinkage Resistant Grout: Premixed and packaged ferrous aggregate type complying with U.S. Corps of Engineers CRD-C558, Type M.

c. Non-metallic, Non-Shrink Grout: Premixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents complying with CRD-C558, Type A.

5. Precasting

a. Precast units shall be of concrete with a minimum compressive strength of 232 kg/cm² at 28 days for structural and with a minimum strength of 194 kg/cm² at 28 days for all other items.

b. Precasting may be obtained from a locally available precasting producer or may be precast on-site at the option of the Contractor.

c. Testing of units for conformance with strength requirements shall be performed by the Contractor to the satisfaction of the Engineer.

6. Fabrication

a. General: Fabricate precast concrete units complying with the manufacturing and testing procedures, quality control recommendations, and dimensional tolerances.

b. Where precast concrete elements are required to be white finished, white Portland cement shall be used in the manufacture of such elements.

c. Built-in Anchorages: Accurately position any built-in anchorage devices and secure to the formwork. Locate anchorages where they do not affect the position of main reinforcement or the placing of concrete.

d. Cast-in holes for openings in accordance with approved shop drawings.

e. Coat surfaces of forms with a bond-breaking compound before reinforcement is in place. Provide form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

f. Accurately position, support and secure reinforcement against displacement during formwork construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

g. Observe weather limitation and requirements for hot weather and cold weather concreting. Place concrete in a continuous operation to prevent the formation of seams or planes of weakness in precast units, complying with requirements of ACI 304. Thoroughly consolidate placed concrete in each precast unit by internal and external vibration without dislocation or damage to reinforcement and built-in-times.

h. Identification: Provide permanent markings in precast units to identify pick-up points and orientation in the structure, complying with the markings indicated on the approved shop drawings. Imprint the date of casting on each precast unit where it will not show in the finished structure.

j. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce the curing time.

k. Provide finish of exposed-to-view surfaces of precast concrete units to match color and texture of approved sample panels.

l. Decorative Pattern: Where indicated to have decorative designs and patterns achieve finish by applying liners to the inside of forms.

m. Quality Control: Contractor shall institute quality control procedures for the manufacture, inspection, and testing of precast units. Furnish the Engineer with copies of test reports and/or certification for materials and quality control testing precast units.

F. Workmanship

1. Examination of surfaces and Conditions

All surfaces which will receive the work of this section and all conditions which affect the work of this section shall be carefully examined by the Contractor prior to installation of the work of this section.

Starting installation on any surface shall be construed as an acceptance of such surface and acceptance of all prevailing conditions, and as a waiver of any subsequent claim to the contrary.

2. Installation

a. Surfaces to receive cement mortar shall be dry and thoroughly cleared of all dirt, paint and other materials which may adversely affect the bond of the setting bed.

b. Joints between adjacent pieces of precast units, and between precast units and adjacent pointing mortar coloured to match the colour of the precast unit with which it is used as approved.

c. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connections and joints with shrinkage-resistant grout consisting of pre-mixed, non-staining compound and only enough water to provide a flowable mixture without segregation or bleeding.

d. Paving in basement shall receive mastic pointing at edges with adjacent finishes.

3. Quality Control Evaluations

a. The Contractor shall provide all the requirements for quality control and testing methods to be used in evaluating the production of precast concrete units to the satisfaction of the Engineer.

b. Dimensional Tolerances

i. Comply with the applicable requirements for dimensional tolerances specified in PCI MNL 117.

ii. Units having any dimension smaller or greater than required, and outside the specified tolerance limits, will be considered deficient and subject to rejection.

iii. Precast units having any dimension greater than required will be rejected if in the opinion of the Engineer the appearance or function is adversely affected, or if the larger dimensions interface with other construction. Repair, or remove and replace rejected units as required to meet the construction conditions.

c. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions:

i. Failure to meet compressive strength tests requirements.

ii. Reinforcement not conforming to specified fabrication requirements.

iii. Concrete curing, and protection of precast units against extremes in temperature, not as specified.

iv. Precast units damaged during handling and erection.

v. Poor workmanship and quality control likely to result in deficient strength.

d. Testing Precast Concrete Units for Strength: When there is evidence that the strength of precast concrete units does not meet specification requirements, the Contractor shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42.

i. Test results shall be made in writing to the Engineer on the same day that tests are made. Include in test reports the project identification name

and number, date, name of precast concrete manufacturer, identification letter, number and type of member or members represented by core tests, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.

e. Patching: Where core test results are satisfactory and precast units are acceptable for use in the work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

BEDS AND SCREEDS (03500)

A. Scope

Screeds are to be the depths, thickness and location shown on the drawings.

Screeds shall be furnish in roof, terraces, parkings and where shown on the drawings.

B. Performance and standards

1. The proportion of the mixes used and the hardness of the finished beds and screeds should be determined during the course of the work by methods referred to in clause 72 B of BS CP 204. Specimens shall be provided from samples of the mixes being made and in accordance with the stipulations contained in CP 204. All screeds and beds shall be free of curling, and shall not crack unduly.
Hollow sounding areas shall be cut out and shall be made good.

2. The tolerance of screeds and beds shall be in accordance with BS CP 204.

3. Standards
BS CP 203, Tile Flooring and Slab Flooring.
BS CP 204, In-Situ Floor Finishes.

C. Related Items

Joint Sealers	07900
Membrane Roofing and Waterproofing	07500-07100

D. Submittals

1. Aggregate Samples
Supply samples for the Engineer's approval of all aggregates, sources of supply are to be indicated.

2. Aggregate Testing
Carry out preliminary tests on natural aggregates to determine drying shrinkage as set out in BRE Digest 35, and submit results for approval. Carry out tests on aggregates to BS 812 for the following and submit for approval.

a. Sieve Analysis

b. Clay and Fine Silt

c. Specific Gravity

d. Water Absorption

e. 10% Fines Value

3. Additives
Additives such as workability aids shall not be used without permission of the Engineer. If such permission is sought full particulars of the material shall be submitted.

4. Sample of Screed
Prepare specimens of the mixes being used for the approval of the Engineer.

5. Other Materials
Submit manufacturer's data for all ancillary materials used in conjunction with the laying of beds and screeds.

E. Product Handling

1. General
The specifications regarding the delivery, storage, handling and transport of cement and aggregates, Cast In Place Concrete, shall apply.

2. Mixing
Except where hand-mixing of small batches is approved by the Engineer, mechanical mixers of an approved type shall be used. Mixers shall be thoroughly cleaned after each batch and kept free of deposit from previous batches.

3. Transport and Placing
Care shall be taken to avoid contamination or segregation of ingredients in the manner in which mixed materials are transported and placed.

F. Materials

1. Cement
Cement shall be ordinary Portland Cement to BS 12.

2. Fine Aggregates
Clean washed sharp pit sand to BS 882, Part 2 Table 2, Zone 2, well graded from 5mm down.

3. Coarse Aggregate
Clean washed crushed shingle to BS 882, Part 2, Table 1, well graded from 10mm down. Maximum drying shrinkage of concrete : 0.045%.

4. Aggregate Quality
All aggregates shall be free from deleterious algae or minerals.

5. Additives
Additives shall not be used without the permission of the Engineer. If permitted, such use must be maintained throughout the Contract and trowelling off must be carried out at the correct period. Calcium chloride shall not be used.

6. Water
Water shall be clean and uncontaminated to the Engineer, and shall be tested if so instructed by the Engineer to BS 3148.

7. Bonder
The bonder shall be a PVA based adhesive. The bonding agent shall also be incorporated in the screed mix as recommended by the manufacturer.

8. Separating Layer
Separating layer shall be as shown on the drawings, and provided by an approved manufacturer.

9. Screed Mixes

a. For screed thicknesses up to and including 40mm 1:3 cement: fine aggregate by volume, bonded.

b. For screed thicknesses in excess of 40mm 1:1 1/2:3 cement: fine aggregate: coarse aggregate by volume, unbonded.

G. Workmanship

1. General
Comply with the recommendations of BS CP 202 and BS CP 204.

2. Preparation
Protect all existing work and approaches with sheets, duck boards or other suitable means.
Clean all bases thoroughly to remove all dirt, dust, rust and oil.

3. Roof screed Preparation
Before laying screed cut shall neat holes through roof slab at low points to effectively drain surplus water. When screed has drained completely, fill and seal holes to approval.

4. Pipes, Conduits Etc.
Where any pipe, conduit, bolt head or other article is to remain buried in the screed, it shall have a strip of wire netting overlaid of sufficient width to extend 225mm each side beyond the pipe etc.

5. Unbonded Screeds
Lay polythene sheet on the base and lap all joints not less than 50mm.

6. Batching and Mixing
Mixes incorporation dense aggregate shall be batched by weight.
The water content of mixes shall be the minimum necessary to achieve full compaction, and low enough to prevent excessive mortar being brought to the surface during compaction.

7. Laying
The screed shall be laid so that the surface is even, smooth and free of ridges, and shall be fully compacted by approved means. Cement shall not be sprinkled on the surface.
Maintain precise levels or falls as required.

8. Joints
Screeds and beds shall be laid in alternate bays not exceeding 10 square meters, limiting the length of each bay to 1 1/2 times the width. The forms used shall be true and square, with steel top surface, securely fixed, and at the edges to ensure that joints are level and close butted. Wherever practicable form a joint to coincide with construction joints concrete base.

9. Tolerances
Sudden irregularities shall not be permitted. The maximum permissible deviation from the designed level or fall shall be plus/minus 3mm in any distance of 2m, non-accumulative.
The roof screed low spots will not be acceptable between drainage outlets.

10. Curing and Drying Out
Immediately after laying protect the surface from wind, draughts and strong sunlight.
As soon as the screed has set cover it closely with polythene sheeting and keep it so covered for not less than 7 days.
Do not heat screeds or the building artificially during the first 4 weeks after laying, then raise the temperature slowly.
Prevent damage by following trades.

11. Roof Screeds

The Programme shall be arranged to ensure that roof screeds are as dry as practicable when waterproof coverings are laid.

Roof screeds laid to falls shall be bonded over the full areas of the screed in all cases where the minimum screed thickness is less than 35mm.

EXPANSION & CONTRACTION JOINTS (03250)

A. Scope

1. This section specifies materials and workmanship for movement joints in the structure and finishes. Sealants for expansion and contraction joints are specified in section 07900.

2. Expansion joints in structural concrete occur as detailed on the drawings. Intermediate contraction joints in concrete structures will be incorporated as necessary.

B. Performance and Standards

1. Joint and infilling materials shall be constructed in accordance with the Specification and with all relevant manufacturer's recommendations, including preparation of surfaces, and shall maintain their essential characteristics in all conditions of temperature, humidity and solar radiation that can be anticipated at this site..

2. The recommendations of relevant British Standards shall be complied with where applicable, in particular :
Design of joints and jointing in Building Construction : BS 6093
Flexible PVC compounds : BS 2571
Guide to the selections of Constructional Sealants : BS 6213

C. Related Items

Concrete Formwork :	03100
Cast-In Place Concrete.	03300
Joint Sealers	07900

D. Submittals

1. Substitutions
The Contractor shall submit for the Engineer's approval, full details and technical literature for any materials or product that he wishes to substitute for an item specified or shown on the drawings.

2. Inspection
Where a joint is to be hidden by subsequent construction or cladding, the Contractor shall advise the Engineer so that an inspection of the work may be carried out before the work is hidden.

E. Product Handling

All materials for the construction of expansion and contraction joints shall be handled and stored strictly in accordance with the manufacturer's instructions and any relevant British Standards, in particular, the Contractor shall refer to manufacturer's literature for guidance on safety precautions when handling and applying any toxic materials.

F. Materials

1. Joint filler
Expansion joints in structural concrete and concrete shall be filled with :

a. Compressible filler board consisting of Polystyrene board approved by the Engineer.

b. Compressible backing rod cell expanded polyethylene or polyurethane.

2. Sealant
Joint sealants are specified in section 07900.

3. Back-up to sealants
Sealants shall be separated from joint filler materials by either backing rod cell foam or approved bond breaking tapes which not adhere to the sealant.

4. Water Bars
Water bars for concrete, where specified on the drawings shall be external type flexible high grade PVC.

5. Crack inducers
Crack inducers at partial contraction joints in paving shall be approved by the Engineer.

G. Workmanship

1. General
Expansion and contraction joints shall be constructed in accordance with all relevant British Standards, and with the recommendations of the manufacturers of individual components and materials. In particular, the correct sequence of assembly shall be maintained.

2. Width of joints
Expansion joints in both Concrete and Concrete Blockwork shall be constructed to be within a plus or minus 3mm tolerance of the followings:

a. 40mm wide horizontally and as shown on drawing.

3. Falsework
The Contractor shall provide sufficient falseworks to ensure that joints, including insets such as water bars, crack inducers etc … remain true to line and level during concreting. Dowel bars in slabs and pavings shall be maintained parallel to the line of action of the joint.

4. Joint fillers
Joint fillers shall be of the correct thickness to fill the width of the joint, and for face work shall be set back from each fairface set as to form a groove for the application of sealant.

5. Sealing
Surfaces to receive jointing materials shall be free of dust, loose particles, moisture, oils, greases, or corrosion products, and any temporary protective coatings shall be removed. Except where backing rod cell are shown on the drawings, an approved bond breaking tape the joint filling material. This tape shall not lap over or adhere to the concrete faces.

6. Continuity of seals

The Contractor shall ensure that the continuity of seals in maintained at the intersections of joints, and in concrete blockwork that junctions with cloaks, etc., are correctly executed.

DIVISION 4

MASONRY

DIVISION 4

MASONRY

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Division 4

MASONRY

MASONRY MORTAR (04100)

A. Scope

1. This Section specifies the constituent materials, mixing, handling and testing of mortars for use with precast concrete blockwork.

2. Procedures for the use of mortars with precast concrete blockwork are specified in Section 04220.

B. Performance and Standards

1. Performance
The constituent materials for mortar shall be subject to the same standards of quality control as those specified for cast-in-place concrete, with regular sampling and testing. Sampling and testing of mortar mixes shall also be carried out to ensure compliance with the requirements of BS 5628.

2. Standards

Cement:	Portland cement complying with BS 12, Part 2.
Sand:	Naturally occurring sand complying with BS 1206, BS 1199, BS 1200
Water:	To comply with requirements of BS 3148.
Colouring Agents:	To comply with the requirements of BS 1014.
Plasticisers:	To comply with the requirements of BS 4887.

Sampling and Testing of Aggregates: Carried out in accordance with BS 812, Parts 1-4.
Storage and Testing of Mortar Samples: Carried out in accordance with BS 4551.
Strength of Mortar: Complying with BS 5628, Part 1.

C. Related Items

Masonry accessories 04150

Concrete Unit Masonry 04220

D. Submittals

1. Sampling of Materials
As soon as practicable but at least 8 weeks before the commencement of laying, the Contractor shall arrange for representative samples of sand and cement for the approval of the Engineer. Samples shall be labeled as follows:

a. Type of material

b. Name of site

c. Name of supplier.

d. Source

2. Compliance of Materials
The constituent materials for mortar shall be subject to the same standard or certification and compliance as those specified in Section 03300 for cast-in-place concrete.

E. Product Handling

1. Storage of Cement
Cement shall be stored off the ground in a dry structure so as to permit inspection and used in the order of delivery. Cement affected by dampness shall not be used.

2. Storage of Sand
Sand shall be stored separately, according to type, where it will not become contaminated.

3. Reconstitution
Mortars shall be used before the initial set takes place. Any mortar left after this shall be discarded, and on no account shall mortars be reconstituted.

4. Cleanliness
All plant and equipment used for mixing and transporting mortar shall be kept clean. All such containers shall be thoroughly washed out whenever mixing ceases, or whenever there is a change of mix.

F. Materials

1. Cement
The cement used in mortars shall be:
- Portland cement to BS 12 - Part 2.

2. Sand
Sand for mortar shall comply with the requirements of either BS 1206, or BS 1200 and the grading shall be to BS 1200. Sand which has been in contact with sea-water shall not be used unless the Engineer is satisfied that it has been washed adequately and that no trace of deleterious salts remains.

3. Water
Water shall be clean and free from any harmful impurity, and shall pass the tests referred to in BS 3148.

4. Calcium Chloride
Calcium chloride or additives based on calcium chloride shall not be used.

5. Colouring Agents
Pigments shall conform to the requirements of BS 1014 and shall be premixed with the cement or sand, so as not to exceed 10% by weight of the cement in the mortar, care being taken to ensure that the strength of the mortar remains adequate. Carbon black shall be limited to 3% by weight of the cement.

6. Plasticisers
Plasticisers shall conform to the requirements of BS 4887, and shall be used only with the written approval of the Engineer. Only plasticisers of known chemical compositions shall be permitted. Where permitted they shall be used strictly in accordance with the manufacturer's instructions.

G. Workmanship

1. Proportioning
The proportioning of the constituents in all mortars for blockwork shall be those given BS 1200 corresponding to the appropriate mix specified by the Engineer in each respective section.

2. Mixing
Every batch of mortar shall be thoroughly mixed and shall be used within 2 hours of mixing.

MASONRY ACCESSORIES (04150)

A. Scope

1. This Section specifies wall ties for blockwork joints for blockwork.

B. Performance and Standards

1. All materials shall perform as required without deterioration due to dampness of other conditions.

2. Standards.
The Structural Use of Masonry : BS 5628, part 1.
Hot Dip Galvanized Coatings : BS 729

C. Related Items

Concrete Unit Masonry	04220
Metal First Fixing	05010

D. Submittals

1. Samples
The contractor shall supply samples for the Engineer's approval.

E. Product Handling

1. Delivery
Materials shall be properly packed and labeled for delivery.

F. Materials

1. General
The wall ties shall be vertical twisted type constructed galvanized steel strip and shall be obtained from approved manufacturer and complying with BS 1243.

2. Strip Reinforcement to concrete
These shall be woven mesh made from high tensile steel wire with straight tension strands at 19mm centers in widths to suit blockwall used in corners and intersections in blockwall construction.

3. Angles
Angles for support of stonework shall be galvanized steel angles to meet the specification of section 05010.

G. Workmanship

1. Wall Ties & Strip Reinforcement
Build in ties as specified in Section 04220.

CONCRETE UNIT MASONRY (04220)

A. Scope

1. This Section covers the performance standards, materials, workmanship and other requirements to be met in the construction of precast concrete blockwork as required for walls and partitions, cavity walls, sills, closing up openings and cavities.

B. Performance and Standards

1. The blockwork is designed, detailed and specified to achieve a performance not less in any respect than that described in BS CP 121, Part 1: code of Practice for Walling, Brick and Block masonry, and BS 5628, Part 1 : The Structural Use of Masonry. Materials and workmanship shall comply with the above Codes of Practice and all relevant British Standards, in particular BS 6073, Parts 1 and 2. Precast Concrete Blocks, as included in his specification, and with the recommendations and instructions of the manufacturer.

2. The constituent materials for precast concrete blocks will be subject to similar standards of quality control to those specified for in-situ concrete work, with regular sampling and testing of cement, sand, coarse aggregate and water, as specified in Section 03300.

C. Related Items

Masonry Mortar	04100
Masonry Accessories	04150

D. Submittals

1. Sample Blocks
The Contractor shall submit for approval samples of each type of block specified. Sufficient samples shall be provided to show the range of appearance and surface quality within which the blocks shall lie.

2. Sample Wall panels
As soon as possible upon obtaining possession of the site the Contractor shall erect samples of blockwork using the specified mortar.
Sample panels shall be not less than 2m square. Samples shall be produced until the approval of the Engineer is obtained, and the approved sample shall be retained and protected until all blockwork is completed.

3. Testing
All sampling and testing of blocks shall be carried out in accordance with BS 607, Part 1 and the frequency of testing shall be as directed at any time by the Engineer.
Certified copies of test reports shall be submitted as soon as possible after testing.
The testing of all materials used in the manufacture of the blocks shall be in accordance with the relevant British Standards and test reports shall be made available if called for by the Engineer.

E. Product Handling

1. Storage of Materials
The Contractor shall provide storage for all materials suitable for their respective kinds. Cement delivered in bags shall have a weatherproof store having a raised

timber floor. (a concrete floor will not be permitted) to avoid any presetting of the material.
Storage shall be so organised to ensure a turnover of stocks on the basis of first delivered, first used. All masonry accessories shall also be stored under cover.
Sands shall be stored separately according to grade, on a prepared base that will prevent the possibility of contamination, particularly from soil.
Blocks shall be stored in stacks on a prepared base.
All deteriorated blocks shall be removed from site.

2. Maturing
No blocks shall be built into the structure until 21 days have elapsed from the completion of the manufacturing process allowing a longer period if possible.
No "hot" blocks shall be delivered to site.

F. Materials

1. Precast Concrete Hollow Blocks
The hollow blocks shall be made with an approved block making machine and the blocks and their constituent materials shall conform in all respects with BS 6073, Part 1. The blocks shall be of the following work sizes:
400 x 200 x 200 Hollow
400 x 200 x 150 Hollow
400 x 200 x 100 Hollow
400 x 200 x 60 Hollow
And shall be of a minimum compressive strength of 60kg/cm^2.
The hollow blocks shall be minimum 60 minute fire rated where directed by the Engineer.

2. Blocks for Plastering or Rendering
Blocks which are to be plastered or rendered shall have a coarse surface, suitable in all respects to receive plaster or render.

3. Brick tiles
Brick tiles shall be as manufactured by Muller industries, type (Marseille) or equivalent approved by the Engineer.

4. Cement
Grey cement and white cement shall conform to the requirement of BS 12 and shall be delivered to site in sealed bags.

5. Aggregate
Aggregate shall be obtained from approved sources which shall be capable or supplying adequate guaranties of a consistent quality throughout the contract. The aggregates shall be one or more of the aggregates listed in paragraph 5.2 BS 6073, Part 1, and shall conform with the British Standards listed therein appropriate to the selected aggregate.

6. Water
Water shall be clean, free from impurities and shall pass the tests referred to in BS 3148.

7. Other Materials
The specification for other materials used in concrete blockwork construction is to be found in the Section listed below:

Masonry Mortar	04100
Masonry Accessories	04150
Joint Sealers	07900

G. Workmanship

1. Precast Concrete Blockwork

a. Laying and Jointing: Generally

Lay concrete masonry units with full mortar coverage mix (1:4) on horizontal and vertical face on the units.

Construct walling with all materials fully bonded or tied together and joints filled to ensure compliance with design requirements for stability and strength. Block walls are to be full height, floor to underside of roof, unless otherwise detailed, made good around all services.

b. Accuracy

Blockwork, unless specified otherwise by the Engineer, shall be constructed to the tolerances given below. Notwithstanding the above, all work shall be set out carefully to ensure satisfactory junctions and joints with adjoining or built-in elements and components.

