

TECHNICAL SPECIFICATIONS

A.1 Generally

These specifications shall be read in conjunction with the Conditions of Contract, Drawings and Bills of Quantities and it shall form part of the Contract Documents.

Unless otherwise stated or contradicted, materials and workmanship specifications are to apply reciprocally between sections.

All work is to be executed in accordance with the building laws and regulations of the Town Planning Department and other authorities and all good practice guidance and international charters for monuments.

Where trade names are given the term “or equal and approved” shall apply in all cases and in no case it will denote preference to that trade name. The Contractor must submit samples from at least two manufacturers and these samples must be equal and approved.

A.2 Construction Duration

Construction Durations for all works to be 4 months.

A.3 Materials

Materials are to be of the best quality consistent with the character of the Works. Materials are deemed to be specified to comply in general with the relevant British standards or European standards and Eurocodes unless otherwise indicated.

Where a particular proprietary product, supplier, or supplier’s catalogue is referred to in the Bills of Quantities, the material specified may be obtained from another source provided it is equivalent, equal and complies with the appropriate British standards.

Where local practice is such that an alternative material or quality of material to that specified is generally accepted then the Engineers approval must first be obtained before such alternative will be permitted to be used.

If during the course of the Contract certain materials required for use in the Works should be unobtainable despite the best efforts of the Contractor, then the Contractor may offer for the approval of the Engineer substitute materials.

These substitute materials, although not complying fully with the Specification, must nevertheless be suitable and appropriate for use in the Works. Acceptance or refusal of such substitute materials shall be at the sole discretion of the Engineer.

In the event of acceptance of the substitute materials a suitable price reduction shall be made in respect of decrease in quality or value but no price addition shall be made in respect of increase in quality or value. In the event of refusal of the substitute materials the Contractor shall not be relieved of any of his obligations under the Contract and shall be solely liable for any delay or loss occasioned by his failure to provide materials as specified.

Branded materials are to be handled, stored and used and processes are to be carried out strictly in accordance with manufacturer’s instructions and recommendations.

The Contractor shall furnish for approval all sample of materials and workmanship required by the Engineer.

Materials rejected by the Engineer are to be removed from site within 24 hours of such rejection and the Contractor shall substitute proper and suitable materials to the approval of the Engineer. All additional costs in connection therewith shall be borne by the Contractor.

The Contractor will be held entirely responsible for ensuring that all materials to be imported arrive on Site in sufficient time to maintain the programme.

The Bills of Quantities shall not be used as a basis for ordering materials and the Contractor is entirely responsible for assessing the quantities of materials to be ordered and no claim will be entertained in respect of the quantities contained in the Bills of Quantities being approximate.

A.4 Workmanship

The Engineer have the right to issue instructions requiring the dismissal from the Works of any person employed thereon, whose performance is judged as unsuitable.

The Engineer have also the right to issue instructions in regard to the removal from the site of any equipment or plant which are not safe or suitable for the correct execution of the works.

Except were otherwise stated or contradicted workmanship is to comply with British Standard Codes of Practice where applicable.

Workmanship is to be of a high standard throughout, particularly with regard to the accuracy of dimensions, lines, planes, levels and the quality of surface textures. The Contractor is to do everything necessary to ensure that the standard of finish which is hereby demanded by this contract is achieved.

Work rejected by the Engineer is to be demolished and cleared away within such time as may be instructed by the Engineer and re-executed to his approval. All additional costs in connection therewith shall be borne by the Contractor.

A.5 Samples and shop drawings

The Contractor shall furnish for approval, with reasonable promptness, all samples of materials and workmanship required by the Engineer. All materials or workmanship which according to the Engineer's judgment are not equal in quality, appearance, strength or otherwise to the approved samples, shall be rejected. All additional costs in connection therewith shall be borne by the Contractor.

The Contractor must prepare, whenever required by the Engineer and for any workmanship, shop drawings.

A.6 Testing

All costs in connection with routine tests for quality of materials and workmanship, referred to in the specification, shall be borne by the Contractor despite their results.

In addition to the above tests the Engineer has the right to obtain samples of materials and workmanship and demand testing by independent laboratories.

All costs in connection with such testing shall be borne by the Employer except in the cases where the results are negative and require rejection of the materials or workman-ship being tested. In such cases all costs shall be borne by the Contractor.

A.7 Drawings

All original drawings that have been used for the preparation of the Bills of Quantities, shall constitute part of the