Tolerances:

i. Length
Up to and including 5m, plus or minus 10mm.
Over 5m up to and including 10m, plus or minus 15mm.

ii. Height
Up to and including 3m, plus or minus 5mm.
Over 5m up to and including 6m, plus or minus 15mm.
Over 6m, plus or minus 20mm.

iii. Straightness
In any 5m (not cumulative), 10mm.

iv. Vertically
In any 8 courses, plus or minus 5mm.
Blockwalls shall not deviate more than 10mm from the vertical in their full height.

c. Height of Lifts

No portion of any section of the work shall rise more than 1.2m above the general level at any time: Between levels during construction the work shall be racked back. The maximum height of blockwork that shall be built in a day is 1.5m.

d. Bonding

The walls shall be built in stretching half lap bond when not specified otherwise. Setting out shall be carefully predetermined so that full carefully predetermined so that full length blocks occur beneath lintols.

e. Pointing

Samples of pointing to by approved by the Engineer.

f. Built-in Work

Built-in items such as door jamb, louvres, access doors, lintols, steel plates shall be grouted solidly into masonry work.

g. Interruption of the Works

Freshly laid work shall be adequately protected at the completion of each day's work and at any interruption caused by rain or any other factor.

h. Curing

As laid, the work shall be kept continuously damp by sprinkling for not less than 2 days, or such other method as the Engineer may approve.

j. Appearance

i. Blocks shall have unbroken arises and flat surfaces.

ii. Use solid blocks when cutting is required at jambs, junctions and closing of cavities ends.

iii. Putlog scaffolding will not be permitted.

k. Colour

Unless the wall is to be painted or coated, blocks of varying colour shall be evenly distributed throughout the work so that no patches appear. Different deliveries which vary in colour shall be mixed to avoid horizontal stripes and racking-back marks.

l. Chases and Holes

Chases and holes where permitted blockwork shall be in approved locations. They shall be cut cleanly without damage to the wall, using suitable tools, to the smallest practical size and not more than:

i. Horizontal and diagonal chases, 13mm depth.

ii. Vertical chases, 25mm depth.

iii. Holes, 300mm square.

m. Anchors

Provide continuity at corners and wall intersections by use of prefabricated "L" & "T" sections. Anchor walls to concrete members horizontally and vertically with "L" shaped anchors.

n. Seismic system

Constructives dispositions of Masonry shall be applied according to the seismic regulations of PS92 (Règles de Construction Parasismique, item 12.3) the Contractor shall submit shop drawings for approval.

2. Brick tiles

Brick tiles shall be true and free from deleterious cracks, laminations, cavities and block core.

Brick shall be laid or wood backing fixed on concrete, as shown on drawing.

The work shall be executed as per manufacturer’s instruction and by an experience skilled and to the approval of the Engineer.

DIVISION 5

METALS

DIVISION 5

METALS

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Division 5

METALS

METAL FIRST FIXING MATERIALS (05010)

A. Scope

7. This section specifies metals used in first fixing of all items specified elsewhere in this Specification.

8. Metals included are mild steel, galvanized steel, aluminum and stainless steel.

B. Performance and Standards

1. All metals used in the Works shall comply with all relevant British Standards whether or not listed in 05010F below.

C. Related Items

Metal Finishes 05030

D. Submittals

2. Samples
The Contractor shall submit any samples called for by the Engineer.

E. Product Handling

1. All materials shall be handled, stored, transported and protected as necessary to prevent damage or deterioration.

F. Materials

1. Steel
Mild steel sections shall conform to BS 4: Part 1, or rolled from steel to BS 4360 or ASTM A283, ASTM A 786.
Mild steel angles shall conform to BS 4848, Part 4 or ASTM A 36.
Square hollow sections shall conform to BS 4848, Part 2 or ASTM A 53 Schedule 40.
Circular hollow sections shall conform to BS 1387.

2. Cold Rolled Steel
Cold rolled steel sections shall generally conform to BS 2994 or ASTM A 500, Grade 5. Galvanized cold rolled steel shall be made from galvanized sheet to BS 2989.

3. Galvanized Steel
Galvanized steel, not required to be galvanized after manufacture of the complete item shall be to BS 2989. Hot dip galvanized coating shall be to ASTM A 123 Table 1 or ASTM A 153 Table 1.

4. Aluminum
   Wrought aluminum shall be of the alloys stated and shall conform to:
   Angle Channel, I and T Sections - BS 1161.
   Plate Sheet and Strip - BS 1470.
   Drawn tube - BS 1471.
   Bars and Extruded Round Tubes and Sections - BS 1474 or ASTM B 221.
   Alloys 6061-T6 or 6063-T6

5. Stainless Steel
   Bars to ASTM A 276, Type 316L.
   Plate to ASTM A 167, Type 316L.
   Fasteners to ASTM F 593, Type 316L.

6. Iron Casting
   Gray iron casting shall conform to ASTM A48, class 30.
   Malleable iron castings shall conform to ASTM A47, Grade 32510.

7. Brackets, Flanges and Anchors
   Brackets, flanges and anchors shall match the supporting rails.

8. Fixings and Fastenings
   Fixings and fastenings shall be of adequate size and frequency to provide the necessary stability and strength.
   Unless otherwise specified fastenings are to be of the same metal as the item being fixed with matching finish or coating.
   Steel bolts and nuts shall conform to BS 4190 and have 150 metric screw threads conforming to BS 3692 or ASTM A 307.
   Machine screws and nuts shall conform to BS 4183 or to FS FF-S-92.
   Anchor bolts shall be approved by the Engineer.
   Self-tapping screws shall conform to BS 4174 or FS FF-S-92.
   Wood screws shall conform to BS 1210 or FS FF-S-111 flat head carbon steel.
   Drilled in expansion anchors: shall conform to FS FF-S-325, Group VIII Type I and machine bolts complying with FS-B-575 Grade 5.
   Concrete inserts threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers and shines as required, hot dip galvanized, ASTM A 153.
   Drilled-in Expansion Anchors complying with FS FF-S-325 - Group VIII, Type 1, and machine bolts complying with FS-FF-B575.

G. Workmanship

1. Quality of Work
   Fabricate metalwork carefully and accurately to ensure compliance with design and performance requirements, using types and grades of metal appropriate for the purpose. Finished work must be free from distortion and cracks. Use proprietary products to manufacturer's recommendations.

2. Corners
   Unless specified otherwise, miter junctions of identical sections. Miters shall be precisely formed and true in plane.

3. Holes
   Holes for metric bolts and screws to be sized to BS 4186, medium fit series, unless specified otherwise.

4. Cleaning
Remove all burrs and sharp arises which would be visible after fixing or a hazard to the user.

5. Riveted Joints
Riveted joints shall be drawn tightly together, with rivets closed to completely fill holes.

6. Mechanical Joints
Mechanical joints shall be tight with no visible gaps.
Where screw heads will be visible after component is fixed, or raised screw heads would interfere with any moving part of component, use countersunk machine screws unless specified otherwise.
Mechanical Joints of components which will be located externally shall be bedded in bedding compound, including all mating surfaces, cleats and other fixings.

7. Welding of Steel

a. Thoroughly clean surfaces to be welded.
Ensure accurate fit using clamps and jigs where practicable. Use tack welds only for temporary attachment unless specified otherwise.
Make joints with parent and filler metal fully bonded throughout with no inclusions, holes, porosity or cracks.
Completely remove all traces of flux residue and slag.

b. Spatter.
Prevent weld spatter falling on surfaces of materials which will be self-finished and visible in complete work.

c. Butt Welds.
Butt welds which will be visible in completed work shall be finished smooth flush with adjacent surfaces.

d. Metal arc welding to BS 5135, or other equal subject to approval.

e. Do not weld, braze or solder on site without approval.

8. Site Dimensions
Site dimensions must be taken before starting where necessary to ensure proper fit and relationship to other parts of the building elements.

9. Compatibility of Materials
Where different metals which are incompatible are in contact, then the Contractor shall introduce a separating membrane or coating between the contact faces.
Before fixing apply two coats of bitumen solution, or mastic impregnated tape, to surfaces of aluminum in contact with blockwall, concrete, plaster, render, or non compatible metal.

METAL FINISHES (05030)

A. Scope

1. This section covers the following types of finish to the surface of metals except where finishes are specified in other sections of the work:
- Galvanizing; zinc spraying;
- Anodizing.
- Works Priming.

B. Performance and Standards

1. All finishes shall be applied in conformity with the recognized best methods in the trade; in the case of coatings shall measure up to the specified density and/or thickness; shall where so specified afford the intended protection to the metal; shall, where required for decorative purposes, present a uniform, even and unblemished surface; and shall maintain its specified quality on all surfaces including arises, joints, internal corners and wherever the protection or decorative effect is required.

2. All finishes shall withstand all conditions of temperature, humidity, solar radiation, sand abrasion and other conditions that can be expected at the Site, to the extent that is generally accepted as good quality and good practice.
All finishes shall conform all current relevant British Standards with particular reference to the following:
- BS CP 3012 Cleaning and Preparation of Metal Surfaces.
- BS 729 Hot Dip Galvanised Coatings on Iron and Steel Articles.
- BS 1615 Anodic Oxidation Coatings on Aluminum.
- BS 1706 Electroplated Coatings of Cadmium and Zinc on Iron and steel.
- BS 2569 Sprayed Metal Coatings: Parts 1 and 2.
- BS 2989 Hot-dip Zinc Coated Steel Sheet and Coil.
- BS 3698 Calcium Plumbate Priming Paints.
- BS 2987 Anodic Oxide Coatings on Wrought Aluminum for External Architectural Application.
- BS 4232 Surface Finish of Blast-cleaned Steel for Painting.
- BS 4479 The Design of Metal Articles that are to be coated.
- BS 4652 Metallic Zinc-rich Priming Paint.
- BS 5493 Code of Practice for Protective Coating of Iron and Steel Against Corrosion.
- BS 6001 Sampling procedures and tables for inspection by attributes.
- ASTM A123 Table 1, Hot dip galvanizing.
- ASTM B633 Electro-galvanizing.
- ASTM A446 Hot dip galvanizing steel sheet.
- ASTM A153 Table 1, Galvanizing coating on iron and steel hardware.
- ASTM A383 Table 1, Galvanized coating on assembled steel products.
- SSPC Good Painting Practice.
- SSPC Systems and specifications.

C. Related Items

Metal Materials	05010
Metal Fabrications	05500

D. Submittals

1. Samples
The Contractor shall provide the Engineer for approval with any samples called for to demonstrate the quality of the metal finishes, and shall only proceed with the generality of the work when the relevant samples have been approved.
In particular, samples shall be provided to enable selection to be made of colour and tone of Aluminum works..

2. Guarantee of Anodizing or Powder Coated Finish
The firm carrying out anodizing or powder coated works shall be an approved specialist firm who shall furnish to the Engineer a written guarantee against failure of the finish over a ten year period subject to reasonable maintenance by the Employer as recommended by the specialist firm.
Information on processes and methods shall be submitted as detailed in G3 below.

E. Product Handling

1. General
Prevent all damage to surfaces.

2. Protective Film
Apply protection film to all exposed bright work or Aluminum works. The film shall be applied prior to site delivery and completion of the Contract without leaving adhesive remnants on the protected item.
The requirements in respect of handling and temporary protection set out in Appendix G of BS 3987 relating to Aluminum works shall be strictly complied with.

F. Materials

1. Galvanized Steel Sheet
Galvanized steel sheet, not required to be galvanized after manufacture of the completed item, shall be to BS 2989.

2. Galvanized Works
Unless otherwise described, work specified to be galvanized shall be galvanized after manufacture or fabrication by immersion in a zinc bath in one operation in accordance with BS 729, to produce a coating not less than 200 micron.

3. Anodizing of Aluminum

4. All anodic coating and sealing of Aluminum members shall conform to the requirements of BS 3987 and BS 1615.

5. The work shall be carried out by a firm approved by the Engineer.

6. Anodizing shall be by the 'hard' integral process. The Kalcolor, Analok or Duranodic processes, applied in each case to the appropriate Aluminum alloy, will be acceptable. The Contractor shall be responsible to ensure that the correct alloy is used and that the anodizing firm and the manufacturer of the articles to be anodized are mutually satisfied on this point. The Engineer shall be informed of the selected process.

7. The thickness of the anodic coat shall be an average of 25 microns, and not less than 21 microns.

8. The colour and surface texture of each category of anodized items shall be selected by the Engineer by reference to approved samples.

9. The texture of all anodized surfaces shall be mechanically produced, non-directional etched, and shall be satin unless otherwise specified.

10. The anodizing of any part or component shall be carried out as far as is feasible after that part or component has been fully formed and fabricated.

11. Powder Coated Finish of Aluminum
The procedure of powder coated shall be as follows:
- After decreasing and cleaning, the profiles shall undergo a chemical conversion treatment.
- The thermo-hardinery polyester powder coated shall be applied under an electrostatic pulverisation field.
- Then the complete polymerisation of the polyester powder shall be obtained by heating in an over to a temperature of + 190^{O}C.
- The coating thickness shall be 60 microns.

12. Works Priming of Steel
Primer for steel, shall apply, and is to be painted on site shall be calcium plumbate primer to BS 3698.

G. Workmanship

1. General
All finishes shall be properly applied to give a surface free from distortion or cracks, and shall be subject to strict quality control.
Making good of damaged finishes shall only be done with the agreement of the Engineer and by approved methods.
Where making good is not agreed, the damaged component shall be removed and replaced.

2. Preparation
All metals shall be carefully and thoroughly prepared for the finish that is to be applied including cleaning and removal of dirt and loose particles by hand, power driven carborundum discs, wire brushes (where steel is being prepared wire brushes must have steel bristles) etc. All welding slag, weld spatter, anti-spatter compounds, paint, grease, flux, rust, burns and sharp arisses shall be removed. All defects which would show after application of the finish shall be made good.

3. Anodizing
The anodizing shall present a uniform appearance of all visible surfaces in a colour and texture corresponding to the approved sample for the item concerned, and within the range of tolerance for colour and texture demonstrated by the approved tolerance samples. The extent of 'significant' surfaces, as defined in BS 1615, shall be agreed between the manufacturer and the anodised, and approved by the Engineer, as shall the position and size of contact marks. All necessary pre-anodic treatments to achieve the required textural finish shall be carried out. The film of anodising shall be free of inter metallic particles, resistant against pitting and bloom, and free from banding or streaking.
The sampling procedures applied to general production for acceptance of the product by the Engineer shall be agreed with the Engineer and shall be in accordance with guidance given in BS 6001.

4. Powder Coating
The powder coating shall present a uniform appearance of all visible surfaces in colour and texture corresponding to the approved sample for the item concerned. Within the range of tolerance for colour and texture demonstrated by the approved tolerance samples.

5. Works Priming
See sections 09900 for full Painting Specification. Entirely coat the whole of the fabricated steelwork, prior to assembly, including all contact surfaces, with specified primer, applied to prepared surfaces which shall be clean and dry.

METAL FABRICATIONS (05500)

A. Scope

This section covers metal fabrications but not limited to the following:

- Metal ladders
- Balustrades and handrails
- Corugated sheet cover
- Lift
- Features.

B. Performance and Standards

1. All handrails, balustrades and other metal work shall be designed to withstand an intensity of load on the top rail of 740N/m whether cast iron or steel fabrication.

2. All work shall be as approved by the Engineer.
BS CP 3 chapter V, Part 1 and BS 6180.

C. Related Items

Metal Materials 05010

Metal Finishes 05030

D. Submittals

1. Samples
The Contractor shall supply such samples as the Engineer may require, fully finished except where the finish is to be site applied.

2. Shop Drawings
The Contractor shall provide at his own expense all layout and detailed drawings as required by the Engineer. The responsibility and the procedure for submission of drawings shall be as set out in section 01300, Submittals.

Where Site dimensions have been taken prior to the submission of the drawings, Site dimensions which vary from design dimensions shall be given on the drawings and they shall be clearly identified as such.

E. Product Handling

1. Protection and Handling Generally
Prevent distortion of metalwork during transit, handling, storage and fixing.
Store under cover.
Protect finishes.
Prevent damage to arises, projecting features, and surfaces which will be exposed in the finished work.
Prevent contact with mud, ashes, plaster and cement.
Provide protective coverings as necessary and remove all protection on completion.
Do not use railings as strutting or supports after fixing.

F. Materials

1. All materials shall be as set out in section 05010, Metal Materials.

2. All fabrications shall accord with the Engineer's detail drawings or with shop drawings when these have been approved by the Engineer.

G. Workmanship

1. Quality of Work
Fabricate metalwork carefully and accurately to ensure compliance with design and performance requirements, using types and grades of metal appropriate for the purpose. Finished work must be free from distortion and cracks. Use proprietary products to manufacturer's recommendations.
Where appropriate, metalwork shall be fabricated with rebates to receive other finishes.

2. Pre-finished Metal
Pre-finished metal may be used if:

- Finish complies with this Specification.
- Methods of fabrication do not damage or alter appearance of finish.
- Finish is adequately protected during fabrication.

3. Corners
Unless specified otherwise, mitre junctions of identical sections. Mitres shall be precisely formed and true in plane.

4. Holes
Holes for metric bolts and screws to be sized, medium fit series, unless specified otherwise.

5. Moving Parts
When assembled all moving parts must move freely and without binding.

6. Cleaning
Remove all burrs and sharp arises which would be visible after fixing or a hazard to the user.

7. Bonding
Prepare surfaces of metals to receive adhesives by degreasing and abrading mechanically or chemically.
Use adhesives to manufacturer's recommendations.
Form bond under pressure.

8. Riveted Joints
Riveted joints shall be drawn tightly together, with rivets closed to completely fill holes.

9. Mechanical Joints
Mechanical joints shall be tight with no visible gaps.
Where screw heads will be visible after component is fixed, or raised screw heads would interfere with any moving part of component, use countersunk machine screws unless specified otherwise.
Mechanical Joints of components which will be located externally shall be bedded in bedding compound, including all mating surfaces, cleats and other fixings.

10. Welding of Steel

Thoroughly clean surfaces to be welded.

- Ensure accurate fit using clamps and jigs where practicable. Use tack welds only for temporary attachment unless specified otherwise.
- Make joints with parent and filler metal fully bonded throughout with no inclusions, holes, porosity or cracks.
- Completely remove all traces of flux residue and slag.

11. Spatter.

- Prevent weld spatter falling on surfaces of materials which will be self-finished and visible in complete work.

12. Butt Welds.

- Butt welds which will be visible in completed work shall be finished smooth flush with adjacent surfaces.

13. Welding of Steel.

- Metal arc welding subject to approval.

14. Welding of Stainless Steel.

- TIG welding or other methods subject to approval. Use double level butt welds, backing bars to remove heat, jigging, tack welds and any other measures necessary to minimize distortion. Remove slight distortion by light hammering, taking care not to damage surface finish.

15. Welding of Aluminum Alloys.

- TIG welding or MIG welding or gas welding or other methods subject to approval.
- Do not weld, braze or solder on site without approval.

16. Site Examination
Site dimensions must be taken before starting where necessary to ensure proper fit and relationship to other parts of the building elements.

17. Compatibility of Materials
Where different metals which are incompatible are in contact, then the Contractor shall introduce a separating membrane or coating between the contact faces.
Before fixing apply two coats of bitumen solution, or mastic impregnated tape, to surfaces of aluminum in contact with brickwork, concrete, plaster, render, or non compatible metal.

18. Fixing

- Position metalwork accurately, plumb, level and true to line. Fix securely to prevent pulling away, deflection, or prevent other movement during use. Do not distort when tightening fastenings.

19. Cast iron Railings and Handrails

- Fabricate railings and handrails to comply with requirements indicated for design, dimensions, details, finish and member sizes, including wall thickness of pipe, post spacings and anchorage, but not less that than required to support structural loads.
- Interconnect railing and handrail members internal connectors units.

- Provide wall brackets, end closures, flanges, miscellaneous fittings and anchors for interconnections and attachment of railings and handrails to other work. Furnish inserts and other anchorage devices for connecting railings and handrails to concrete or masonry work.
- For railing posts set in concrete, fabricate sleeves less than 150mm (6 inches) long and with steel plate closure welded to bottom of sleeve.

20. Lift

All materials used in this work shall be as specified in their relative section.

21. Miscellaneous Steel and Structural Steel

- Furnish and install steel framing, posts, bracing, brackets, columns, beams, girders, plates, angles, channels, closures, brackets and miscellaneous steel indicated on the drawings or described in this specification.
- Miscellaneous steel shall include required support steel for the work of this section, and for the work of other sections.
- Steel members shall be of such shapes and sizes indicated on the drawings and details or as required to suit the condition and shall be provided with necessary supports and reinforcing such as hangers, braces, struts, clip angles, anchors, bolts, nuts, welds, etc., as required to properly support and rigidly fasten and anchor same in place and to steel, concrete, masonry and other connecting and adjoining work.
- Equip units with integrally welded anchors for casting into concrete or building in to masonry. Space anchors 300mm on center and provide minimum anchor units of 31.6mm by 6.4mm by 200mm steel straps.
- Steel shall be of domestic source conforming to ASTM A36 or equivalent.
- Included under this heading of miscellaneous steel are:

1. Steel angles for framed opening in floors.
2. Steel angles and plates for pipe and duct protection.
3. Elevator tie down and machine beams.
4. Steel supports for cladding if directed by the Engineer.
5. Plaster stops.

DIVISION 6

WOOD AND PLASTICS

DIVISION 6

WOOD AND PLASTICS

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Division 6

WOOD AND PLASTICS

ROUGH CARPENTRY (06100)

A. Scope

1. The work covers Sub-frame, rough framings, blocking and grounds, etc … whether shown on drawings or as commonly necessary in the proper execution of the work of the Contract. The work covers traps … etc and as shown on drawing.

B. Performance and Standards

1. All members shall be employed, secured, jointed as in most appropriate, and constructed so as to transmit the loads and resist the stresses to which they will be subjected.

2. All materials shall conform to the appropriate British Standards where such standards exist, including:
BS CP 112, Part 2: 1971, The Structural Use of Timber.
BS 1186, Quality of Timber and Workmanship in Joinery.
BS 4471, Part 1: Sizes of Sawn and Planed Timber.
BS 1455, Plywood: Note, Grade 3 acceptable for rough carpentry.

C. Related Items

Architectural Woodwork 06400

D. Submittals

1. Samples
If the Contractor wishes to use a timber outside the range of timbers specified he shall obtain the Engineer's approval of the proposed timber.

2. Drawings
Where appropriate, shop drawings shall be submitted for approval.

E. Product Handling

1. General
All timber shall be handled, stored and protected as specified in section 06400.

F. Materials

1. Seasoning and Treatment
All timber used in rough carpentry, whatever its use, shall be properly seasoned and treated with preservative as specified in section 06300, Wood Treatment.

2. General
The timber shall in every case be appropriate to its use, free from pitch pockets, splits, loose, decayed or dead knots, knot holes, knots exceeding half the width of the face on which they occur, rot, beetle attach, and warping detrimental to its specified use.

3. Softwood
Softwood shall be Douglas Fir, European Redwood, Longleaf pine or other equal approved.

4. Nails
Nails shall comply with BS 1207, Part 1, of a type to suit each case.

5. Screws
Steel screws shall be finished to resist corrosion.

G. Workmanship

1. General
All rough carpentry shall be soundly constructed and firmly fixed and shall be properly sized, to perform its intended function, all to the complete satisfaction of the Engineer.
All work shall be full to the dimensions stated, whether wrought or unwrought.

ARCHITECTURAL WOODWORK (06400)

A. Scope

1. The work covers sub-frame, rough framings, blocking and grounds, etc., whether shown on drawings or as commonly necessary in the proper execution of the work of the Contract.

B. Performance and Standards

1. The Design, Materials and Workmanship of all woodwork shall comply with the provisions of BS 1186, Parts 1 and 2: Quality of Timber and Workmanship in Joinery. Where better quality is required this will be noted subsequently in this Specifications.

2. Hardwoods
BS 1186, exposed surface Class 1 in Appendix C. (clauses 8,9,10,11,15,16 shall read 'not permitted').

3. Plywoods
BS 3444, bonding type BR, long grain.

4. Chipboard
BS 2604, minimum density 480 Kg/m^3.

5. Hardboard
BS 1142, section 2.

6. Adhesives
BS 1204, Part 1 Gap filling, Part 2 close contact bonding WBP.

7. Decorative Laminates
BS 3794, Class 1 material.

C. Related Items

Rough Carpentry 06100

D. Submittals

1. Samples of Timber
The Contractor shall provide for the Engineer's approval samples of each species of timber he wishes to use, in accordance with the Specifications.
Each sample shall be labeled to indicate its species and the purpose for which it will be used, and country of origin. Where the indicated use is for a component which is specified as requiring a wood treatment, the sample shall be treated and the labeling shall indicate the treatment.
Where the indicated use is for a component which is to be stained, clear sealed, polished or otherwise finished so that the grain and character of the timber is apparent, two samples shall be provided, one unfinished and one finished.
Each sample shall be a piece 1.5m long; its cross-sectional profile shall accord with its intended use or, where the species will have a variety of uses, shall be not less than 75 x 35mm in section. Approved samples shall be regarded as representative of the quality and characteristics of the timber that shall be used in the work.

2. Alternative Timbers
If the Contractor wishes to use a timber outside the range of specified timbers he shall submit for approval samples of the species for which it is an alternative.

3. Wood Veneer and Melamine Samples
Samples of each type of veneer and melamine shall be submitted for approval.
The samples shall be 1m x 1m applied to their specified baking, and shall have two adjacent edges finished as they will be in the work, including concealed or exposed lipping, chamfering etc., and showing the method of forming and finishing corners.
Where these materials are specified to receive an applied finish half of the sample is to be so finished. In addition to the above samples the Contractor shall submit samples, not less than 200 x 200mm, to show the extremes of colour or grain variation in wood veneers.

4. Other Board and Sheet Samples
Samples, 1m square and with one half finished as may be specified, shall be provided for approval of each type of hardboard, plywood, blockboard, chipboard or other board or sheet material specified, or which the Contractor wishes to use appropriately labeled as in D1 above.

5. Ironmongery Samples
Note: This clause is to be read in conjunction with relevant clauses in sections:
Aluminum Doors and Windows 08120-08520
Ironmongery 08700
Samples of all ironmongery used in the joinery work, whether specified or not, shall be submitted to the Engineer for approval. When approved, a corresponding set of samples, labeled as being approved, shall be lodged with the joinery manufacturers concerned.

6. Prototype Components
For all repetitive items a prototype full sizes is to be prepared for approval, which must be obtained before the main production of each item is commenced.

7. Drawings
Before fabrication is commenced shop drawings of each item which requires such drawings are to be submitted to the Engineer for approval. The drawings shall be fully dimensioned and shall indicate those dimensions which have been ascertained by Site Measurement. They shall be specific as regards indication of materials and compliance with Standards and Specification clauses as appropriate. Methods of fixing and relationship to adjacent components shall be as shown as necessary.

8. Manufacturer's Data
Data covering Specification, recommendation and instructions shall be submitted for the Engineer's consideration on manufactured components, proprietary fittings, sheet, board and laminate materials and adhesives. Where applicable this data shall indicate compliance with the Specification.

9. Certificates
The Contractor shall supply certificates of assurance that all specified preservative and flame retardant treatments have been carried out.

E. Product Handling

1. Handling Generally
All materials and components shall be carefully handled at all times at Works, during transportation and storage and on Site to prevent damage. Any damaged or defective item shall be removed from Site and replaced at no additional cost.

2. Identification
Fabricated items shall be clearly identified by marking or secure labeling, but marking shall not be applied to any surface which will be visible in the finished work.

3. Protection
Joinery shall be stored in the manufacturer's factory stores before delivery and shall be given waterproof cover during transit and at all times kept dry. Timber and woodbase sheet materials shall be stored in stacks with provision for air circulation within stacks. The bottom of stacks shall be protected against contact with damp surfaces.
All necessary precautions are to be taken to protect timber products from fungus or insect attack before, during and after incorporation in the work. Joinery shall be protected from damage with approved temporary covering.

4. Delivery to Site
No joinery shall be delivered to work Site until conditions are suitable.

F. Materials

1. Softwood
Softwood shall conform to BS 1186, Part 1, Class 2. Exposed surfaces shall be as defined in Appendix C. Softwood shall be kiln dried, free from Sapwood, pitch pockets, and Wayne edge.
It shall be free of splits, ring shakes, knots exceeding 25mm diameter or exceeding half the width of the face on which they occur, loose or decayed or dead notes or knot holes unless cut out and plugged.
The softwood shall be of low resin content. The species of timber shall not be mixed unless so specified in any group of items.

2. Hardwood
Hardwood shall conform to BS 1186, Part 1, with exposed surface conforming to Class 1 as defined in Appendix C, subject to the proviso that clause numbers 8,9,10,11,15 and 16 shall read 'not permitted'. The material shall be kiln dried, free from Wayne edge, warping, brittle heart, rot stain (in so far as this will affect the finished appearance only) and beetle attack. Isolated sound tight knots will be permitted provided they do not occur on joints or on visible surfaces.

3. Plywood
Plywood generally shall comply with the requirements of BS 1455, bonding type WBP, Grade 1 face veneer having the grain of the face parallel to the long dimension of the board. The thickness shall be as indicated on the drawings and in no case shall be less than 5mm. Manufacture shall be by the dry-cementing process.
Where plywood is specified on the drawings as 'Resin Bonded' it shall be similar in all respects to a material complying with BS 1088, Plywood for Marine Craft.

4. Blockboard and Laminboard

Blockboard and laminboard shall be to BS 3444, bonding type BR, Grade 1 face veneer, having the grain of the face parallel to the long dimension of the board. The face veneer shall be approved by the Engineer. The thickness of the board shall be as shown on the drawings.

Where the edges of the board are exposed in the work they shall be lipped in hardwood matching the face veneer and shall show 9mm thickness on the board face.

5. Chipboard

Chipboard shall be resin bonded, having a density of not less than 480 Kg/m^3, and shall comply with the requirements of BS 5669. Thickness shall be as shown on the drawings.

6. Fire Resistant Mineral or Extruded Particle Board

Fire resistant cores shall be mineral or extruded particle board and have a Class 0 fire rating with all the properties, strength etc.., as required by the contract or as directed by the Engineer.

7. Hardboard (MDF)

The various type and qualities of fibre boards shall comply in all relevant respects with BS 1142, fibre building boards, for insulating board, standard hardboard and medium hardboard in accordance with section 2 that standard.

8. Veneers

Wood veneers shall be of the timber varieties shown on drawings: all sheets of one variety shall come from the same source. Veneers shall be hard, free from disfiguring defects to the satisfaction of the Engineer, capable of being easily finished to a smooth surface, and consistent in colour and grain.

9. Adhesives

a. General

Synthetic adhesives for general joinery use shall comply with BS 1204, part 1, gap filling: Part 2 close contact bonding WBA: cold setting with in a range of 10° -25° C, warm setting 25° -90° C. The Contractor shall select the type of adhesive appropriate to the form of jointing to be adopted and to the working temperature to be expected.

b. Plywood, Blockboard, Laminboard: adhesives shall comply with BS 1203, WBP Grade.

10. Nails

All nails and pins shall comply with BS 1202, Part 1 of a type to suit each case. Nails in external work shall be galvanized.

11. Screws

All steel screws shall be finished to resist corrosion by sherardizing, cadmium plating, nickel plating or other approved finish.

Screws shall be protected steel, stainless steel, brass silicone bronze, nickel/copper alloy or aluminum as specified on drawings or as appropriate to the work. Screws for fixing hardware shall match the items being fixed.

Screw heads shall be for the generality of the work, countersunk slotted. Screw heads in the finished work shall, unless otherwise described, be brass, bronzed finish with matching fully countersunk brass cups. Phillips cross-head screws or pozidrive screws shall be used where so described on drawings.

12. Bolts

Bolts shall be steel and comply with BS 916 and washers to BS 3410, Part 2.

G. Workmanship

1. Quality
The Contractor shall be responsible for the proper rigid and sound construction of all components and joints including the selection of jointing methods to provide the largest possible gluing area, and the use of suitable and sufficient fixing to all connections.
All joinery shall be substantially fixed to a high standard of accuracy and to Engineer's satisfaction.

2. Site Dimensions
The Contractor shall take all necessary Site dimensions to ensure an accurate fit of all items.

3. Building Tolerances
The Contractor shall take note of the agreed tolerances for the structural element of the buildings.

4. Sizes
Timber sections shown on detail drawings are full finished sizes. The Contractor must allow for sawn sizes that will achieve the dimensions required after planing and machining. Grounds, backings, fixing slips etc. may be sawn sections of the size indicated.

5. Preservative Treatment
No converting to smaller sections, planing, rebating etc. will be permitted after treatment, and cutting to length shall be avoided as far as possible. Cut ends, bored holes etc. made after treatment shall have the cut generously swabbed with an approved preservative.

6. Framing and Jointing
The terms 'frame', 'framed' or 'framing' means work put together by proper carpentry or joinery joints such as morticing and tenoning, dovetailing, doweling etc. Butted and screwed or nailed joints or halved and the like will not be accepted for framed work, unless specifically so shown on the drawings.
All joints shall be properly made and accurately machined to give a perfect fit without gaps between shoulders of the joints and abutting surfaces. All joints shall be glued properly under pressure with the best quality glues of the appropriate type, applied in accordance with the glue manufacturer's instructions.
Open joints disguised with filler will not be accepted. Excess glue shall be cleaned off.
Glue staining of surfaces that are to receive a clear finish will not be accepted.

7. Timber Finishing
On completion of assembly and gluing-up the surface of all members shall be cleaned off to ensure a true surface, and shall be sanded to ensure that a planner marks, grain texture or joints are apparent after decoration.

8. Arises
All exposed arises shall be finished rounded to a radius of 1.5mm.

9. Matching
Joinery for staining, clear sealing or polishing shall have all surfaces of the same character of grain and similar colour.

10. Bonding of Plastic Laminate Veneers
Bonding must be under pressure using the specified and approved adhesive in accordance with the manufacturer’s instructions.
Balancing veneers shall always be used, and for surfaces not visible these can be standard brown laminate veneer mad for this purpose.

Where specified or shown on the drawings that the laminate is carried over the edgings, it shall be brought flush with the face of the edging and then finished with a chamfer at 60° to the face of the panel for the full depth of the laminate.
Panels shall be faced on each side with a single sheet of laminate faces shall be drawings. Finished laminate faces shall be flat and true, free from warping, waving, high or low spots. Spalling of the edge of laminate will not be accepted.

11. Post Formed Laminate
Post forming grade laminate shall used for all post forming work. The work shall be carried out by a specialist in this field.

12. Decorative Wood Veneers
The decorative wood veneers shall be laid at right angles to the grain of the plywood or blockboard backing. The moisture content of the veneer shall match that of the backing.
The veneer shall be finished by fine sanding or scraping to eliminate high spots or undulations.

13. Core Construction
All cores to panels or components shall be solid and of the same material throughout and shall be chipboard, plywood, laminboard or blockboard, as specified or shown on drawings. The core to fire doors shall be fire resistant mineral or extruded particle board as described herein where the drawing indicates a fire resistant requirement. The core shall be in one piece in any one panel.

14. Hardwood Edgings
All cores shall be edged all round with hardwood to match the timber veneer or as specified. Tongues between edgings and cores, whether or not shown on drawings, may be considered as optional and may be omitted if the Contractor undertakes to provide equally strong glued joints without a tongue. Edgings shall applied with adhesive, not panel pins, and shall be sanded flush with the core material before veneering. Exposed corners shall be precisely mitred.

15. Prefabricated Fittings
Fittings such as floor and wall cabinets and cupboards, counters and such like shall be constructed as detailed on the drawings and all constituent materials shall be specified herein. Doors and drawers shall operate smoothly and shall be fitted with minimum tolerances consistent with such operation.

16. Ironmongery and Hardware
Install specified ironmongery and all items of hardware associate with Architectural Woodwork in accordance with manufacturer's instructions and lubricate operating mechanisms as required.

17. Fixing Generally
The Contractor shall fix all joinery items securely and accurately: fixings shall not be visible on exposed surfaces of finished components beyond the extent shown on the drawings. The fixed components shall be plumb and square. The Contractor shall supply all necessary nuts, bolts, screws, rawlbolts, grout, lugs, packings, grounds etc. required to fabricate components and complete the installation.

18. Grounds
Grounds shall be clean sawn hardwood or softwood, free from knots, splayed as required, plugged to walls as necessary to ensure complete firmness, and in continuous lengths, level, even and plumb.
Grounds shall be treated with a preservative as specified in F2 above.

19. Scribing

All skirtings, architraves, cover strips, scribing fillets etc., which are required to have a close butt connection to floor, wall or other adjacent surfaces shall be accurately scribed to fit thereto. They shall be in long lengths, with joints scarfed, mitred on external corners and square butted and scribed at internal corners.

20. Drilling and Plugging

Where fixing to concrete or blockwork etc., (except where plugs are shown on drawings) holes for screws shall be drilled with a rotary drill and plugged with cold caulking compound or approved proprietary plugs. No end grain fixing into timber plugs will be allowed. Where fixing to hollow partitions etc. the method of fixing (by toggle bolt, butterfly bolt, expanding bolt etc.) shall be agreed by the Engineer.

Fixings shall be at such intervals as will provide firm fixing to the approval of the Engineer.

21. Screwing and Nailing

Screw heads in work which is to be painted are to be sunk below the timber surface and stopped. Screws which are visible only on the opening of cabinet or cupboard doors or in other locations as may be approved by the Engineer shall be brass countersunk. Screws fixing panels etc., which may be periodically removed for access purposes shall be brass countersunk with fully countersunk brass cups. Small items such as beads or fillets shall be fixed with brass cups and screws.

Screws in exposed hardwood surfaces generally or any timber which will be stained or clear finished, shall be sunk and pelted with timber of matching species and with the grain of the pellet in the same direction as the grain of the member.

Where nails are permitted they shall be of lost-head type, punched in and stopped with approve hard stopping.

22. Notching

Notching and drilling of joinery members for services, conduits, etc. shall be kept to a minimum and the responsibility for any weakening of members cause thereby shall be the Contractor's.

23. Final Finishing

Ensure after fixing that all work is cleanly finished and ready to receive Site-applied finishes.

24. Timing of Site Work

Joinery work in general shall not be installed until the building is enclosed, watertight and dry to the satisfaction of the Engineer.

25. Defective Work

Should any shrinkage, warping or other defects appear during construction or during the defects liability period, all such defective work shall be made good at the Contractor's expense.

DIVISION 7

THERMAL AND MOISTURE PROTECTION

DIVISION 7

THERMAL & MOISTURE PROTECTION

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Division 7

THERMAL AND MOISTURE PROTECTION

CEMENTITIOUS DAMPROOFING (07180)

A. Scope

The extent of waterproofing for water tanks shall be checked on site. Special care shall be taken to check all the concrete surfaces for adequate preparation.

B. Performance and Standards

The Contractor shall provide water and shall test the water tanks for one week. Any leak or water seepage shall be repaired at no additional cost to the Employer.

C. Related Items

Membrane Roofing and Waterproofing 07500

D. Submittals

- Prior to commencing work the Contractor shall obtain from the manufacturer full fixing instructions which shall be handed to the Engineer.
- The Contractor shall carry out a sample area minimum $10m^2$ including repair mortar, water resistant paint, work to pipe penetration and angles for approval of the Engineer prior to commencing work.
- The Contractor shall execute and deliver to the Employer before the certificate of completion, a written warranty in an approved form, stating should any defects develop during the warranty period, the Contractor shall replace or satisfactorily repair such defects, including adjustments to adjacent work as required at the convenience of and without expense to the Employer. The warranty period shall extend 5 years from the date of certificate of completion.

E. Product Handling

All products shall be carefully handled at all times during transportations, storing on site to prevent damage.

All materials shall be maintained in condition which shall in no way cause deterioration of the material.

Any damaged or defective items shall be removed from Site and replaced at no additional cost.

All products shall be delivered clearly marked and stamped with the manufacturer's brand.

F. Materials

1. Water Resistant Paint

The water resistant surface treatment shall be a two component, non-toxic elastomeric cementitious coating approved by the DWI (British Drinking Water Inspectorate) for contact with potable water. The material shall be able to withstand high positive and negative hydrostatic pressures, and excellent crack accommodation before and after immersion. The surface treatment shall comply with the following requirements:

Tensile strength:	ASTM C-190	5.0 N/mm²
Compressive strength:	ASTM C-109	39.0 N/mm²
Flexural strength:	ASTM C-348	11.0 N/mm²
Bond strength:	ASTM C-321	3.5 N/mm²
Shear bond strength:	ASTM C-109	5.5 N/mm²
Abrasion resistance:	ASTM C-241	1.15 % Wt. loss
Impact strength:		16.0 Inch-Pounds

In addition, the surface treatment shall be resistant to a wide range of industrial chemicals.

Material shall be Nitocote CM 210 by Fosroc or approved equal.

G. Workmanship

1. Preparation of Concrete or other surfaces

All areas to receive the water resistant surface treatment shall be delineated and clearly marked out prior to the commencement of the works.

All areas to receive the water resistant surface treatment shall be clean, dry and sound free from all contamination and surface laitence. Any contamination or laitence shall be removed by suitable mechanical means prior to the application of the surface treatment.

All dust or surface debris from the preparation processes shall be thoroughly cleaned off the substrate prior to continuing.

All surfaces to be treated shall be pre-soaked with clean water immediately prior to the application of the water resistant surface treatment. Application of the surface treatment over dry or insufficiently wetted areas shall not be permitted.

All surfaces to receive the application shall be thoroughly wetted using large volumes of clean water.

The application shall be in accordance with the manufacturer’s recommendations.

INSULATION (07200)

A. Scope

1. Provide labour, materials, equipment and services, and perform operations required for installation of Insulation and related work as indicated on the drawings and specified herein.

2. Work Included
The work of this section will include, but not be limited to, the following:
- Trap doors.
- Steel doors.

B. Performance and Standards

Materials and work shall conform to applicable codes and standards.

C. Related Items

Metal Fabrications	05500
Steel Doors	08110

D. Submittals

1. Product Data
Submit copies of manufacturer's latest published literature for materials specified herein for approval and obtain approval before materials are delivered to the site. Include copies of certified test reports showing compliance with specified performance values, including R-values (aged values for plastic insulations), densities, compression strengths, fire performance characteristics, perm ratings, water absorption ratings and similar properties.

2. Submit samples, as requested by the Engineer, of all materials specified herein in accordance with the requirements of the Contract.

E. Product Handling

1. Deliver materials to the site in original unopened packages clearly indicating manufacturer's name, brand name and other identifying information.

2. Store materials in a dry location off the ground and in such a manner as to prevent damage or intrusion of foreign matter. Replace damage or unfit materials at Contractor's expense.

3. Do not expose insulation to sunlight, except when necessary during period of installation and concealment.

4. Protect insulation against ignition. Do not deliver insulating materials to project site ahead of installation time. Complete installation and concealment of materials as rapidly as possible in each area of work.

F. Materials

1. Extruded Polystyrene Board Insulation
Rigid, cellular thermal insulation of thickness to the approval of the Engineer with closed-cells and integral high density skin, formed by the expansion of polystyrene base resin in an extrusion process having thermal resistance coefficient R=1, $1/m^2$. Comply with ASTM C578 for type indicated. density $35kg/m^3$.

G. Workmanship

1. Examination

- Examine conditions at the job site where work of this section is to be performed to insure proper arrangement and fit of the work. Start of work implies acceptance of job site conditions.
- Verify that required work and penetration of surfaces have been completed prior to commencement of work.

2. Preparation
Surfaces receiving thermal insulation shall be firm, smooth, fully cured, clean and dry. Holes, joints and cracks shall be pointed flush with mortar. Cut or ground high spots smooth. Clean surfaces of dust and foreign matter. Surfaces shall be in proper condition for satisfactory installation of the thermal insulation.

3. Installation

- Comply with manufacturer's instructions for particular condition of each installation. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
- Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions. Fill voids with insulation. Remove projections which interfere with placement.
- Apply a single layer of insulation of required thickness unless otherwise shown or required to make up total thickness.
- Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations. If no specific method is indicated, bond units to substrate with adhesive.

4. Cleaning and Protection

- Upon completion of the work, remove unused materials, containers, equipment, etc., from the site. Damage shall be repaired and work and adjacent surfaces shall be left in a clean, undamaged condition.
- Protect completed work from damage by subsequent building operations and effects of weather. Protection shall be by methods recommended by the manufacturer of installed materials and as approved by the Engineer.

WATER PROOFING MEMBRANE (TANKING) FOR FOUNDATION AND BASEMENT WALLS (IF APPLICABLE)

A. Scope

The following specification covers the furnishing and applying of waterproofing protective membrane complying with the “General Specifications for basement retaining walls” and foundation as shown on the Drawings or where directed by the Engineer.

B. Performance and standards

1. All materials shall perform as specified, and the handling, transportation and storage shall be as specified.
All materials shall be of a standard not less than that set out in the current editions of all relevant British standards.

C. Related item

Precast concrete blockwork 04220.

D. Submittals

1. Prior to commencing work, the Contractor shall obtain from the membrane manufacturer full fixing instructions which shall be handed to the Engineer.

2. The Contractor shall submit shop drawings at large scale for approval of the Engineer prior to commencing work.

3. The Contractor shall carry out a sample area after approval of shop drawings, minimum 10m^2 including jointing between sheets and perimeter, together with samples of external angles.

4. The Contractor shall submit a 10 years guarantee effective from the date of substantial completion of the works. Upon notification of any leak within the guarantee period, the Contractor shall repair and replace including supervised work at no additional cost to the Employer.

E. Product Handling

1. All sheet shall be carefully handled at all times, during transportations, storage and on site to prevent damage. Particular care shall be taken to prevent damage to the edges of sheet.

2. All materials shall be maintained in condition which shall in no way cause deterioration of the material.

3. Any damaged or defective items shall be removed from site and replaced at no additional cost.

4. All product shall be delivered dearly marked and stamped with the manufacturer’s brand.

F. Materials

1. Primer
Primer for sealing concrete surfaces prior to waterproofing shall be spirit based and compatible with the type of waterproofing membrane according to the rate of 350 gr/m². The viscosity of the primer shall be such that it penetrates the concrete without forming a skin. Primer shall be allowed to cure for 24 hours.

2. Waterproofing membrane
Waterproofing shall be specially formulated reinforced bitumen with proven record or performance and durability for the intended use. It should be a 4mm thick SBS modified bituminous membrane with 200gr/m2 non-woven polyester reinforcement.

3. Separation layer shall be a 200gr/m^2 non woven geotextile.

G. Workmanship

1. Conditions of surrounding walls and foundations
Immediately before the application of the primer or laying of the waterproofing membrane, the concrete surface shall be clean, dry and free from laitance, loose, aggregate, dust and other debris and, where the adhesion to the concrete could be impaired, free from curing liquids, compounds and membranes.

2. Protection
Prevent damaged to the waterproofing membrane during installation and after.

3. Waterproofing

- The waterproofing membrane shall be applied in accordance with the written instructions of the manufacturer as agreed by the Engineer.
- The waterproofing membrane, primer and bonding agents including tack coat shall be compatible with each other.
- Lap joints shall be minimum 75mm wide.
- Special care shall be taking during backfilling
- Over lapping at all corners shall be 100cm as shown on drawing.

4. Repairs
The Contractor shall immediately repair any defects, gouges and other damage to the completed membrane in a manner approved by the Engineer.

MEMBRANE ROOFING AND WATERPROOFING (07500)

A. Scope

1. This section specifies the provision and installation of the complete waterproofing system for the works as detailed on the drawings.
2. All waterproofing work shall be carried out by a Specialist Sub-Contractor.
3. Waterproofing system to top roof shall be screed laid to falls and cross falls and covered by waterproofing membrane with separation layer (inaccessible areas).
4. Waterproofing system to roofs, shall be screed laid to falls and crossfalls and covered by waterproofing membrane with separation layer and protected with gravel or tiles as shown on drawings, for accessible area only as per drawing.
5. Waterproofing system to wet areas shall be liquid rubberized bitumen emulsion reinforced by fibre-glass with special accessories for pipes penetration and protected with sand bed and ceramic tiles.

B. Performance and Standards

1. All work shall be provided and carried out in such a way that there shall be undivided responsibility for all component parts and for the whole system as an entity. The membrane shall be covered by 10 years warranty.
2. The system shall not permit water or moisture penetration through any component part of the waterproof layer in any condition of weather that may be encountered.
3. All materials, mineral or organic, shall be resistant to decay over the life expectancy of the whole waterproofing system.
4. The completed waterproofing system and its constituent components must not suffer breakdown or degradation of performance under temperature changes in a range between -10°C and +40°C nor under conditions of thermal shock.
5. Provisions shall be made for accommodating any movement of the structural deck and adjacent building materials and components, moisture movement, creep and shrinkage movements and thermal movement in the -10°C to +50°C range.
6. All materials shall be of a standard not less than that set out in the current editions of all relevant British Standards.

C. Related Items

Beds and Screeds	03500
Insulation	07200
Joints Sealers	07900

D. Submittals

1. Prior to commencing work, the Contractor shall obtain from the membrane manufacturer full fixing instructions which shall be handed to the Engineer.
2. The Contractor shall submit shop drawings at large scale for approval of the Engineer prior to commencing work.
3. The Contractor shall carry out a sample area after approval of shop drawings, minimum 10m² including jointing between sheets, perimeter skirtings and flashings,

and work to the pipe penetration, together with samples of internal and external angles.

4. Before commencing work the Contractor shall submit written statement signed by him, stating that the Contract documents for the waterproofing have been reviewed with a qualified representative of the waterproofing materials manufacturer and that he is in agreement that the selected materials for waterproofing are proper, compatible and adequate for the application shown.

5. The Contractor shall submit a 10 years Guarantee effective from the date of substantial completion of the works. Upon notification of any leak within the guarantee period, the Contractor shall repair and replace including removing, replacing and supervised work over the membrane waterproofing at no additional cost to the Employer.

E. Product Handling

1. Handling Generally
   All sheet and slab materials shall be carefully handled at all times, during transportations, storage and on Site to prevent damage. Particular care shall be taken to prevent damage to the edges of sheet and slab material.
   All materials shall be maintained in condition which shall in no way cause deterioration of the material.
   Any damaged or defective items shall be removed from Site and replaced at no additional cost.

2. All products shall be delivered clearly marked and stamped with the manufacturer's brand.

F. Materials

1. Screeding
   Screeds thickness shall be as shown on the drawings and shall be cement and sand proportion 1:3 laid to slope as specified in section 03500.

2. Waterproofing System

3. Roof and top roof

   The waterproofing system shall be a cold applied emulsion to the dry clean screed at an average of 300 gr/m² with hot applied elastomeric membrane 4mm thick composed of SBS modified bituminous with 180gr/m2 non woven polyester reinforcement under a 200gr/m2 non woven geotextile sheet separation layer and protected with concrete tiles to roof and gravel to upper roof. Exposed skirting membrane to be aluminum finish.

   All internal and external angles shall be reinforced with an additional layer of membrane.

   Waterproofing membrane shall be granule finish to give protection against UV rays (for non accessible roof).

   Material shall be of type TECH 1000 PA by Pluvitec or approved equal.

4. Wet Areas (bathrooms and kitchen)

The waterproofing system shall be two coats of rubberized bitumen emulsion reinforced with fibre-glass and shall be applied by roller at the rate of 0.75 kg/m² for each coat and shall be extend to 15cm min. height to walls, with special connection to pipe penetration.

All internal and external angles shall be reinforced with an additional layer of membrane.

Material shall be of type Nitoproof 30 by Fosroc or approved equal.

5. Primer
Primer for bonding to screed shall be BITUPRIME by Bitumat or approved equal.

6. Mastic Pointing
The turning of the membrane into the groove in the concrete shall be pointed with mastic as specified in Section 07900.

7. Aluminum Flashings
0.76mm thick with non-corrosive fasteners.

8. Bituminous Coating
Solvent type bituminous mastic, normally free of sulfur, compounded for 375 micrometers (15 mil) dry film thickness per coat.

9. Gravel
Gravel shall be rounded with no sharp edges.

G. Workmanship

1. Conditions of Screed and Surrounding Walls
Before laying the membrane, ensure that the screeds are to the correct falls, and that any preliminary preparation work including the formation of grooves is complete. The screed must be clean and dry and wood float finished, free from ridges, protuberances and hollows.
Before laying of underground waterproofing membrane make sure that all plaster is levelled, plumb and clean from all deleterious materials.

2. Protection
Prevent damage to the system during installation and after. Lay paving slabs, shingle etc., immediately after the laying of the membrane. On no account shall materials be mixed or stored on the roofing membrane, nor shall it be use as a building platform.

3. General
The whole of the roofing, flashings and formed fittings and waterproofing shall be carried out completely in accordance with the manufacturer's instructions.

4. Waterproofing System
The membrane and primer shall be laid, fixed as directed by the manufacturer of the system.
Lap joints shall be minimum 150mm wide.
The membrane shall be laid in the direction flow of the water.

5. Flashing Installation
Install flashings in accordance with manufacturer's instructions SMACNA Architectural Sheet Metal Manual Requirements.
Weather lap joints minimum 150mm and seal with mastic. Secure in place with nails at 300mm with concealed fasteners.

Flash and seal work projecting through or mounted on roofing with mastic. Provide weather tight installation.
Form flashings to profiles required by the Engineer.
Form sections square, true and accurate to profile, in maximum possible lengths, free from distortion and other defects detrimental to appearance or performance.
Hem exposed edges of flashings minimum 6mm on under side.
Apply bituminous paint on concealed surfaces of flashings.
All pipes, conduits, sleeves and other projections passing through membrane shall be flashed to provide tight construction throughout.

6. Gravel
Gravel shall be laid up to a minimum 50mm thick or as shown on drawing using a guide board to obtain a uniform thickness.

7. Testing
The horizontal areas of waterproofing membrane shall be water flood tested after plugging all drains, for a period of 48 hours. Dry area where leaks occur shall be drained thoroughly dried, repaired and then retested at no additional cost to the Employer. Testing certificate shall be issued upon handing over of the works.

8. Completion
Leave all waterproofing clean on completion. Debris will not be accepted.

JOINT SEALERS (07900)

A. Scope

This section specifies sealants, joint fillers and related products, applied to exterior and interior moving and non-moving joints to prevent penetration of moisture and air or to assist in the reduction of sound transmission.

For any joint which is subject to movement, either thermal expansion or dynamic, at which it is necessary to prevent the ingress of water or passage of air whether explicitly shown on drawings or not, the Contractor shall provide and apply the appropriate sealant or caulking compound together with compatible and appropriate backing material, joint filler, bond breaker tape, etc. Sealants selected shall be compatible with materials with which they are in contact. The work, including preparation of surfaces to receive sealant, shall be in strict accordance with the manufacturer's instructions or recommendations having regard to the conditions of installation and use.

The work of this section shall include but not limited to, the following:

- Joints between items of equipment and other construction.
- Joints between plumbing fixtures and wall surfaces, completely around each fixture.
- Edge of waterproofing membrane abutting against walls and penetrations to provide a watertight and airtight barrier.
- Sealing and caulking shall include sealants, joint fillers, backer rods, primers, bond breaker tape.

B. Performance and Standards

1. The sealed joint shall not fail to perform as required in terms of air tightness, or fail in joint adhesion, cohesion, abrasion, weather, extension, migration or stain resistance; or fail in general durability or appearance; provided that such failure indicates a standard of performance lower than is specified or can be expected from the manufacturer's data.

2. All materials shall be of a standard not less than that of relevant British Standards where these exist.

C. Related Items

Membrane Roofing and Waterproofing 07500

D. Submittals

1. Samples
Samples of each type of sealant, with full range of colours shall be submitted for selection by the Engineer.
A minimum 2m run of sealant in-situ of each sealant material, in each situation, shall be submitted for the approval of the Engineer. Such samples shall include an intersection of mastic runs, where these are to be provided in finished work.
The approved samples shall be retained and protected for reference, and may form part of the finished work.

2. Manufacturers' Recommendations
The Contractor shall obtain the manufacturers' recommendations for use, together with detailed application instructions, for all materials used, and shall issue copies to the Engineer, prior to any sealant application going forward.

3. Warranty
The Contractor shall execute and deliver to the Employer before the certificate of completion, a written warranty in an approved form, stating should any defects develop during the warranty period, the Contractor shall replace or satisfactorily repair such defects, including adjustments to adjacent work as required at the convenience of and without expense to the Employer. The warranty period shall extend 10 years from the date of certificate of completion.

E. Product Handling

1. Delivery
Each tin of sealant is to be delivered to Site clearly marked with relevant batch number.
Records of batch numbers and tins issued to Site are to be kept and are to show in which area contents of tins have been used. These records are to be submitted to the Engineer if called for.

2. Storage
Materials, at all times prior to applications, shall be stored in conditions which shall in no way cause any deterioration or affect the life of the material.

F. Materials

1. Sealant
The sealant to be used in each case shall be as shown as detailed below:

- Sealant for non-traffic vertical or horizontal surfaces shall be a non-sagging, gun grade sealant. Sealant shall be one of the following types:
    1. Polyurethane: One part polyurethane compound of approved manufacture, with a Shore A cured hardness of 25 plus or minus 5, conforming to Federal Specifications TT-S-00230C, Type II, Class A + 25% movement capability, ASTM C-920-87. Colours to match adjacent materials from manufacturer's standard colours.
    2. Silicone: One part low modulus silicone sealant of approved manufacturer with a Shore A hardness of 22 conforming to Federal Specification TT-S-001543 A and TT-S-00230C and ASTM C920. Colours to match adjacent materials from manufacturer's standard colours.
    3. Thiokol shall be as manufacturer’s instructions and to the approved of the Engineer.
    4. Silicone Fire Rated: One part silicone rubber sealant for use in passive fire protection of approved manufacturer with a share A cured hardness of 15-20 ASTM E-814 (UL 1479) and ASTM E-119 (UL 263).

- Sealant for interior and exterior horizontal traffic surfaces shall be non-staining, pourable and self-levelling. Sealant shall be two-part polyurethane compound of approved manufacture, with a Shore A cured hardness of 35 plus or minus 5, conforming to Federal Specifications TT-S-00227 E, Class A, type I and ASTM C920. Sealant shall have a joint movement capability of plus/minus 50 percent. Colour to match adjacent materials from manufacturer's standard colours.
- Primers and cleaners for the various surfaces to which sealants are to be applied shall be of types recommended by the approved manufacturer. Primers and cleaners shall not damage applied metal finishes.

G. Workmanship

1. Tools and Plant
Provide all necessary special plant and tools required to clean and properly prepare the recesses to be sealed, also as required for the proper application of the sealants. All such tools and plant to be obtained from or approved by the approved sealant manufacturers.

2. Preparation
All joints to receive sealant shall be clean and dry. Horizontal joints shall be vacuum cleaned to remove any debris.

3. Mixing Sealant
Thoroughly mix together the components of 2 part sealants. In hot weather mix in a cool, shaded place. Do not mix, at any one time, larger quantities than can be used within the period stated by the manufacturer.
Mixing with a mechanical mixer shall be carried out at low speed to avoid air bubbles and a rise in temperature leading to premature curing.

4. Gunning Sealant
Extrude sealants firmly from the gun; fill joints completely from inside outwards, so as not to entrap air. In the event of difficulties in 'wetting' and gaining adhesion to the adjacent faces, replace contents of gun with new batch of sealant.
Work sealants into joint with wetted palette knife, pressing home and scraping off surplus.
Check sealant within a few days of application, particularly at horizontal joints, for sag, loss of adhesion or other faults. Make good any such defects immediately.

5. Finishing
Clean off adjacent surfaces, ensuring that no sealant or cleaning solvent remains on the surface.
In carrying out this work, only use materials recommended by the sealant manufacturer, ensuring that no solvent or similar material comes into contact with the sealant within the joint. Abrasive materials which can cause damage shall not be used.

6. Protection
Protect the jointing from dust and inclement weather until the sealant has completely set. Continue protection where necessary to prevent damage from building operations, trafficking etc., until completion of the Works.

DIVISION 8

DOORS AND WINDOWS

DIVISION 8

DOORS AND WINDOWS

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Division 8

DOORS AND WINDOWS

STEEL DOORS (08110)

A. Scope

This work shall include for the supply, installation and fixing of steel doors, access doors, steel frames, and others as shown on drawings.

B. Performance and Standards

1. Steel doors shall comply with BS 1245. All mild steel shall comply with BS 4630 and with BS4, Part 1. All sheet steel shall comply with BS 1449, Part 1.
The fire rated doors shall comply with the requirements of the relevant parts of BS 476 and to be acceptable to the Fire Authority.

C. Related Items

Metal Materials	05010
Metal Finishes	05030
Ironmongery	08700
Painting	09900

D. Submittals

1. Samples of Doors
The Contractor shall provide for the Engineer's approval one sample, 200mm long, of each separate profile that is to be used in the work.

2. Drawings
Fully detailed shop drawings shall be submitted to the Engineer for approval before fabrication commences.

3. Ironmongery
The Contractor shall supply to the manufacturer of doors samples of all item of ironmongery as specified which will be fixed to the frame to ensure that proper provision is made for their fixing, and all details are to be given to the manufacturer as to which items apply to which frames.
The samples and information are to be given to the manufacturer before production is commenced.

E. Product Handling

1. Handling Generally
All doors shall be carefully handled at works, during transportation and storage and on site to prevent damage. Any damaged or defective frames shall be removed from the site and replaced at no additional cost.

2. Identification
All doors shall have suitable identification in terms of the door frame schedule marked on them or attached in such a way that the labeling will not easily become detached. Crates shall similarly clearly identify their contents.

3. Protection
The doors are to be suitably protected and crated to prevent damage during transportation and storage. The protection shall be such that doors are not subject to damp.

4. Storage
Storage on site shall be in dry conditions. Doors shall be stored in such a way that they are not liable to distortion caused by undue weight in stacking.

F. Materials

1. Steel
Doors shall be manufactured from metal angles, plate & sheets, and shall be to BS4, Part 1 and BS 1449, Part 1. Dimensions and frame profiles shall conform to the detail drawings.
Fire rated door, frame accessories and hardware shall conform to S.D.I. 118-88 steel door Institute or approved equal, and shall be rated for minimum 60 minutes.
Fire steel door and hardware shall be of class as manufacturer's recommendations, all as directed and to the approval of the Engineer.
Steel doors shall be insulated with mineral wool insulation and fire rated steel doors shall be insulated with 90 minutes fire proof insulation.

2. Welding
Welding shall be in accordance with BS 693 or BS 5135 as appropriate.

3. Corrosion Inhibiting Coatings

Protection coat plus 1 coat calcium plumbate primer to BS 3698, type B or equal approved.

At manufacturer's discretion other corrosion inhibiting coatings recommended in BS CP2008 may be offered for approval.

4. Water Bar
Provide water bars to those doors and frames shown on the drawings requiring them.

G. Workmanship

1. Preparation
Steel shall be free of scale, dust, grease, oil and surface adhesives before priming.

2. Profiles
Profiles shall be formed as shown on drawings and shall be appropriate to the thickness of the doors and windows.

3. Joints
Joints shall be welded to proper lines..

4. Provision for Ironmongery
The frames shall be factory-prepared to receive specified ironmongery.

The hinges shall be welded to doors, windows and frames.

5. Striking plates for the specified locks and latches shall be fitted, complete with mortar guards.

6. Bolt holes for double doors shall be drilled at works and provided with mortar guards.

7. Fixings or all other specified ironmongery which fixes to the frame shall be provided, tapped as necessary, reinforced by backplates where necessary, and provided with mortar guards where the fixing penetrates the frame.

8. The manufacturer shall make provision for and shall fit all items of ironmongery listed for the aluminum doors and the drawings or schedules of ironmongery.

9. Frame Fixings
The provisions for jamb fixing shall be as shown on drawings. In addition there shall be a m.s. horizontal plate at the foot of each jamb welded in all drilled with 6mm holes for fixing down to the floor.

10. Alignment
The doors supplier shall provide a steel for alignment purposes.

11. Fixing
Frames are to be fitted plumb, square, without racking, twist, sag or misalignment.
Where frames are built in temporary struts shall be positioned between jambs to prevent bowing.

12. General Quality of Finished Work
Any parts of the installation which are indented, distorted, out of alignment, visible welds not ground flush, or defective in any way shall be rejected and replaced at no additional cost or made good to the satisfaction of the Engineer.
Any damage to the corrosion inhibiting coatings shall be made good immediately on completion of the frame fixing.

13. Painting
Frames shall be zinc-platted hollow steel frames and shall be painted on site in accordance with decoration schedules and with the Specification for Painting in section 09900.

ALUMINUM DOORS AND WINDOWS (08120&08520)

A. Scope

1. The work includes the removal of the existing aluminum doors as shown on the drawing and the supply, installation and fixing of new aluminum doors, windows, mullions, cills, framing and associated work, in accordance with the design drawings.

2. The term "doors and windows" in this section shall also include louvres and frames manufactured in aluminum.

3. The doors and windows shall be obtained from an approved manufacturer and shall be constructed using his standard components and methods of assembly when these have been agreed on submission of design and shop drawings and such samples as are specified here or called for by the Engineer. They shall incorporate all necessary ironmongery, fixing components, operating gear and weather stripping glass and shall be powder centered.

B. Performance and Standards

1. Materials, Goods and Workmanship shall be of the best quality of their respective kinds, and those for which there is a British Standard or Code of Practice shall comply therewith unless otherwise stated. All articles and materials are to be not less than those standards contained in the latest British Standards Institution Specification where such exists. No Workmanship shall be inferior in any way to the standards laid down in the latest British Standard Codes of Practice.
All British Standards and Codes of Practice relevant to aluminum work, window, metalwork and to glazing shall be deemed to form part of this Specification in their entirety, or to a limited extent if so directed. A Contractor's ignorance of any of the provisions of the British Standards or Codes of Practice shall in no way be considered to relieve him of his responsibility to comply with them insofar as they apply.
Materials provided of whatever origin shall comply with the relevant British Standards.

2. The doors and windows shall conform with the requirements of BS 4873.

3. Performance
The Contractor shall have full regard to BS CP 3, Chapter 5, Part 2, Wind Loads, or an equal and approved document when detailing for strength requirements. Reference should also be made in establishing test criteria to Technical Note No.1, "Performance Requirements for Windows", published by the DOE.
Test methods shall be in accordance with BS 5368, depending on the ability to test in the available rig. the procedures in BS 5368 shall preferably be used.

This wind exposure condition to be applied in the following tests shall be:
Pressure Difference 1250 N/m^2.

a. Strength

All doors and windows and spandrel elements shall be capable of resisting sporadic pressures from wind gusts as stated above.

There shall be no fracture or permanent deflection of any part, nor any deterioration of specified performance. The deflection/span ratio of any part of a light shall not exceed 1/250 for glazing. However in a vertical load test a concentrated load of 15 kg acting vertically and applied at the centre of the span of any horizontal sash rail shall not cause a vertical deflection of more than 1/375. The max. deflection in case of double glazing shall not exceed 8mm.

These requirements shall apply when the exposed face is subjected to pressure or to suction.

If so required by the Engineer the Contractor shall state the actual deflection ratio of any part of the light at the specified pressure.

The method of test to establish compliance with the above requirements shall be established by transducer.

b. Air Penetration

For the air permeability test the pressure shall be applied to the outside face only of the window. The maximum pressure to be applied shall be 600 Pa.

For fixed lights the average leakage rate shall not exceed 1m3/h per metre length of perimeter joint.

For opening lights the average leakage rate shall not exceed 6.5m3/h per metre length of perimeter joint.

c. Water Penetration

There shall be no water leakage at a pressure of 200 Pa.

There shall be no water leakage after a repeated gusting test to a pressure difference of 1250 N/m^2 when tested again with a pressure of 200 Pa.

d. Temperature Conditions

The window may be exposed to variations in ambient still air dry bulb temperature within the extreme limits from -20° C to +50° C.

Any changes in dimension of a window or its parts, due to changes in temperature within the specified limits, shall not affect the performance as specified elsewhere. The Contractor will be required to state the amount of the thermal movement which will occur, and the effect of this movement on the dimensions or shape of system. Allowance should be made assuming that surface temperatures of up to 90° C may be experienced.

e. Movement

There shall be no loss of function or domination of performance as described in this Specification due to:

i deflection of the window caused by wind pressure,
ii. the design deflection of the building structure,
iii. thermal movement of the building structure.

The design of the fixings, the fixing gap around the window, and manufacturing tolerances shall take full account of the above.

C. Related Items

Metal Materials	05010
Metal Finishes	05030
Joint Sealers	07900
Ironmongery	08700
Glazing	08800

D. Submittals

1. Design Drawings

Design drawings prepared by the Engineer shall form the basis of the manufacturer's design of the doors and windows insofar as they show the basis design requirements including size, configuration, type of opening, and other functional and architectural requirements.

The Contractor shall submit for approval the manufacturer's preliminary design drawings to indicate that the Engineer's design parameters have been met. These drawings shall include full scale details of the extensions or pressings that the manufacturer intends to use, typical details of fixings, and details of sealing and glazing.

2. Shop Drawings

Upon approval of the manufacturer's design drawings fully detailed shop drawings shall be submitted to the Engineer for approval before fabrication commences. The drawings shall show elevations of all units, full-size sections of members, methods of installation and anchorage, locations of operating and other ironmongery, method and material of weather stripping, details of relationship with adjacent work, glazing methods, glass thickness, sealants, and provision of thermal movement. Adequate time in accordance with a program to be agreed by the Engineer shall be allowed between submission of drawings and commencement of manufacture, to take account of comments made and modification called for by the Engineer.

Approval of the shop drawings by the Engineer will not relieve the Contractor of responsibility for fulfilling all the requirements of the design drawings and the Specification.

3. Sample Doors and windows

The Contractor shall supply for the Engineer's approval one complete sample window of each separate window type as will be determined by the Engineer. Each sample shall be completed with all its specified ironmongery and weather-stripping, and shall be glazed with the specified glass. Sample doors and windows shall be finished in accordance with the Specification. When the samples have been approved they shall be so marked and retained on site for reference.

4. Testing

At the Engineer's discretions a sample of any type of door and window he may require shall be submitted to an approved testing authority for tests to determine compliance with the performance requirements specified in B above. Should the door and window not meet these requirements the design shall be modified and further samples re-tested until they are met. Testing and any necessary re-testing shall be at no cost to the Contract. Samples which have satisfactorily passed tests shall be labeled accordingly.

5. Capillarity Data

The Contractor shall provide details of the methods by which capillarity will be controlled, so that the specific performance of the lights and doors is unaffected by this phenomenon.

6. Maintenance-free Period

The Contractor shall state the periods of maintenance-free life of all assemblies. Within the period of maintenance free life, the assembly shall perform at or above the levels specified elsewhere.

The Contractor shall give a recommended method of maintenance, after the expiration of the maintenance free life, in order to ensure that the components shall serve throughout the expected life of the building without loss of performance or appearance.

7. Window Data
The Contractor shall supply the Engineer with copies of all relevant manufacturer's data relating to the window.

E. Product Handling

1. Handling Generally
The doors and windows shall be carefully handled at all times at works, during transportation and storage and on site to prevent damage. Any damaged or defective items shall be removed from site and replaced at no additional cost.
The requirements in respect of handling and temporary protection set out in Appendix G of BS 3987 shall be strictly complied with.

2. Identification
The doors and windows shall be clearly identified in accordance with the window schedules. Identification shall be on a surface which shall not be visible in the finished work.

3. Protection
The doors and windows shall be carefully packaged for transport and when in store shall be properly protected against damage and discoloration.

4. Stacking
When in store the doors and windows shall be so stacked that they will not be subjected to undue stress or liable to distortion.

5. Gaskets
Gaskets shall be suitably protected before and during delivery and during storage by packing in polythene bags to keep free from dust and dirt.

6. Installation
The doors and windows shall be installed in the work only when all relevant conditions are suitable and when the general progress of the work is such that they will not be liable to undue damage.

F. Materials

1. Aluminum Components
All alloys to be similarly finished shall comply with BS 1474 or other equal approved Specification.
Aluminum shall be bronze anodized aluminum profile, colour to the approval of the Engineer.
All extensions shall be of adequate thickness and strength, not only to meet the structural requirements, but also to eliminate any risk of distortion in the finished surfaces. The thickness of extension shall be sufficient to ensure their complete rigidity in the lengths required in the final installation.
No web shall be less than 1.8 mm in thickness.
The aluminum sheet and plate shall be of suitable thickness and quality, suitably laminated where appropriate, to be retained in their position, without showing any deformation whatsoever under thermal influence, windload and any other physical force. Deformation in excess of any tolerances under clause "Tolerances" will not be permitted.

2. Bolts and Screws

All bolts and screws shall be of sufficient strength for their purpose. Visible screw or bolt heads will in general not be permitted. All bolts and screws in contact with aluminum shall be stainless steel.

3. Glass

The glass for opening and fixed parts of the door assemblies shall be in accordance with section 08800, Glazing. The Contractor shall ensure that the type and weight of glass is fully in accordance with regulations for the safe glazing of doors or windows.

4. Weather-stripping

The weather-stripping shall be Neoprene gasket as manufactured strictly in accordance with the recommendations of the raw product manufacturer. It shall be entirely suitable for the performance required of it, easy to install and replace, shall not change its shape or become tacky as a result of aging or temperature variation.

Samples of gaskets shall be tested by approved testing firm in accordance with BS 4255.

The gaskets shall withstand water penetration and air penetration under the aforementioned wind load or wind load combined with driving rain and shall have "no leakage" as defined by BS 4315.

Gross leakage shall not be accepted. The clamping pressure shall be designed to be such strength as to allow for the effects of weather aging, normally anticipated to be approximately 25-30%. The reduction of clamping pressure i.e. stress relaxation shall be tested when exposed to a weather mometer test for at least 900 hours under alternating exposure to UVL, ozone and water. The clamping pressure after the weather mometer test shall be such as to provide for a safety factor normally used in structural members.

Gaskets shall be suitably protected before and during storage by packing in Polythene bags to keep free from dust and dirt.

5. Ironmongery

The window manufacturer shall be responsible for the selection of entirely suitable ironmongery which shall be subject to the approval of the Engineer.

All working parts shall be capable of withstanding at least 20,000 operations under the normal conditions of use without causing damage to any part of the window nor showing any applicable sign of wear or defect.

All materials shall be mutually compatible and able to withstand the effects of the climatic conditions of the site.

Metals shall comply with the requirements of sections 05010, Metal Materials, and 05030 Metal Finishes. Ferrous metals shall be rustproofed by approved galvanic methods.

All doors and windows shall be complete with all ironmongery as listed in the window schedules, including butts, locks, internal and external handles, kicking plates and push plates, flush bolts and door/window stops.

The manufacturer shall make provision for and shall fit all items of ironmongery listed for the aluminum doors and the drawings or schedules of ironmongery.

Where ironmongery is not specified for a particular door the provision of section 08520; F5 shall apply.

6. Water Bar

All doors and windows shall have a water bar of aluminum same colour as profile set in mastic.

7. Fixing

Fixing devices, including nuts, bolts, washers, packing pieces, lugs etc. shall be in accordance with the approved shop drawings and shall be in materials conforming with section 05010, Metal Materials.

8. Fly Screens
All aluminum louvres shall be in ordinary anodized colour and supplied with fly screens.

G. Workmanship

1. General
A high standard of finished workmanship and precision in assembly and fixing of components is required.

2. Dimensions
The overall size of each assembled unit shall be such that with a joint width between structure and unit of 6mm + 0mm - 3mm it shall fit into the actual opening as called for on the Engineer's drawings.

3. Tolerances
The surface flatness shall be established by use of a metal straight edge and a feeler gauge. Permitted deviations from the true shall not be in excess of + 1.00mm non-accumulative. Permitted deviation of window width shall not be in excess of +0.5mm and permitted deviation in window height shall not be more than +1.0mm. Permitted variations in diagonals shall not exceed 1.0mm.
The required testing instruments and appliances shall be placed at the disposal of the Engineer in order to establish compliance.
All finished metal surfaces shall be flat and free from undulations or irregularities.

4. Manufacture
All joints between extrusions shall be carefully machined in the shop. Corners of hinged frames shall be mitred. Carry out all work necessary to ensure closely fitting, straight flush joints in all cases. After fitting together in the shop, all members shall be suitably marked on a concealed face so that they can later be identified on site and fixed in their correct relationship with each other.
Arises where shown on drawings shall be sharp and precise and worked to a radius of no more than 1mm.
Extrusions adjacent to, and in the same plane as, pressings shall be formed so as to have the same radius.
After fabrication all aluminum surfaces to be exposed to view shall be smooth and even in texture, free from superficial blemishes or damage of any kind and ready for the finish specified.
Fabricate all necessary weather stripping, flashings, supports and other component parts required for the complete installation.

5. Fixing
Completely concealed fixing methods shall be adopted as a principle throughout the work. If in isolated cases, face fixings are unavoidable, particular care shall be taken to locate these in unobtrusive positions, where heads of screws or bolts etc., shall be countersunk and finished to match the adjoining exposed aluminum surfaces. Details of all fixings to be subject to Engineer's approval at shop drawing stage.
All members at joints in external work shall be bedded in sealant.
The Contractor shall supply all fixing devices necessary. Due regard must be paid to the wind pressure to be expected and the method of fixing must meet the performance requirements previously specified.
The design shall take account of the building tolerances normally to be anticipated but ensure that the fixings are flexible to take up the tolerances to ensure accurate and straight positioning of the window.

The fixings to the concrete or concrete blocks of steel or other material, as agreed by the Engineer conforming to all statutory requirements both as to strength and to type. They shall be fully protected to prevent corrosion and electrolysis. It shall be the Contractor's responsibility to allow for suitable materials.
In the case of a number units being installed to provide a continuous range, the jointing between adjoining units shall be such that no ingress of air or water shall take place.
All external jointing and screw fixings shall be coated to prevent the incursion of crevice corrosion. Face fixings shall be avoided.
The fixings shall be such that final positioning of the units may be adjusted to provide an accurate whole, truly vertical, in proper alignment and thoroughly secure.

6. Corrosive Action between Metals
No metals likely to cause galvanic or other corrosion must be placed or fixed in contact with the aluminum. Any other dissimilar materials are to be treated to avoid such action between metals.

7. Perimeter Sealing
The joint around the window frame on all sides shall be pointed in polysulphide or silicone sealant backed by joint filler.

8. Glazing
All doors and windows shall be single or double glazed with glass conforming to the Specification in section 08800 and using glazing materials and methods therein specified.

9. Protection
The Contractor will be responsible for the adequate protection of his work until completed and handed over, and particular emphasis is placed upon the importance of avoiding any blemishes whatsoever on the finished aluminum faces.
Any protective tape or coating shall be removed with great care to avoid any damage whatsoever to the finished surfaces of the window.

10. Defective Work
The Contractor shall be required to replace at no extra cost any window which does not come up to the approved sample, or show signs of twisting, or any other defect. The cost shall not fall on the Contract for any fixing, decoration, transferring ironmongery or any other operation consequent upon the replacement of the window.
The installation shall be carried out with care to avoid damage to adjacent materials and surfaces.

11. Completion
On completion, all work shall be left clean and free from damage or defect, to the satisfaction of the Engineer.

WOOD DOORS (08210)

A. Scope

The work shall include the supply and fixing of internal wood doors.
If recommended by the Engineer or stated in the B.O.Q.
Frames for wood doors shall be pre-painted steel frames as specified in Steel Doors, or painted wood …….. as shown on drawings.

B. Performance and Standards

1. General
The doors shall comply generally with BS 459, Part 2 and BS 4787.
If recommended by the Engineer or stated in the B.O.Q. The fire rated doors shall comply with the requirements of the relevant parts of BS 476 and to be acceptable to the Fire Authority.

2. Seasoning
All timber shall be well seasoned to a moisture content of approximately 10% plus or minus 2%.

3. Specific Standards
Timber for cores and lipping shall be as defined in Appendix A of BS 1186, Part 1 as being suitable. Plywood shall be MR to BS 1455 paragraph 6, with facings Grade 2 in paragraph 3.

C. Related Items

Steel Doors	08110
Ironmongery	08700
Painting	09900

D. Submittals

1. Sample Doors
Prior to general manufacture the Contractor shall provide for the approval of the Engineer one standard size single door melamine laminate.
In addition to the above the Contractor shall supply one construction sample of each type of door as detailed on the drawings.
When the samples have been approved they shall be so marked and retained on site for reference.

2. Ironmongery Samples
Samples of all approved ironmongery associated with wood doors shall be supplied by the Contractor to the door manufacturer before manufacture is commenced to ensure that proper provision is made for their incorporation, and full details are to be given as to which items apply to which door.
Particular attention is to be paid where concealed hinges are specified in order that the provision for fixing is adequate to withstand stresses set up by the operation of the hinges.

E. Product Handling

1. Handling Generally
The doors shall be carefully handled at all times at works, during transportation and storage and on site to prevent damage. Any damaged or defective item shall be removed and replaced at no additional cost.

2. Identification
The doors shall be clearly identified in accordance with the door schedules. Identification shall be on the top edge of the door.

3. Protection
The doors shall be carefully packaged for transport and when in store shall be properly protected against damage, discoloration, damp and insect attack.

4. Stacking
The doors shall be stacked when in store in such a manner that they will not be subjected to undue stress or liable to distortion, and they shall have adequate air circulation to all faces.

5. Installation
The doors shall not be installed within the building until the building is closed in.

F. Materials

1. Doors
The clauses hereafter shall apply equally to flushed faced or patterned doors.

2. General
All materials shall be in accordance with the requirement of BS 459 and BS 476 for Fire Rated Doors.

3. All doors shall be of MDF laminated board, as shown on the drawings. Doors and fire rated doors shall be 45mm thick.

4. Frames shall be fire rated steel as detailed on the drawings.

5. Core Construction: Timber
Timber cores shall consist of fully glued longitudinal battens, wrought on all faces, of Western Red Cedar or other approved softwood or exotic redwood hardwood.
The laminations shall be tight butted throughout their length: battens shall be continuous through the height of the door except for rails at the top and bottom to which the battens are to be tight butted.
The top and bottom rails shall be framed to vertical jamb members.
The assembled frame shall be precision planed or sanded to a true level surface before faces are applied, and opposite faces shall be truly parallel.

6. Fire Resisting Construction
Materials and components to meet fire resistance requirements to the Fire Authority when tested in accordance with the requirements of BS 476: Parts 20 to 23 inclusive and as appropriate.
Wood doors shall also be treated with flame retardant material applied by brush all in accordance with BS 476: Part 7 or equivalent and agreed. All plywood, hardwood and others shall be treated in accordance with manufacturers recommendations for specific type and thickness of wood.

7. Provision of Ironmongery
Adequate provision shall be incorporated in the core to accept fixings for the specified ironmongery. The provision for concealed hinges, locks and latches shall be such that hinges, lock or latch case shall be entirely surrounded by solid material.
The provision for fixing hinges, door closers and pivots shall in all cases be solid timber, not chipboard or flaxboard.

8. Plywood or Hardboard
The final facing of the door, consisting of melamine laminate, shall be applied to a substrate of plywood not less than 4mm thick, or approved hardboard not less than 3.2mm thick at the manufacturer's description. The substrate shall be fully bonded to the core.

9. Lipping
Doors shall be lipped on all vertical and top edges with lippings not less than 8mm thick. Single swing doors shall have a head lipping to the door and bottom lipping to the panel of adequate dimension to permit the rebate to be accommodated entirely in the lipping, and in any case not less than 25mm thick.
Lipping shall be in hardwood suitable in all respects for the finish to be applied. The lipping shall be of the same species as the melamine laminate and matching it in colour and general appearance.

10. Adhesives
All adhesives used in the manufacture of the doors and windows shall be in all respects appropriate to the duty required of them and the best of their respective types.

G. Workmanship

1. Dimensions
Doors and frames shall be of the dimensions and profiles shown on the drawings.
The Contractor shall be responsible for coordinating the size of doors with internal width and height of door frames so that the gap between door and frame shall be 2mm at jambs and head, the gap between leaves of double doors shall be 3mm and the clearance between bottom of door and finished floor 3mm.

2. Finish and General Quality
Doors and frames shall be finished flat and smooth, free from undulations, ripples, unevenness, face blistering, other defects and in particular any splitting of the face melamine laminate: in achieving the required finish the manufacturer or the Contractor shall not sand or scrape the faces to the extent that the face melamine laminate thickness is significantly reduced.

3. Painting
The painting of door’s frame or other is specified in section 09900.
The paint will be as specified in 09900.
Workmanship shall be in full accordance with 09900 G; particular attention shall be paid to filling of the surface to eliminate grain, as specified in 09900, including board knife filling is required, to the complete satisfaction of the Engineer.
The transparent lacquer for veneered doors shall be applied in accordance with the manufacturer's instructions.

4. Hanging
The recesses for hinges shall be cut accurately to provide correct hanging without the introduction of packing.

5. Morticing for Ironmongery
The mortices shall be minimum size to accommodate the ironmongery.
Mortice for locks and latches shall be on the centre line of the thickness of the doors.

6. Defects
Doors shall be straight and true on all faces, opposite faces shall be parallel, and the doors shall be square. Doors shall be judged for general flatness and for squareness in accordance with BS 5277 and BS 5278 respectively.
The Contractor shall be required to replace at no extra cost any door which does not come up to the approved sample, or shows signs of warping, twisting, undulation, unevenness, face blistering or splitting or any other defects. The cost shall not fall on the Contract of any hanging, decoration, transferring ironmongery or any other operation consequent upon the replacement of the faulty door.

IRONMONGERY (08700)

A. Scope

1. The work includes the supplying and fixing of all ironmongery and door furniture described in the schedules of ironmongery.

2. All ironmongery shall be subject to the approval of the Engineer as regards quality, compliance with specified standards, functional performance and appropriateness, appearance in terms of finish and of compatibility with other items and availability for spares and replacements.

B. Performance and Standards

1. Ironmongery to be used externally shall not deteriorate in the conditions of temperature/humidity that pertain to the area.

2. Standards
BS 455 & 2088: Locks and latches for doors and performance requirements.
BS 2377: Hinges.
BS 1331 & 4112: Hardware for housing and performance tests.
BS 316: Stainless steel.

C. Related Items

Metal Materials	05010
Metal Finishes	05030
Aluminum Doors and Windows	08120-08520

D. Submittals

1. Samples
The Contractor shall supply a sample board (or boards) of all listed ironmongery, including locks fitted into door thickness panels for the approval of the Engineer before placing an order for the materials as a whole.

2. Manufacturer's Data
Copies of all manufacturer's published data fixing instructions, etc. shall be lodged with the Engineer.

3. Mastering Schedule
A full mastering schedule shall be submitted to the Engineer for approval.

4. Samples for Door and Frame Manufacturers
The Contractor shall supply samples of approved ironmongery to door, door frame and window manufacturers as specified in Sections, 08211, 08520.

E. Product Handling

1. Packaging
Ironmongery shall be securely packed and clearly labeled.

2. General Handling
Ironmongery shall be handled at all times to avoid damage, scratches, burred metal, etc. and shall be removed temporarily from surfaces which are to receive paint or other applied surface treatment, to permit these operations.

F. Materials

1. Ironmongery
The materials shall be to the approval of the Engineer "Mckinney" or approved equal.
The following materials shall be used as appropriate:
Aluminum Alloy
HE9-TF (extrusions)
NS4-0 (sheet)
HE9-M (stampings), and
LN5 (castings)
Anodized to a minimum of 10 microns.
Stainless steel 18/10/3
Chromium - nickel-molybdenum type.

2. Screws
All necessary screws shall be provided by the ironmongery suppliers. They are to be of the same material as the item they are to fix: screw heads shall match the finish of the adjacent metal and shall be packed with the ironmongery item. Crosshead countersunk screws shall be used where exposed to view.

3. Floor Springs
Floor plates shall not be engraved.

4. Key and Lock Marking
All keys and lock for ends or cylinders shall be engraved for identification as required by the Engineer.

5. Number of Keys
3 keys to each lock.

6. Locksets
Knob locksets shall be 6 line standard duty BHMA certified under ANSI A156 2 series 4000 Grade 2 U2 listed for use on fire doors or approved equal.

7. Automatic door holders and stops
Stops shall be Sargent 1300 series No. 1312 wall type and 1324 floor type or approved equal.

8. Door Closers
Door closers shall be Sargent 1250 and 1251 series standard (S) type or approved equal.

9. Hinges
Hinges shall be full mortise bearing hinges TA-TB2314 steel 5 knuckle type or double acting clamp flange spring butt-hinges No. 1001 or approved equal.

10. Steel hinges
Type TA-TB 2895 steel hinges or approved equal.

11. All ironmongery for all wood doors and closets shall be to the approval of the Engineer.

G. Workmanship

1. Fixing
All ironmongery shall be fitted strictly in accordance with the manufacturer's instructions.
Screws shall be driven centrally in drilled fixing holes and shall finish true to the face of the fixed item.

2. Security
The sub master and grand master keys are to be dispatched direct to the Engineer by the lock manufacturer.
Keys used by the Contractor during the works shall be held only by responsible persons named as key holders, whose names shall be given to the Engineer.
No keys shall leave the site: when the site is not operating keys shall be kept in a secure place.

3. Damage
Any scratched or otherwise damaged ironmongery shall be replaced.

4. Completion
All ironmongery shall be adjusted, cleaned, oiled and put in proper working order on completion.

GLAZING (08800)

A. Scope

1. This Section describes the glazing of screens, doors, windows and mirrors and covers single and double glazing.
Glass nameboard is covered in this section.

B. Performance Standards

1. All glass shall be in accordance with BS952. Glazing shall comply fully with the recommendations of BS 6262, especially in the selection of appropriate type and thickness of glass having regard to wind load safety under impact.
Toughened or other safety glass shall be used where shown on the drawings or where necessary to comply with BS 6262, Clauses 4.7 and 5.7, and BS 6026, Clause 4.

2. The Contractor shall ensure that all glazed-in materials are of adequate thickness, quality and strength to meet the required standards for wind loading and fire rating.
Exposure up to 1800 N/m2 shall be allowed for.
The glass shall not fail under thermal stress or thermal shock caused by part of the glazing being exposed to the sun while another part lies in shadow. This applies in particular to double-glazing units.

3. Unless otherwise directed, all situations where the presence of transparent glass may not be evident, or where the injury or risk of breakage is to be assumed, and in order to avoid the risk of human impact with the glazing, stainless steel discs or other configurations approved by the Engineer shall be adhered to indicate the presence of glass.

C. Related Items

Aluminum Doors and Windows 08120-08520

D. Submittals

1. Samples of Glass
Samples 300mm square of each type of glass specified shall be submitted for approval of colour, texture and pattern only. Compliance with other requirements is the exclusive responsibility of the Contractor.

2. Samples of Glazing Materials
Samples 300mm long of each type of glazing gasket or sealant shall be submitted for approval.

3. Manufacturer's Data
The Contractor shall submit manufacturer's specifications, data and installation instructions, including certified test results where available, for all glass and glazing materials.

E. Product Handling

1. Delivery
All glass shall be delivered to site in proper containers with marker's name, guarantee, type of glass and thickness or weight of glass attached to the outside of the containers.
Safety glass shall be visibly marked to indicate the tested level of impact resistance.
All deteriorated glass shall be removed from site

2. Storage on Site
Glass on site shall be stored in a dry, sheltered location, in felt-lined racks with back support in a near vertical position, secured against wind loading. Stacked glass an opened cases containing glass must not be subjected to direct sunlight which can cause build-up in the stack resulting in thermal stress breakage.
Stacks shall not be more than 500mm deep.

3. Protection
The glass shall be protected at all times from edge damage during handling and installation.

F. Materials

1. General
Glass shall be of uniform thickness, free from weaviness, air bubbles and all other defects. It shall be in conformity with BS 952.
Striations, where visible, shall run horizontally.
Glass shall be obtained from “Ford”, “Saint Gobain”, “Glaverbell” or approved equal.

2. Clear single glass
Clear single glass shall be ordinary glazing quality in accordance with the following table or as shown on drawings.

Nominal Thickness	Thickness Range	Approx Mass
mm	mm	Kg/m^2
6	5.7-6.3	15.0

3. Miscellaneous Glazing Materials

- Setting Blocks

  3mm thick x 75mm long x width to suit rebate details, neoprene or P.V.C. with a Shore a hardness of approximately 70-80.

- Location pieces and distance pieces

  Neoprene or other approved resilient material of not more than 25-30 Shore a hardness.

- Glazing Compound

  Shall be from an approved manufacturer.

- Gaskets

  Gaskets shall be pre-formed sections providing a continuous surround for the glass and a weather tight seal when compressed, and shall be manufactured from Neoprene from an approved supplier.

- Wash Leather

  Wash leathers for the use of fixed glazing in banisters, etc. where not under constant vibration shall be synthetic wash leather from an approved supplier.

- Glazing Beads

  Glazing beads shall be secured with self-tapping screws at distances of not more than 300mm unless fixed by other approved methods.

G. Workmanship

1. General

Watertight and airtight installation of each piece of glass is required, and the glazing must withstand temperature changes, wind loading, impact loading in the case of doors and opening lights, without failure of glass or glazing materials. The recommendations of glass and glassing compound manufacturers shall be followed.

2. Preparation

Rebates and beads must be clean immediately before glazing. Primer of sealer shall be applied to the timber surfaced in contact with glazing compound if so recommended by the compound manufacturer.

3. Measurement and Cutting

The Contractor shall take all necessary site measurements. Safety glass and sealed double-glazing units shall be manufactured to the required size and shall not be cut, nipped or abraded on site. All glass panels shall be cut or manufactured to allow a 2mm gap all round each opening to be glazed, or as otherwise specified by the manufacturer and agreed by the Engineer.

4. Dimensional Tolerances

a. Single and Double Glazing

   Glazed units shall be square and the maximum variation shall be plus or minus permissible tolerance for glass shall be plus or minus 3mm out of square and plus or minus 0.5mm in thickness.

5. Installation

Comply with the requirements and recommendations of BS 6262. All glass panes shall be set on setting blocks, centralized by means of location pieces between the edge of the glass and the face of the opening, and spaced equally between the back of the rebate and the bead by distance pieces. The spaced around the edge of the glass shall be completely filled with glazing compound. Tool exposed surfaces of the glazing compound in such a way as to shed water away from the glass, leaving clear smooth surfaces with any excess compound trimmed away.

Securely fix beads on a thin bed of glazing compound with cups and screws as specified for wood doors and windows, or in accordance with manufacture's details for aluminum doors and windows. Eliminate glazing compound stains and discolourations from glass and all adjacent surfaces.

Glazing materials shall be used in accordance with the recommendations of the manufacturer.

6. Protection and Cleaning

Protect glass from breakage after installation and indicate presence of glass by a from of taping or marking which will leave no remark or stain after eventual removal. Before buildings are handed over remove and replace any broken, damaged, stained or marked glass, however caused.

Wash and polish both faces of glass immediately before hand-over.

DIVISION 9

FINISHES

DIVISION 9

FINISHES

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Division 9

FINISHES

CEILING SUSPENSION SYSTEMS (09120)

A. Scope

1. The work shall consist of the supply and fixing of new suspension systems appropriate in all respects to each of the types of suspended ceiling employed in the Contract.

B. Performance and Standards

1. Adequacy of Support

a. The suspension systems shall be designed to provide substantial support for the ceiling finishes and associated light fittings, grilles, margins and any item forming part of the finished ceilings, in order that the soffit of the ceiling remains permanently true and level within specified tolerances.

b. The method of fixing the suspension system to the building structure shall be agreed with the Engineer and shall be completely secure.

c. Where so required the system shall be sufficiently robust to provide fixings and support for mechanical and electrical services suspended within the ceiling voids, and shall be designed and set out to facilitate the integration of such services.

d. Where partitions terminate at the suspended ceiling level and are not otherwise restrained the suspension system shall be sufficiently robust and suitably braced to provide rigid support to the tops of the partitions.

Wherever possible the bracing shall be two directional forming a 'V' in elevation and 'X' in plan, with 45 deg. angles.

2. Rust and Corrosion Resistance
All members shall not rust and shall not suffer any form of corrosion.

3. Thermal Movement
The system shall make allowance for thermal movement of the ceiling material due to temperature fluctuations deriving from heat emitted by light fittings or from any other cause.

4. Standards
All materials shall conform to relevant British Standards, in particular to those Standards, where appropriate, listed in sections 05010, Metal Materials, and 05030, Metal Finishes. BS CP 290.

C. Related Items

Metal Materials	05010
Metal Finishes	05030
Suspended Ceiling Systems	09515

D. Submittals

1. Data
The Contractor shall supply the Engineer with duplicate copies of manufacturer's published data, instructions for fixing and assembly and any other relevant information.

2. Samples
The Contractor shall provide samples of components and materials to be used in the work.
A mock-up shall be erected of each type of ceiling, including light fittings, diffusers, etc., as described elsewhere. The mock-ups shall comprehensively include the suspension system, which shall be approved by the Engineer before the commencement of the work in general.

3. Shop Drawings
The Contractor shall submit requisite copies of shop drawings showing all necessary details prior to the commencement of work and shall obtain Engineer's approval.

E. Product Handling

1. All materials shall be handled at all times as to prevent damage. Any damaged materials shall be replaced at no additional charge.

F. Materials

1. Note: The Contractor is referred also to the following sections which include relevant suspension systems:
Section 09515 Suspended Ceiling Systems

2. Materials Generally
Suspension systems shall generally be of hot dip galvanized steel members comprising all hangers, runners, trimmers, bearers, clips, tie wires, bolts and screws necessary to install the ceilings rigidly and to a true and level finish. The use of timber is to be avoided where possible, but if necessary, shall be carcassing grade softwood free from defects, pressure impregnated, rendered fully resistant to termite attack, and of appropriate moisture content.
All cut ends and any damage to protective coatings shall be made good before plastering commences, to ensure that no subsequent staining occurs on adjacent finishes and that no corrosion will occur in the ceiling void on any ceiling components. Should any such defects occur before the end of Defects Liability period, the Contractor will be required, at his own expense, to cut out and make good to the satisfaction of the Engineer, including redecoration of the complete ceiling involved.
In spaces of particularly high humidity, (80 deg. humidity) the members of the suspension system shall be aluminum alloy in lieu of steel.
Wherever dissimilar metals are in contact with each other precautions shall be taken to prevent corrosion from electrolytic action.

3. Bolts and Screws
All bolts and screws, washers and nuts shall be sherardized or otherwise protected to the Engineer's satisfaction, and shall be of sufficient strength for their purpose.

4. Tying Wire
All tying wire shall be galvanized soft wire conforming with BS 443 and shall be 1.2mm (for securing expanded metal) and 3mm (for securing ceiling runners to bearer channel.

5. Expanded Metal Beads
At all perimeters and openings in expanded metal ceilings, angle bead, or stop beads shall be to the approval of the Engineer.
All metal beads shall comply with BS 1246: 1959.

6. Hangers, Bearers, Runners, etc.
The principal components of the suspension system shall be in accordance with the drawings, or approved manufacturer's standard components, in mild steel, (or aluminum: see F2 above).

G. Workmanship

1. General
Methods of erection and all workmanship shall be in accordance with the recommendations of the manufacturer of the ceiling system, and with the relevant clauses of BS CP 290.

2. Setting Out
The contractor shall allow for all secondary systems of suspension as may be necessary to bridge ducts or other services to maintain the necessary fixing centres on the system. Before starting work ensure that light fittings, grilles, etc., are in correct positions relative to ceiling grid. Ensure that all trades use common setting out points. Ensure that the ceiling is properly related to each grid line of the building, and that there is no accumulative creep over the length or width of any ceiling. The ceilings are part of a modular co-ordination system joint lines will dictate locations for pre manufactured partitions, panels, screens, etc., which will be fixed later. No cutting or making up will be allowed.

PORTLAND CEMENT PLASTER (09220)

A. Scope

This section specifies internal plaster of cement and sand to blockwall or concrete surfaces.

B. Performance and Standards

1. The plaster shall have complete adhesion to the wall and shall not crack or craze.

2. Cement BS 12
Sand BS 1199. Table 1.

C. Related Items

Precast Concrete Blockwork 04220

Suspended Ceiling Systems 09515

D. Submittals

1. Samples of Materials
The Contractor shall supply a sample of the sand for plastering for approval by the Engineer, and such samples as the Engineer might require of miscellaneous plastering materials such as plaster stops and casing beads.

2. Sample of Workmanship
The Contractor shall carry out the plastering of one wall as a sample of workmanship and finish. The generality of the work shall not proceed until the sample is approved by the Engineer.

E. Product Handling

Cement shall be delivered in the manufacturer's sealed bags or other approved container, and shall be stored off the ground, in a dry shed. Sand shall be kept free from organic or any other contaminated substance.

F. Materials

1. Cement
Cement shall be Portland Cement to BS 12.

2. Sand
Sand shall be clean, washed sharp sand to BS 1199, Table 1.

3. Angle Beads, Stop Beads, etc.
All such plastering accessories shall be standard galvanized mild steel products.

4. Mix
The mix shall be 1 part cement to three parts sand by volume, or as otherwise agreed with the Engineer. Plasticiser shall only be used with the approval of the Engineer.

5. Accessories
Angle beads shall be to the approval of the Engineer.
Stop beads shall be to the approval of the Engineer.

The above accessories are from 0.56 tight coat galvanized sheet, synthetic coated, with white PVC protective nosing.

G. Workmanship

1. Preparation of Substrate
Ensure that all chases or other apertures have been cut. Ensure that the substrate surface is free from dust, oil, etc. Ensure adequate key for plaster, if necessary by hacking the surface or applying a coat of approved bonding agent. Rake out joints in blockwork.

2. Trims and Joints
Fix beads, stops, angle beads, etc., plumb, square and true to line and level, as indicated on drawings.

3. Plaster
Unless single coat plastering is agreed by the Engineer apply plaster in two coats to a total thickness as shown on drawing on as stated in the B.O.Q.
Cross-scratch surface of first coat to provide key for second coat.
Allow the first coat to dry thoroughly before applying second coat.
Dub out as necessary to correct inaccuracies; dubbing out shall not exceed 10mm.
Apply second coat and finish with a wood float.
Each coat shall be applied firmly to achieve good adhesion, in one continuous operation. Finish the surface to a true plane to the correct line and level and plumb, with all angles and corners to a right angle unless otherwise shown on the drawings.
Wire mesh metal lathing shall be installed at all junctions of dissimilar materials.

4. First coat of plaster under wall cladding where indicated shall be scratched for good adhesion of mortar for tiling.

CERAMIC FLOOR TILES (09312)

A. Scope

This section covers the supply and fix a mass ceramic tiles and skirting.

The work shall include all necessary expansion and control joints and joint sealers as specified in section 07900: Sealants.

B. Performance and Standard

Fully vitrified tiles shall have a water absorption not exceeding 0.3%.

The whole floor, including bedding and jointing materials shall be capable of resisting the action of acids, oils or fats to which it can be expected to be subjected according to its location in the project.

The ceramic floor tiling shall be carried out in accordance with BS CP 202.

The tiles shall conform to BS 6431, Fully vitrified ceramic.

C. Related Items

Beds and Screeds 03500

D. Submittals

1. Sample Tiles
The Contractor shall submit for the Engineer's approval sufficient plain flooring tiles to indicate the quality and range of color or shade variety that can be expected.

2. Sample Panel
Following initial selection of a specific tile the contractor shall submit a panel not less than 1m square of the tiles stuck onto an appropriate rigid backing sheet with joints of the specified width pointed with the specified grout.

3. Sample Floor
Following approval of the sample panel the Contractor shall lay one complete room floor which, when approved, shall remain as the standard by which the remainder of the work shall be judged.
The room shall be one selected by the Engineer, and shall include a movement joint which shall be completed with the specified joint sealer as part of the sample.

4. Compliance with Standard
The Contractor shall supply a written statement of compliance with the specified standard in respect of each type of tile submitted.

5. Data
Copies of the manufacturer's data and fixing recommendations shall be handed to the Engineer. Any variation between such recommendations and the requirements of this Specification shall be called to the attention of the Engineer.

E. Product Handling

1. Tiles
The tiles shall be transported and stored in the manufacturer's cartons with seals unbroken and labels intact until time of use.
Tiles shall be handled and stored at all times to prevent damage and soiling.

2. Bedding Materials
Cement, aggregates, etc., shall be handled and stored.

3. Mortar
Cement and sand mortar shall be 1:3.
The cement shall be Portland cement to BS12. The water shall be clean, free of impurities and the least needed for proper workability.
The bedding mortar shall consist of a mixture not richer than 1 part cement to 3 parts sand and not leaner than 1 part cement to 4 parts sand, and shall be not less than 12mm thick. The sand for the mortar shall be in all respects in accordance with the requirements of BS 1200.

F. Materials

1. Tiles

- All tiles shall be as manufactured by “China 1rst choice” or approved equal.
- All tiles shall be in accordance with BS 6431.
- Tiles shall be fully vitrified as defined in BS 6431.
- Tiles used in wet areas shall have an approved anti-slip surface produced by the nature of the tile ingredients and not by ribbing, projecting studs or other form of surface profiling.

  Tiles used for steps shall be provided with special anti-slip grooves.

2. Sizes

- Size shall be as indicated in the Bill of Quantities and/or as directed by the Engineer.
- Skirting tiles shall be 80mm high x 8mm thick and shall match the floor tiles with rounded edge and be from the same manufacturer.
- Colours, Finish and Defects

  These shall be selected by the Engineer and shall accurately match approved samples. The tiles shall be entirely free from defects and blemishes.
  Ceramic tiles shall be mat, or as directed by the Engineer.

3. Bedding Materials: Mortar
Cement shall be Portland Cement to BS 12. Sand shall comply with the requirements of BS 1200 clean, sharp, not too fine and free from clay, organic or soluble matter. Sea sand shall not be used. The mixture shall be not richer than 1:3 and not leaner than 1:4, cement: sand, and the mortar shall not be less than 12mm thick.

4. Grout
The grouting mortar shall be flooring grade colored grout to the Engineer's approval.

G. Workmanship

1. General
The floors shall be laid in accordance with BS CP 202.

2. Inspection and Protection of Base
The Contractor shall inspect the base on which the ceramic tiles are to be laid. The base surface shall be thoroughly clean, free from dust, oil, plaster, lime or other foreign materials immediately before tile laying is commenced.

3. Bay Division

The floor areas shall be sub-divided into bays not exceeding 10m^2 with the long side of each bay not exceeding the shorter side by more than one and a half times.
Movement joints around the perimeter of the floor and at bay sub-divisions shall be 6mm wide, through the depth of the tile and bed, filled with strip filler materials and finished with sealant.

4. Ceramic Tile Fixing

- Tiles shall be fixed by bedding on a bed of cement and sand mortar, at the discretion of the Contractor who shall be solely responsible for making any adjustments including dimensional adjustments, to the satisfaction of the Engineer, which his choice necessitates.
- Ceramic skirting shall be fixed as ceramic tiles.

5. Grouting

The tiling shall be grouted on completion with epoxy of a colour to match the tiles, ensuring, that all joints are completely filled.
Surplus grout is to be cleaned off the face of the tile and adjoining surfaces and the tiles are to be carefully cleaned.

6. Final Cleaning

The final polished surface is to be washed with hot water and alkali-free detergent, and left clean and protected from damage to the satisfaction of the Engineer.

CERAMIC WALL TILES (09310)

A. Scope

This Specification covers glazed ceramic wall tiling in selected sizes and colours.

B. Performance and Standards

1. The work shall comply with BS 5385, Code of Practice for Wall Tiling, Part 1, and Part 2.

2. Tiles shall comply with BS 1281.

C. Related Items

Joint Sealers	07900
Ceramic Floor Tiles	09312

D. Submittals

1. Samples of Tiles
For each specified type or colour of tile the Contractor shall supply for the Engineer's approval a panel of tiles not less than 300mm square stuck onto a backing board of hardboard or similar and grouted with the specified grout.
The Contractor shall also submit full size samples of each tile accessory.

2. Sample of Work
Before the generality of the work is commenced carry out one area of each type (not necessarily each colour) of tiling, not less than 4m sq. which, when approved, shall stand as the minimum standard of workmanship to be achieved. Where appropriate in the context of the work and as may be required by the Engineer the sample shall include a length of at least 1m of sealant jointing. The remainder of the work shall not proceed before approval has been given to this sample.

3. Data
Copies of the tile and tiling materials manufacturer's data and fixing recommendations or instructions shall be handed to the Engineer, and tile fixing shall not be at variance with these instructions without the written agreement of the Engineer.

E. Product Handling

1. Tiles
The tiles shall be transported and stored in the manufacturer's cartons with seals unbroken and labels intact until time of use.
Tiles shall at all times be handled and stored to prevent damage and soiling.

2. Pointing Mortar and Grout
Materials shall be transported and stored in the manufacturer's sealed containers until required for use and shall at all times be handled in accordance with the manufacturer's instructions.

3. Cement and Sand Mortar
Cement and sand mortar shall be as specified in 04220 Precast concrete blockwork.

F. Materials

1. Glazed Ceramic Wall Tiles

- Source
  All tiles shall be obtained from China 1rst choice or approved equal. Each type of tile shall be obtained from a single manufacturer together with all fittings and specials relating to that type.
- Tiles
  The tiles shall be to BS 1281 with cushion edges and spacer lugs. Fittings and specials shall be to BS 1281: round edge fittings shall be as Fig. 1 in the BS.
  All internal and external corner tiles whether vertical or horizontal shall be round edged.
- Sizes
  Size shall be as indicated on the drawings.
  or as otherwise agreed with the Engineer. Tolerances shall be in accordance with BS 6431.
- Colours, Finish and Patterns
  Colours, finish and patterns for ceramic wall tiles shall be selected by the Engineer and shall accurately match approved samples.
- Defects
  The tiles shall be entirely free from defects and blemishes.

2. Mortar
Cement and sand mortar shall be 1:3.
The cement shall be portland cement to BS12. The water shall be clean, free of impurities and the least needed for proper workability.
The bedding mortar shall consist of a mixture not richer than 1 part cement to 3 parts sand and not leaner than 1 part cement to 4 parts sand, and shall be not less than 12mm thick. The sand for the mortar shall be in all respects in accordance with the requirements of BS 1200.

3. Grout
The ceramic tiles grout shall be determined by the Engineer. The grout shall be used in accordance with the instructions of the manufacturer. The Engineer shall determine what grout will be used if there was a danger of damp penetration.

4. Tiling adhesive shall be a thin-bed PVA adhesive Type BCR or approved equal if recommended.

G. Workmanship

1. General

- Manufacturer's recommendations are to be strictly followed for all products and materials.
- Standards
  Comply with the requirements of BS 5385, Part 1.

2. Setting Out

- The tiling shall be set out strictly in accordance with the Engineer's drawings or approved Contractor's drawings.
- Cut tiles shall be kept to a minimum and shall not be less than half the width of a full tile. Joints shall be truly horizontal and vertical and horizontal joints in adjacent walls shall align. All joints shall be 1.5mm wide or as determined by spacers.

3. Tolerance

- Maximum permissible gap under a 2m straight edge shall be 3mm.
- Owing to variations which may occur in tile sizes within the limits of BS 6431, the Contractor shall be responsible for sorting all tiles into batches after delivery to site and before any fixing is commenced. Each batch shall contain tiles of the same size and the tiler shall apportion the batches to ensure that only tiles of one size are used in any one room.

4. Background

a. Acceptance of Background
Before fixing tiling ensure that the background is:
   i. Adequately true and level to achieve specified tolerances.
   ii. Free from contamination and loose areas.
   iii. Adequately prepared to give a good bond.

b. Tiling on Plaster
Tiles may be applied to plaster surfaces only in the case of small areas where agreed by the Engineer. Such areas shall include splash backs to sanitary fittings where the area of tiles does not exceed 1m square.
Plaster surfaces shall be cleaned before tiling, in accordance with the manufacturer's instructions.

c. Drying Out
Before fixing tiles ensure that concrete and masonry backgrounds have been exposed to the air for not less than four weeks and are thoroughly dry.

5. Fixing

a. Preparation of Tiles
Tiles which are dirty or have a coating of dust shall be cleaned with clean water, but must be entirely dry before application of adhesive.

b. Floated and Buttered Thin Bed

   i. Apply adhesive to dry background as a continuous float coat, using a plasterer's trowel having 6mm x 6mm notches at 25mm centres.
   ii. Apply a thin, even coat of adhesive to the backs of dry tiles.
   iii. Press tiles onto bedding with a twisting/sliding action to give a finished bed thickness of not more than 3mm.
   iv. Ensure solid bedding under the whole tile and adhesion over the whole of the background and tile back.

c. Adjustment
Make any necessary adjustment to tiles within 10 minutes of fixing.

d. Cleaning Off
Remove surplus mortar as soon as bedding is complete. Do not disturb tiles.

6. Grouting

When bedding has set sufficiently to prevent disturbance of tiles, but not more than 7 days after fixing, all joints are to be grouted by working ceramic tile grout in so that the joint is completely filled. Finish flush and thoroughly clean off surplus grout as the work proceeds using a damp cloth. Tool joints smooth.

7. Finishing

The finished work shall be left clean and free from cement, plaster, paint, dust or any other marks or imperfections; cleaning down must not be carried out with materials which will scratch or in any way impair the finished work.

Final polishing shall be done with a soft dry cloth.

8. Protection

The Contractor shall adequately protect the tiling from all damage, howsoever likely to be caused, until the handing over. Any damage which does occur shall be made good by the Contractor at his own expense. The whole of the work shall be prepared for handover in a state satisfactory to the Engineer.

GYPSUM BOARD FALSE CEILING (09513)

A. Scope

1. This section covers suspended ceilings consisting of panels complete with suspension system and all necessary trims and accessories.

B. Performance and Standards

1. Suspension System
The suspension system shall be designed to provide substantial support for the ceiling finish and associated light fittings, and for grilles, margins and any item forming part of the finished ceiling, in order that the soffit of the ceiling remains permanently true and level.

2. British Standards
All materials shall comply with the relevant current British Standards.
Workmanship shall be in accordance with BS CP 290.

C. Related Items

Ceiling Suspension Systems 09120

D. Submittals

1. Samples
The Contractor shall supply samples for approval of each size and type and of such other component members as may be called by the Engineer.

2. Shop Drawings
The Contractor shall submit for approval shop drawings showing all necessary details, including trimming for light fittings, grilles, laboratory service boxes, etc … perimeter details, and all suspension and fixing details.
The Contractor shall submit also layout drawings for each type of room or space which has a suspended metal ceiling.
Drawings shall be submitted so that they can be cleared by the Engineer as may be required to progress the main works and specialist's work, but in any event not late than 21 working days before the work is put in hand.

E. Product Handling

1. Protection and Handling Generally
Prevent distortion or damage or panels and other components during transit, handling, storage and fixing.
Store under cover.
Protect metal finishes as specified in Section 05030.
Prevent contact with wet plaster or cement or any other deleterious matter.
Provide protective coverings as necessary and remove all protection on completion.

F. Materials

1. Gypsum board
Shall be panel board tapered edge type 20 mm thick conforming to ASTM C36 Type Regular. Platres Lafarge Co. or approved equal.

2. Downward demountable concealed grid egg crate open cell ceiling folded aluminium blade formation to polyester powder paint color as approved by the Engineer, installed on the manufacturer's proprietary suspension system consisting of hanger runners, cross runners and patented spring clips into which the modular panels are located. Material shall be Damper Hunter Douglas or equivalent.

   The Contractor will be responsible for ensuring selected light fittings are compatible for installation into the specified suspended ceiling system.

3. Access to Ceiling Void
   All units must be demountable without disturbance to adjacent units, by means of a key, without distortion or risk of damage to the panel or tile.

4. Accessories
   The system is to be complete with all necessary accessories including infill channels, perimeter trim, etc., as may be shown on the Engineer's or manufacturer's approved drawings.

5. Suspension
   The suspension system shall consist of angle hangers or suspension wires, primary suspension channels and main runners, with all necessary clips. The main runners shall be of the split 'T' type to give a fully concealed fixing system. All members shall be zinc sprayed, sherardized or given other approved protective coating.

G. Workmanship

1. General
   The Contractor shall set out the whole ceiling in accordance with the approved drawings, in such a way that close tolerances are achieved. The deviation from the nominal shall not be in excess of + or - 3mm over 4m length, non-accumulative.
   Method of erection and all workmanship shall be in accordance with the instructions of the manufacturer of the ceiling system, and with the relevant clauses BS CP 290.

2. Suspension
   The method of fixing hangers to the structural soffit shall be agreed with the Engineer.

3. Additional Loads on Suspension System
   Light fittings, ventilation diffusers, etc., are to be supported on the ceiling suspension at ceiling level and the Contractor shall allow for substantial support for these loads when designing the system. He shall liaise with the manufacturers of the various items so that they are compatible with the ceiling system, and he shall incorporate the necessary runners, lugs or other support to fix or rest on the ceiling suspension.

4. Gypsum Board
   a. Gypsum board thickness at suspended ceiling and bulkhead shall be 12.7mm thick.
   b. Carefully cut gypsum boards to the required sizes with cut edges and ends of the board sandpapered to obtain neat jointing.
   c. Apply gypsum board with the reverse side against the framing members. Separate boards shall be in moderate contact. In no cases shall the boards be forced into place. At interior and exterior corners, the cut edges of the boards shall be concealed by overlapping them with the abutting boards. Stagger gypsum board so that the corners of any four boards will not meet at the same point.
   d. Apply gypsum board with the long dimension at right angles to the framing members. Use horizontal application unless vertical application results in fewer joints.

5. Installation of Panels
All wet trade activities shall be completed and dried out before panel installation is commenced.

6. Cut Ends, etc.
All cut ends and any damage to protective coatings shall be made good before fixing to ensure that no subsequent staining will occur on the finished work and no corrosion will occur in the ceiling void or on any member.

7. Fixings, Miscellaneous
The panel and tile fixing system is an invisible one; no visible fixing will be permitted unless there is no alternative; if unavoidable, screws shall be countersunk with flat Phillips head, stove enameled to match the panel or tile. All concealed screws and bolts shall be sherardized and of sufficient strength for their purpose.

The used of timber is to be avoided where possible, but if necessary, shall be in all respects as specified in section 06400.

8. Cleaning, Protection and Patching
a. Be responsible for cutting and patching of defects appearing in the gypsum board work, after the work of other trades has been completed, regardless of how, or by whom, the damage was caused. Patching shall be neatly and properly made to match the original work. Portions of the work damaged beyond repair shall be removed and replaced with new material at no additional cost to the Owner.
b. Clean and repair surfaces soiled or damaged in connection with the work of this Section to the approval of the Engineer. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.
c. Upon completion of the work, remove debris, equipment and excess material resulting from the work of this Section from the site.
d. Protect completed work from damage through construction period.

ALUMINUM SUSPENDED CEILING SYSTEMS (09515)

A. Scope

1. This section covers suspended ceilings consisting of Aluminum panels and strips complete with suspension system and all necessary trims and accessories.

B. Performance and Standards

1. Suspension System
The suspension system shall be designed to provide substantial support for the ceiling finish and associated light fittings, and for grilles, margins and any item forming part of the finished ceiling, in order that the soffit of the ceiling remains permanently true and level.

2. British Standards
All materials shall comply with the relevant current British Standards.
Workmanship shall be in accordance with BS CP 290.

C. Related Items

Ceiling Suspension Systems 09120

D. Submittals

1. Samples
The Contractor shall supply samples of sizes and type and such other members as may be called by the Engineer.

2. Shop Drawings
The Contractor shall submit for approval shop drawings showing all necessary suspension and fixing details, including trimming for light fittings, grilles, etc …

E. Product Handling

1. Protection and Handling Generally
Prevent distortion or damage or panels and other components during transit, handling, storage and fixing.
Store under cover.
Protect metal finishes as specified in Section 05030.
Prevent contact with wet plaster or cement or any other deleterious matter.
Provide protective coverings as necessary and remove all protection on completion.

F. Materials

1. False ceilings
Metal strips paneling, or cell shall be of thickness 0.5 to 0.6mm, lacquered aluminum strips and panels with sealed joints as manufactured by metal screen, Sadi metal, rechter or equal approved by the Engineer.
Sizes to be as per drawings and finishing schedule.

2. Access to Ceiling Void.
All units must be demountable without disturbance to adjacent units, by means of a key, without distortion or risk of damage to the panel or tile.

3. Accessories
The system is to be complete with all necessary accessories including infill channels, perimeter trim, etc., as may be shown on the Engineer's or manufacturer's approved drawings.

4. Suspension
The suspension system shall consist of angle hangers or suspension wires, primary suspension channels and main runners, with all necessary clips. The main runners shall be of the split "T" type to give a fully concealed fixing system. All members shall be zinc sprayed, sherardized or given other approved protective coating.

G. Workmanship

1. General
The Contractor shall set out the whole ceiling in accordance with the approved drawings, in such a way that close tolerances are achieved. The deviation from the nominal shall not be in excess of + or - 3mm over 4m length, non-accumulative.
Method of erection and all workmanship shall be in accordance with the instructions of the manufacturer of the ceiling system, and with the relevant clauses BS CP 290.

2. Suspension
The method of fixing hangers to the structural soffit shall be agreed with the Engineer.

3. Additional Loads on Suspension System
Light fittings, ventilation diffusers, etc., are to be supported on the ceiling suspension at ceiling level and the Contractor shall allow for substantial support for these loads when designing the system. He shall liaise with the manufacturers of the various items so that they are compatible with the ceiling system, and he shall incorporate the necessary runners, lugs or other support to fix or rest on the ceiling suspension.

4. Installation
Ensure that only boards bearing the same batch number are used in any one space.
All wet trade activities shall be completed and dried out before panel installation is commenced.

5. Cut Ends, etc.
All cut ends and any damage to protective coatings shall be made good before fixing to ensure that no subsequent staining will occur on the finished work and no corrosion will occur in the ceiling void or on any member.

6. Fixings, Miscellaneous
The panel and tile fixing system is an invisible one; no visible fixing will be permitted unless there is no alternative; if unavoidable, screws shall be countersunk with flat Phillips head, stove enameled to match the panel or tile. All concealed screws and bolts shall be sherardized and of sufficient strength for their purpose.
The used of timber is to be avoided where possible, but if necessary, shall be in all respects as specified in section 06400.

7. Cleaning, Protection and Patching

- Clean and repair surfaces soiled or damaged in connection with the work of this Section to the approval of the Engineer. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.
- Upon completion of the work, remove debris, equipment and excess material resulting from the work of this Section from the site.
- Protect completed work from damage through construction period.

VINYL SUSPENDED CEILING SYSTEMS (09516)

A. Scope

1. This section covers suspended ceilings consisting of Vinyl panels boards complete with suspension system and all necessary trims and accessories.

B. Performance and Standards

1. Suspension System
The suspension system shall be designed to provide substantial support for the ceiling finish and associated light fittings, and for grilles, margins and any item forming part of the finished ceiling, in order that the soffit of the ceiling remains permanently true and level.

2. British Standards
All materials shall comply with the relevant current British Standards.
Workmanship shall be in accordance with BS CP 290.

C. Related Items

Ceiling Suspension Systems 09120

D. Submittals

1. Samples
The Contractor shall supply samples of sizes and type and such other members as may be called by the Engineer.

2. Shop Drawings
The Contractor shall submit for approval shop drawings showing all necessary suspension and fixing details, including trimming for light fittings, grilles, etc …

E. Product Handling

1. Protection and Handling Generally
Prevent distortion or damage or panels and other components during transit, handling, storage and fixing.
Store under cover.
Protect metal finishes as specified in Section 05030.
Prevent contact with wet plaster or cement or any other deleterious matter.
Provide protective coverings as necessary and remove all protection on completion.

F. Materials

1. Shall be Acoustic vinyl panel board tiles 60 × 60cm as manufactured by Hunter Douglas or equal or as approved by the Engineer.

2. Access to Ceiling Void.
All units must be demountable without disturbance to adjacent units, by means of a key, without distortion or risk of damage to the panel or tile.

3. Accessories
The system is to be complete with all necessary accessories including infill channels, perimeter trim, etc., as may be shown on the Engineer's or manufacturer's approved drawings.

4. Suspension
The suspension system shall consist of angle hangers or suspension wires, primary suspension channels and main runners, with all necessary clips. The main runners shall be of the split "T" type to give a fully concealed fixing system. All members shall be zinc sprayed, sherardized or given other approved protective coating.

G. Workmanship

1. General
The Contractor shall set out the whole ceiling in accordance with the approved drawings, in such a way that close tolerances are achieved. The deviation from the nominal shall not be in excess of + or - 3mm over 4m length, non-accumulative.
Method of erection and all workmanship shall be in accordance with the instructions of the manufacturer of the ceiling system, and with the relevant clauses BS CP 290.

2. Suspension
The method of fixing hangers to the structural soffit shall be agreed with the Engineer.

3. Additional Loads on Suspension System
Light fittings, ventilation diffusers, etc., are to be supported on the ceiling suspension at ceiling level and the Contractor shall allow for substantial support for these loads when designing the system. He shall liaise with the manufacturers of the various items so that they are compatible with the ceiling system, and he shall incorporate the necessary runners, lugs or other support to fix or rest on the ceiling suspension.

4. Installation
Ensure that only boards bearing the same batch number are used in any one space.
All wet trade activities shall be completed and dried out before panel installation is commenced.

5. Cut Ends, etc.
All cut ends and any damage to protective coatings shall be made good before fixing to ensure that no subsequent staining will occur on the finished work and no corrosion will occur in the ceiling void or on any member.

6. Fixings, Miscellaneous
The panel and tile fixing system is an invisible one; no visible fixing will be permitted unless there is no alternative; if unavoidable, screws shall be countersunk with flat Phillips head, stove enameled to match the panel or tile. All concealed screws and bolts shall be sherardized and of sufficient strength for their purpose.
The used of timber is to be avoided where possible, but if necessary, shall be in all respects as specified in section 06400.

7. Cleaning, Protection and Patching

- Clean and repair surfaces soiled or damaged in connection with the work of this Section to the approval of the Engineer. Pay the cost of replacing finishes or materials that cannot be satisfactorily cleaned.
- Upon completion of the work, remove debris, equipment and excess material resulting from the work of this Section from the site.
- Protect completed work from damage through construction period.

STONE (09600)

A. Scope

Work Included:

The Contractor shall furnish and install all stone and Related Work as required by the drawings and/or herein specified, generally as follows:

- Stone exterior wall facing, Paving and where indicated on the drawings.

B. Performance and Standards

Refer to Masonry Mortar	04100
Masonry accessories	04150

C. Related Items

Masonry Mortar	04100
Masonry accessories	04150

D. Submittals

1. Shop Drawings

- The Contractor shall prepare and submit shop and setting drawings of all work included herein for the Engineer's approval.
- Shop and setting drawings shall show in detail all sizes, arrangement of joints, and all provisions for anchoring and soffit suspension.
- Shop drawings shall be submitted as directed by the Engineer.
- All installed materials shall conform to the approved corresponding shop drawings.

2. Samples

- Samples of all materials proposed to be used shall be submitted for approval. Samples of stone shall show the extremes of variations in quality, texture, colour and finish. Materials incorporated in the finished work must be within the approved ranges of the approved samples or will be rejected.
- Samples shall be submitted as directed by the Engineer.
- Field mock-up shall be erected on the site where directed by the Engineer. The panels shall be of sizes directed by the Engineer and shall include joint profile and mortar colour, and anchoring. The mock-up panels shall be immediately revised by the Contractor during the presence of the Engineer, if the Engineer so directs, until each panel is approved by the Engineer. All installed stone construction shall conform to approved mock-up panels. The mock-up panels shall remain intact until their removal is directed by the Engineer, and subsequently, shall be removed by the Contractor.

3. Measurements

The Contractor shall take all necessary measurements as required to assure proper fabrication and installation of the work of this section.

4. Coordination

All work of this section shall be closely coordinated with the work of other sections whose work affects or is affected by the work specified in this section.

E. Materials

1. Stone

- Stone shall be local natural stone and as indicated on the drawings, and to the approval of the Engineer.
- The actual stone used shall be sound, of uniform texture, and shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability or appearance of the work, as determined by the Engineer.
- Inherent variations characteristic of the stone and the quarry from which the stone is obtained shall be brought to the attention of the Engineer at the time the samples are submitted for approval, and such variations shall be subject to approval of the Engineer.
- All stone and Granite stone shall be selected for background colour, veining, marking and matching, and shall run in even shades.
- The Contractor shall cut all stones to sizes required by the drawings and as approved by the Engineer.

2. Mortar Setting Materials

Cement shall be white cement conforming to ASTM C-150, Type 1, latest edition.

- Lime shall be either hydrated or quicklime, Hydrated lime shall conform to ASTM C-207, latest edition, and shall be at least 92% hydrated quicklime shall conform to ASTM C-5, latest edition.
- Lime putty shall be stiff mixture of lime and water, kept moist until used. Putty made from quicklime shall be slaked and allowed to soak before using as recommended by the manufacturer of the lime used.

Sand shall conform to ASTM C-144, latest edition.

Water shall be clean and fresh, from the water supply system.

F. Workmanship

1. Examination of Surfaces

- All surfaces which will receive the work of this section shall be carefully examined prior to the installation of the work. Starting installation on any surface shall be construed as an acceptance of such surface and acceptance of all prevailing conditions, and as a waiver of any subsequent claim to the contrary.

2. Stone

- All stone shall be accurately cut to the shapes, dimensions and profiles indicated on the drawings and in conformance with the approved shop and setting drawings.
- Exposed surface tolerance shall not exceed 3mm in 2.50 meters.

- Holes shall be cut in all stone weighing more than 100 pounds unless other methods of raising stone not requiring holes. No holes shall come closer than 50 to exposed faces of stone.
- Joints of all stone shall be full and square for full thickness of the stone. All concealed surfaces of joints shall be sawed.
- The backs of all stone shall be sawed or roughly dressed to approximately true planes.
- All sawed surfaces shall be cleaned of rust stains and iron particles.
- Stone wall facing shall be natural finish as shown on the drawings. Jointing, coursing, setting patterns and finish of stone shall be as shown on drawings.
- Joints within stone shall be of thickness indicated and shall have a "raked" profile.
- Joints shall be 1/16" thick and shall be flush.
- Stone shall be set in mortar, and all joints shall be filled with mortar and the back of the stone shall be treated with mortar repellent paint.
- When setting stone, adjacent pieces shall be selected for similarity in colour, veining and matching.
- Stone shall be set accurately, true to line, plumb and level.
- All exposed surfaces shall be free from waves, and faces of stone in the same plane shall be flush at joints. Arises shall be sharp and true, square and continuous with adjoining arises.
- Partially completed stone work shall be thoroughly covered when work is interrupted to prevent water and moisture from entering behind stone.
- The Contractor shall have a thoroughly competent stone superintendent in charge of the stone at all times during the handling and setting of stone.
- Stone shall be so delivered and handled to protect it from damage at all times. The patching or hiding of defects shall not be permitted. Stone chipped or stained on the surface shall be redressed or cleaned to remove all traces of such defects before it is set in place, or new stone shall be furnished as directed by the Engineer.
- Walls to receive stone cladding shall be plastered with cement mortar if that shown on drawings. This plaster shall be 10mm thick and scratched while it is green.

3. Mortar Joints

- Mortar shall consist of one part of non-staining white cement, one part hydrated lime, and four parts fine sand or five parts coarse sand.
- All mortar for joints shall be coloured to match the stone with which it is used.

4. Protection

- All work of this section, and related adjacent construction, shall be protected from damage, staining, or other imperfections at all times. Damaged, stained, or imperfect materials shall be repaired or replaced as directed by the Engineer, to the Engineer's satisfaction, without cost to the Owner.
- Use all reasonable means to keep the exposed surface of stone while being laid and particularly to keep it free from and/or caulking compound.

- Galvanized steel cramps and hooks to the braking wall shall be use as directed by the Engineer.

5. Cleaning

- All exposed surfaces of the work of this section and related adjacent surfaces shall be maintained in a clean condition, and upon substantial completion of the Contract shall be thoroughly cleaned to the satisfaction of the Engineer.

MARBLE (09615)

A. Scope

This section covers the following:

- The execution of Marble floors, skirting, treads, risers and threshold, as shown on drawings

All shall be to the satisfaction of the Engineer.

B. Performance and Standards

The work shall be carried out in accordance with BS CP 202, including all current amendments.

C. Quality Assurance

All marble shall be provided from a single source from a single quarry to ensure consistency of quality and color.

D. Related Items

Portland Cement Plaster 09220

E. Submittals

1. Shop Drawings

The Contractor shall prepare and submit shop and setting drawings of all work included herein for the Engineer's approval.

Shop and setting drawings shall show in detail all sizes, arrangement of joints, and all provisions for anchoring.

Shop drawings shall be submitted as directed by the Engineer.

All installed materials shall conform to the approved corresponding shop drawings.

2. Sample of Marble
The Contractor shall provide an adequate number of samples of the specified marble, to demonstrate the range of color and surface marking that will obtain in the finished work. When approved by the Engineer the samples shall be so marked and retained on site, and the work will be expected to lie within the demonstrated range.
Submit sample of colored mortar.

3. Drawings
The Contractor shall submit an approval layout drawings of any pattern required or tread and riser units to staircases.

4. Measurements
The Contractor shall take all necessary measurements at the building as required to assure proper fabrication and installation of the work of this section.

5. Coordination
All work of this section shall be closely coordinated with the work of other sections whose work affects or is affected by the work specified in this section.

F. Materials

1. Marble
The marble shall be of type “LOCAL MARBLE” or similar, to the approval of the Engineer, as per finishing schedule.

2. Sizes
As shown on drawing or B.O.Q.

3. Finish
Exposed surfaces shall be polished on completion for floors.

4. Bonding
Cement and sand mortar, 1:4-6.

5. Grout
The grout shall be to an approved color, from an approved manufacturer.

G. Workmanship

1. General
The manufacturer's recommendations shall be strictly followed for all products and materials.

2. Drying Out and Preparation of Base
Before laying flooring ensure that the base has been allowed to dry by exposure to the air for not less than two weeks. Ensure that the base is adequately true and level to achieve specified tolerances, and free from contamination and loose areas.

3. Bedding for slabs
Spread, level and compact white cement: sand mortar, 1:4-6 of stiff plastic consistency, 20mm thick, and allow any free surface water to dry.

4. Slurry
Butter the backs of the marble slabs with a neat cement slurry 2-3mm thick.

5. The Contractor shall have a thoroughly competent marble superintended in charge of the marble at all times during the handling and setting of marble.

6. Marble shall be so delivered hand and handled to protect it from damage at all times.

7. When setting marble, adjacent pieces shall be selected for similarity in color, veining and matching.

8. Marble shall be set accurately, true to line, plumb and level.

9. All mortar for joints shall be colored to match the marble with which it is used.

10. Laying Slab
Laying of slabs shall be executed by an experienced skilled.
Remove with a damp cloth any bedding material brought to the surface at joints as soon as the slab has been positioned.

11. Finish
Treads and risers units and thresholds shall be delivered polished, while floor tiles shall be polished on completion.

12. Traffic

Allow no traffic on the floor until 2 days after completion of laying and jointing, and then only light traffic for a further 5 days.

RESILIENT FLOORING (09650)

A. Scope

1. This section covers the Resilient flooring sheet roll approx. 2300x200cm complete including accessories.

B. Performance and Standard

1. ASTM – American Society for Testing and Materials
2. ASTM D 257 Test Methods for DC Resistance or Conductance of Insulating materials.
3. ASTM E 84 Test for Surface Burning Characteristics of Building Materials.

C. Submittals

1. Submit shop drawings and product technical data
2. Provide seaming plan and location of joints
3. Provide product data on specified products, describing physical and performance characteristics, sizes, patterns and colors available.
4. Submit 2 samples, in actual size, illustrating color and pattern for material specified.
5. Submit manufacturer's installation instructions.
6. Submit cleaning and maintenance data include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

D. Transportation, Handling and Storage

1. Deliver materials to site in original sealed packages or containers, clearly marked with the Manufacturer's name or brand, type and color, production run number and date of manufacture.
2. Store materials in weatherlight and dry storage facility. Protect from damage, from handling, weather, and construction operations before, during and after installation.
3. Guarantee
4. Submit a written guarantee signed by Contractor and Manufacturer for a period of 2 years from the date of substantial handover. Guarantee shall cover repair and replacement of defective material and workmanship.

   Quality Assurance
5. Install resilient flooring and accessories in strict compliance with manufacturer recommendations and instructions.
6. Install resilient flooring and accessories after other finishing operation, including painting, have been completed.
7. Do not install resilient flooring on Terrazzo tiles until tiles have been cured and are sufficiently dry to achieve bond with adhesive as determined by Manufacturer's recommended bond and moisture test.

E. Materials

1. Resilient Flooring Materials

The resilient flooring shall be anti-static slip retarded, anti-acid resistant of uniform thickness as manufactured by "Tarket-Type Souplan AS", homogenous resilient static control flooring, conducts static electricity, where indicated on the finishing schedule and optima, homogenous vinyl flooring classic Traventine look, where indicated on the finishing schedule or approved equal and to the approval of the Engineer.

Vinyl flooring rolls shall be in compliance with the following requirements:

Size : sheets (Rolls) 200x2300cm meters approx. unless otherwise indicated on drawings.

Total thickness : unless otherwise indicated on drawings, total thickness shall be 2 mm.

Resistant to static electricity.

Abrasion / Thickness Loss: 0.15 mm maximum; in compliance with DIN 51963.

Flame spread: glass B1 in accordance with DIN 4102 as well as BS 476: Part 7.

Chemical Resistance : resistant; in compliance with DIN 51958.

Electrical Resistance : 108 ohm

Colours shall be selected by the Engineer and shall accurately match approved samples.

2. Adhesive

The adhesive for vinyl fixing shall be as manufactured by the manufacturer conforming to BS5980 as a Type 1 Class AA adhesive.

F. Workmanship

1. General

All workmanship shall be fully in accordance with BS 5385, Parts 1 and 2. manufacturer's instructions are to be strictly followed for all products and materials.

2. Setting Out

Setting out shall be in accordance with the drawings. Level setting out lines shall be established.

3. Tolerances

The maximum permissible gap under a 2m straight edge shall be 3mm, except in the case of the marble vinyl to the waterfall where a degree of roughness shall be deliberately achieved in accordance with approved sample, which maintaining overall levels.

4. Backgrounds

The Contractor shall ensure that backgrounds are sufficiently true to permit the finished work to achieve the specified tolerances, and free from contamination or loose areas. Background shall be Terrazzo tiles 30x30x25cm..

5. Vinyl Fixing

The vinyl is to be fixed by the thin-bed method as described in BS 5385.

The bedding adhesive shall be evenly spread to a thickness of 2mm. Immediately before applying the vinyl sheets, pre-grout the backs of the sheets. There shall be no voids in the bedding layer. The vinyl shall be firmly pressed down into the bed: adjacent sheets shall be flush, and the outline of sheets shall not be detectable in the finished work.

Provide brass strips of 5mm wide x 10mm thick where vinyl tiles are in junction with ceramic tiles.

6. Finishing

Leave the work clean and free of excess adhesive or any other alien matter to the complete satisfaction of the Engineer.

PAINTING (09900)

A. Scope

1. This section includes the Site Painting of all interior and exterior items and surfaces throughout the project except as otherwise indicated or work having a natural specified finished surface. The term 'Painting' in this context covers all coating and finishing systems and their component or accessory materials whether used as prime, intermediate or finish coats, and this Specification includes the Site preparation of surfaces by cleaning, roughening, rubbing down, stopping and filling, or other preparatory process all as specified hereunder.

All exposed items and surfaces shall be painted and all materials that require a protective coating shall be painted except were indicated on drawings or schedules as being unpainted, work having a natural specified finished surface, and work covered in the following paragraph.

The work covers the painting and protection of all plant, apparatus, pipework and equipment installed under the Mechanical and Electrical Work.

B. Performance and Standards

1. All painting systems shall be entirely satisfactory in terms of compatibility of constituent to substrate, adhesion, coverage, color-fastness and durability in the climatic and other conditions pertaining to the site within the limits of accepted good practice.

2. Work in this section shall comply with:
- BS CP 231 Painting of Buildings.
- BS CP 3012 Cleaning and Preparation of Metal Surfaces.
- BS 3900 Methods of Tests for Paints.
- BS 5493 Code and Steel Structures against corrosion.

3. All materials shall conform to applicable British Standards whether referred to in this Section or not.

C. Related Items

Metal Finishes 05030

D. Submittals

1. Manufacturer
The names, official addresses and technical brochures of the paint manufacturers, giving properties of materials, shall be submitted to the Engineer for clearance, prior to ordering.

2. Manufacturer's Instructions
Provide the Engineer with copies of the manufacturer's application instructions and call his attention to any discrepancy between these instructions and the Specification. Obtain the written concurrence of the Engineer and manufacturer as appropriate to any proposed change in either Specification or manufacturer's instruction.

3. Coordination
Ensure that the paint manufacturer is aware of and accepts the substrate to which his product is applied, in particular, to ensure compatibility, where the surface to be painted has already received a coating such as shop-applied primer. Provide barrier coats over incompatible primers or remove and reprime as required.

4. Color Samples
After selection but prior to application provide samples of each color on cards 500 x 500mm and obtain the Engineer's approval thereof.

5. Control Samples
Complete representative sample areas of each type of coating as directed by the Engineer, including preparation of surfaces. Obtain approval of appearance before proceeding. Provide, for the Engineer's inspection, lighting conditions such as those under which the work will normally be seen.

6. Testing
Arrange for any tests called for by the Engineer to be carried out to determine compliance with the Specification, and submit the results of the tests to the Engineer.
Permit coating manufacturers to inspect work in progress and to take samples of their products from Site if required. The results of any tests carried out by or on behalf of manufacturers shall be submitted to the Engineer.

7. Certificates
The Contractor shall submit test certificates in respect of any fire-retardant coatings he proposes to use.

E. Product Handling

1. Delivery and Labeling
Coating materials and all materials used in painting shall be delivered to Site in sealed undamaged containers, clearly labeled with the following information:

- Type of material.
- Manufacturer's name, brand name, if any, and identification related to colour schedules.
- Manufacturer's batch number and date of manufacture.
- Contents by volume for major pigment and vehicle constituents.
- Manufacturer's intended use.
- Thinning and application instructions.

2. Order of Use
Batch deliveries of coating materials shall be dated for use in order of delivery which shall reflect the order of manufacturing dates.

3. Container Size
Paints other than water-based and bituminous paints shall be delivered in containers not exceeding 5 liters capacity.

4. Storage
Store materials in a clean, dry area protected from extreme temperatures. Keep storage space neat and accessible at all times. Protect floors from paint spillage. Discard and remove from Site any paints in containers which have received any but superficial damage.

5. Pre-Installation Protection of Mechanical and Electrical Equipment
All ferrous apparatus and equipment shall be provided at the manufacturer's Works with a protective coat of primer paint to minimize corrosion prior to installation.
All bright, polished machined parts, chrome-plated or similarly finished components shall be wrapped with self-adhesive plastic which shall be retained on Site by the Contractor, until the equipment is commissioned. The Contractor shall then remove the wrapping, clean up and re-instate the original finish.

F. Material

1. General
Coating materials shall be obtained from one approved manufacturer only for each type of material. All coats from primer to finishing coat in a system shall be from the one manufacturer.

2. Filling, Stopping, Cleaning Materials

- Paint strippers, abrasive papers and blocks, cleaning agents, etching solutions, mould inhibitors, rust inhibitors, size, stopping, knotting, fillers and other ancillary materials shall be the best of their respective kinds, used as recommended by their respective manufacturers and the decorative coating manufacturer for the surface being prepared, unless otherwise specified.
- White spirit shall be to BS 245.
- Knotting shall be to BS 1336.
- Stopping for woodwork to receive clear finish shall be tinted to match surrounding woodwork, to approval.
- Stopping for other internal work shall be plastic base, non shrinking.

3. Gloss/Semi-Gloss Paint

- Long - oil based alkyd paint, undercoats and finishing coats to BS 2524.
- Polyurethane based paint, undercoat and finishing coat.
- Titanium Dioxide paint, undercoat and finishing coat.

4. Emulsion Paint
Vinyl emulsion paint, matt and semi-gloss as directed by the Engineer. All emulsion paints shall be vinyl unless otherwise specified.

5. Emulsion Primer/Mist Coats
Material shall be thinned strictly in accordance with manufacturer's instructions.

6. Wood Primer
Acrylic.

7. Steel Primer

Calcium plumbate to BS 3698.

Zinc-rich primer.

8. Steel Primer for Mechanical Work
Zinc chromate.

9. Galvanized Steel Primer
2 pack etching primer.

10. Bituminous Paint
To BS 3416.

11. Anti-Alkaline Primer
As recommended and manufactured by the manufacturer of follow-up coats

12. Lead Content
Lead content in the pigment shall not be allowed.

13. Acrylic Paint
Shall be Acrylic polymer emulsion and plasticizers, silicone oils in accordance with manufacturer's instructions.

G. Workmanship

1. Preparation

A. Generally

a. Prepare surfaces in accordance with decorative coating manufacturer's recommendations.

b. Remove ironmongery, electrical plates and fittings, etc., from surfaces to be decorated and refix on completion of decoration.

c. Use rust inhibitors, size, stopping, knotting and fillers in accordance with manufacturer's recommendations.

d. Ensure that all holes, cracks, defective joints and other defects in surfaces to be prepared and decorated have been made good so that they are not visible when decoration is completed.

e. Ensure that pre-primed surfaces have been properly prepared and that the primer is of a suitable type, firmly adhering and in good condition.

f. Before decorating allow surfaces to dry thoroughly.

g. Brush down all surfaces immediately before decorating to remove dust, dirt and loose material. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.

h. Apply three (3) coats of putty to concrete and plaster surfaces, if required by the Engineer, or as per B.O.Q.

B. New Concrete, Block, Plaster and Render Surfaces

a. Remove release agents by washing with a weak detergent solution and rinse off with clean water.

b. Ensure that surface deposits and loose or flaking material are removed.

c. Efflorescence: Remove surface salts with a stiff brush or coarse dry cloth. Remove residue with a damp cloth frequently wrung out in clean water. Leave for 48 hours and repeat process if further efflorescence occurs. Sand or scrape glossy-surfaced hard bloom to provide a key for finish.

C. New Iron and Steel Surfaces

a. Manual cleaning: chip, scrape and wire-brush surfaces to remove loose scale, welding slab and spatter. Clean out crevices. Remove oil, grease and dirt using white spirit, naphtha or steam.

b. Pre-primed surfaces: ensure that defective primer, rust and loose scare are removed back to bare metal, and patch primer to match existing. Remove dirt and grease from satisfactorily primed surfaces and rub down lightly.

D. New Timber, Plywood, Chipboard, Fibre Board Surfaces

a. Moisture content: ensure that at time of decorating timber has a moisture content appropriate to its use.

b. Loose knots: ensure that large and dead knots are removed and made good with sound timber. Rub down flush before priming.

c. Smoothness: ensure that surfaces have a smooth, even finish with arises rounded or eased.

d. Nail and screw heads: ensure that heads are countersunk sufficiently to hold stopping. Ensure that pelleting is of full size, fills the whole of the recess and is securely fixed.

e. Stopping for painting: after priming, stop nail and screw holes and similar depressions with stopping pressed well in. Finish off brush with surface.

f. Stopping for clear coatings: stop nail and screw holes and similar depressions with stopping to match color of timber, pressed well in. Finish off flush with surface.

g. Knotting: remove resinous exudations and apply knotting to resinous timber and all knots and allow to dry.

h. Degreasing: wash down with white spirit immediately before priming hardwoods containing an excess of natural oil. Clean off surface oils from building boards with white spirit and roughen surface with fine abrasive paper. Dust of surface before decorating.

j. Filling: after priming or sealing and stopping, fill pore and grain irregularities with filler, brush or knife applied. Remove surplus and rub down to leave a smooth, even surface.

k. Pre-primed surface: ensure that any areas of defective primer are removed and patch-primed to match existing. Remove dirt and grease from satisfactory primed surfaces and rub down lightly.

E. Mechanical and Electrical Installations

All ferrous pipework, fittings, pump bodies, valves and steelwork supports installed in the Contract Works shall be cleaned down by wire brushing, until all signs of rust have been removed. All surfaces shall then be given a coat of red oxide prior to the application of thermal insulation, or final painting.

All copper pipework where exposed in rooms shall be cleaned down, degreased and adhering metal cleaned off without damage to the installation.

All cement is to be removed from pipework, brackets, etc.

F. Miscellaneous New Surfaces

a. Plastic Surfaces: wash down with soap and water or detergent solution to remove dirt and grease and while wet lightly abrade with fine abrasive paper. Rinse off with clean water.

2. Coating Materials

A. Generally

a. Prepare surfaces for decoration as specified in G1 above.

b. Where surfaces have been treated with preservatives, check wit treatment manufacturer that coating materials are compatible with the treatment.

c. Cleanliness:

Keep all brushes, tools and equipment in clean condition. Keep all surfaces clean and free from dust during coating and drying.

d. Provide suitable receptacle for liquids, slop washings, etc.

B. Precautions and Protection

a. Place paint or solvent soaked rags, waste or other materials which might constitute a fire hazard in metal containers and remove from premises at close of day's work. Take every precaution to avoid damage by fire.

b. Protect freshly applied coatings from damage.

c. Exhibit 'Wet Paint' signs and provide protection barriers where necessary.

d. Protect adjacent surfaces adequately.

e. Protect cordage, seals and the like from contamination by paint. Remove any paint that does get on by appropriate solvent.

f. Remove ironmongery and other fittings as in G 1.01 (b)above. Items which must remain in position during painting must be adequately and carefully taped.

C. Preparation of Materials

a. Generally. Prepare coating materials as recommended by their manufacturers.

b. Strain through fine gauze any coating materials showing bittiness in application.

c. Do not intermix different coating materials.

d. Stir coating materials to attain an even consistency before use unless otherwise recommended by manufacturers.

D. Application

a. Carry out decoration in color as selected by the Engineer and in accordance with approved samples.

b. Generally: apply coatings in accordance with their manufacturer's recommendations to clean, dry surfaces in dry dust free atmospheric coats have hardened.

c. Covering capacity: the Contractor is to allow for quantities of paint necessary to give proper cover in the number of coats specified and in accordance with the nature of the material to which it is to be applied.

d. Unsuitable conditions: don not apply coatings:
   i. To surfaces affected by moisture or frost.
   ii. When ambient temperature is below 4 degrees C.
   iii. When heat is likely to cause blistering or wrinkling.

e. Priming Generally:
   i. Apply priming coats by brush unless other methods are approved.
   ii. Work primer into surface, joints, angles and end grain.
   iii. Ensure that priming coats are of adequate thickness and suit surface porosity.
   iv. Ensure that any primed surfaces which have deteriorated on Site or in transit are touched up or re-primed.

f. Concealed joinery surfaces: apply priming coat to all concealed surfaces of built in joinery components before fixing.

g. Priming metal: prime metal surfaces on same day as they have been cleaned.

h. Undercoats: apply an even film over all exposed surfaces, avoiding uneven thickness at edges and angles.

j. Finishing coats: apply an even film over all exposed surfaces, avoiding brush marks, sags, runs and other defects.

k. Rub down all priming and undercoats to a smooth surface with abrasive paper and remove all dust before applying the next coat.

l. Cut in neatly and cleanly. Do not splash or mark adjacent surfaces.

m. Brush Painting:
   i. Apply all paints by brush unless otherwise specified.
   ii. Lay off all areas evenly and ensure that finished surfaces are free from brush marks.

n. Roller painting will be permitted in the application of emulsion paint and should applied in one coat or if necessary in two coats with roller on priming coat.

p. Spray painting will be permitted in the application of emulsion paint.

q. Spray Painting: mask all adjoining surfaces.

r. Cleaning: clean off any paint spots or spillage from adjacent surfaces as the work proceeds without damage to that surface.

E. Painting of Electrical Installations

The Contractor shall paint all steel supports, bearers, plinths, and structures in the following non-habitable areas:

a. Plantrooms where required.

b. Switch rooms, where applicable.

c. Tank rooms.

d. Ducts, voids and cavities.

e. Work above false ceilings, if required.

The Contractor shall paint all of the pipework, and brackets, lagged or unlagged and ventilation ductwork in habitable areas where these items are exposed and visible. Chromium plated, stainless steel or brass valves and stopcocks are not to be painted.

Damage to priming coats on all equipment and plant shall be made good as the work proceeds as soon as possible after the damage occurs to prevent deterioration.

Priming coats listed hereunder are additional to the Works applied primer specified in E5 above.

All black steel pipework is to be wire-brushed cleaned and painted with one coat of zinc chromate primer as work proceeds.

Uninsulated black steel pipework in ducts, voids and cavities is to be wire-brushed, cleaned and painted one coat zinc chromate primer and one coat of best quality bituminous paint as work proceeds.

All uninsulated black steel pipework in plant rooms, switch rooms and tank rooms is to be wire-brushed, cleaned and painted one undercoat as work proceeds and one coat of hard gloss to an approved color prior to completion.

Supports, bearers and other uncovered steelwork in ducts, voids and cavities shall be prepared, rust-proofed and painted one coat zinc chromate primer and one coat of black bituminous paint as work proceeds.

Exposed bearers and supports and other exposed steelwork, not galvanized, in plant rooms and tank rooms shall be prepared and painted one coat of zinc chromate and two coats of approved epoxy resin paint of approved color.

All exposed metal flues shall be cleaned, prepared, rust-proofed and painted two coats of heat resisting paint of approved quality and color.

All polished work and polished or satin-finished plated articles shall be protected during the progress of the Works and cleaned and repolished immediately prior to handover.

All lagging on pipework and ductwork installations with a cold hard setting or white cotton canvas finish shall be prepared, primed, and painted two coats of approved long oil based alkyd paint to selected color.

All uninsulated non-ferrous valve bodies shall be thoroughly cleaned and left unpainted.

All finishing coats of paint shall be applied when the Works are nearing completion or as directed.

DIVISION 10

IDENTIFYING SIGNS

DIVISION 10

IDENTIFYING SIGNS

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Division 10

IDENTIFYING SIGNS

IDENTIFYING SIGNS (10400)

A. Scope

The extent of identifying sign work includes the provision and installation of letters and numbers where directed by the Engineer.

B. Performance and standards

Codes and Standards : Comply with the applicable requirements of the following codes and standards :

1. American Society for Testing and Materials (ASTM)
2. Specification for Aluminum-Alloy Sand Castings (BS26)
3. Specification for Aluminum-Alloy Permanent Mold Castings (BS 108)

C. Related items

Metal First Fixing Materials 05010
Architectural Woodwork 06400

D. Submittals

Manufacturer's Data : Submit manufacturer's technical data and installation instructions for signs required.

The Engineer will review samples for fabrication, colour, texture and compliance with all other requirements and give approval accordingly.

E. Product Handling

All letters shall be in Arabic and English. The Contractor shall submit complete shop drawings and samples for approval.

Painting for lettering shall be as manufacturer's instruction.

F. Materials

All signs shall conform to the dimensional requirement on the drawings, and shall meet the following minimum requirement :

a. Aluminum-Alloy works : Refer to Division 8
b. Wood works : Refer to Division 6
c. Painting works : Refer to Division 9
d. Galvanized steel : Refer to division 5.

1. Door and wall signs

   Door signs consisting of 1mm thick aluminum plate finished in colored polyester powder, glued to black painted plywood panel.

   Sizes and details to be as shown on drawings.

2. Bracket mounted signs

   Signs sizes as shown on drawings, consisting of 30mm thick extruded aluminum profile finished in colored polyester powder, fixed to 2mm thick prepainted galvanized steel plate, and black aluminum cover edge. Details to be as shown on drawing.

3. Hospital name :

   Sizes and details as shown on drawing.

G. Workmanship

The Contractor shall examine the substrates and the conditions under which the signs shall be installed and correct any unsatisfactory conditions, and do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Engineer.

Installation

Install signs at locations where required securely mounted with concealed theft resistant fasteners, unless otherwise indicated. Attach signs to substrates in accordance with manufacturer's instructions.
Install level, plumb, and at proper height. Repair or replace damaged units as directed by the Engineer.

LIST OF ARCHITECTURAL AND STRUCTURAL APPROVED MATERIALS

(ANY SIMILAR EQUAL WILL BE ACCEPTED)

ITEM		MATERIAL
1.	MASONRY (6,10,15 & 20 CM THICK, BLCKWALL)	DERVICHE HADDAD N. ARAMANE
2.	PRECAST CONCRETE TILES & KERBS	DERVICHE HADDAD N. ARAMANE
3.	ALUMINIUM	TECHNAL SIDEM 2000
4.	IRONMONGERY	MCKINNEY – ESSEX – VACHETTE
5.	WATERPROOFING MEMBRANE	POLYGLASS –INDEX – IMPER – SPEC (BARDAWIL)
6.	THERMAL INSULATION	KILZI
7.	EPOXY COATING	BCR – FOSROC – IMPER
8.	CEMENT	LOCAL CEMENT FACTORIES
9.	GLAZING	FORD – PELKINGTON
10.	PAINTING:	TINOL – SIPES –PLASTER – DUTCH BOY
11.	WOOD	MEKER – TECHNOWOOD-FRANCEPORTE
12.	GLAZED CERAMIC WALL TILES	CHINA 1RST CHOICE
13.	FULLY VITRIFIED CERAMIC FLOOR TILES	CHINA 1RST CHOICE
14.	SUSPENDED CEILING	PROMETAL – SEDIMETAL – HUNTER DOUGLAS – RICHTER SYSTEM
15.	MARBLE & NATURAL STONE	LOCAL MARBLE

LIST OF MECHANICAL APPROVED MATERIALS

(ANY SIMILAR EQUAL WILL BE ACCEPTED)

ITEM	MATERIAL
1. STEEL PIPES	DALMINE
2. ACCESSORIES FOR STEEL PIPES	CRANE, AFL
3. POLYPROPYLENE PIPES	POLYMUTAN, FUSIOTHERM
4. UPVC PIPES	OMNIPLAST, DALMINE
5. COPPER PIPES	KABEL METAL, WEDNESBURY
6. ACCESSORIES FOR UPVC PIPES	ZURN, REDI, NICOLL, SITA
7. MANHOLE COVERS AND GRATING	PAM.
8. SUPPORTS	GRINNELL, WALRAVEN, MUPRO
9. VALVES, STRAINERS	HATTERSLAY, CRANE, VAG, ISI, NIBCO, SERSEG, JENKINS, BRAUKMAN, PEGLERS
10. PICCU	CRANE
11. AUTOMATIC AIR VENTS	BRAUKMAN
12. WATER HAMMER ARRESTORS	JOSAM, ZURN
13. FLEXIBLE CONNEXIONS	MASON, ANACONDA, FLEXONICS
14. THERMAL INSULATION	ARMAFLEX, FRANCE AIR, FIBER
15. FIRE EXTINGUISHER	ANSUL, KIDDE,
16. PUMPS	SALMSON, GRUNDFOSS, RITZ, PULLEN
17. SANITARY FIXTURES	LECICO, V&B, GROHE
18. HOT WATER STORAGE TANK	THERMOR, ARISTON

ITEM	MATERIAL
19. AIR CONDITIONING	UNIC
20. GRILLES AND DIFFUSERS	ANEMOSTAT, TROX, TITUS, FRANCE AIR, METALLAIRE, WATERLOO
21. SOUND ATTENUATORS FLEXIBLE DUCTS	FRANCE AIR, TROX, WOODS
22. FANS	SOLYVENT-VENTEC, WOODS OF CHOCHESTER, FRANCE AIR, GREENHECK
23. MEDICAL GASES	CHEHAB
24. BOILERS ,BURNERS ,	CHAPPEE , DE-DIETRICH

LIST OF ELECTRICAL APPROVED MATERIALS

(ANY SIMILAR EQUAL WILL BE ACCEPTED)

ITEM	**MATERIAL**
1. PANELBOARDS	
1.1 Main distribution Panelboards	MERLIN GERIN, ABB
1.2 Power and Lighting Panelboards	MERLIN GERIN, ABB, LEGRAND BTICINO
2. WIRES CABLES AND FEEDERS	LIBAN CABLES, BICC, PIRELLI
3. CONDUITS AND WIREWAYS	
3.1 Cables trays	TOLARTOIS, OBO BETTERMANN
3.2 Conduits	UNIVOLT, PM
4. EARTHING SYSTEM	OBO-BETTERMANN, FURSE, ERICO, DEHN, Copperweld.
5. LIGHTING FIXTURES	In addition to those listed in the specifications: PHILIPS, HOFFMEISTER, ERCO, IGUZZINI
6. WIRING DEVICES	LEGRAND (MOSAIC 45), GEWISS (PLAYBUS), TICINO (LIVING)
7. FIRE DETECTION SYSTEM	SIMPLEX, MENVIER, NOTIFIER.
8. COLLECTIVE ANTENNA TELEVISION	FUBA, KATHREIN, 3B ELETTRONICA,
HIRSCHMANN	
9. CLOSED CIRCUIT TELEVISION	BURLE, JAVELIN, VISTA
10. TELECOMMUNICATIONS INSTALLATIONS	
10.1 EPABX	ERICSSON, AT&T, SIEMENS, PANASONIC
10.2 Distribution Frames	POUYET, KRONE
10.3 Cables	ACOME, POUYET
11.CONTROL	LANDIS & STAFA, JOHNSON HONEYWELL.
12. GENERATORS	MAN, CATERPILLAR, VOLVO, CUMMINS, PERKINS

13. LIFTS	MITSULIFT THYSSEN (GERMAN), SCHINDLER , OTIS, KONE
14. DATA SYSTEM	
14.1 Outlets	LEGRAND – BITICINO,
GEWIS	
14.2 Passive components	ALCATEL – KRONE –
SIEMON-	
	POUYET
14.3 Active components	SISCO – 3COM – NORTEL
15. Sound System	TEAC, PHILIPS, DB TECHNOLOGIES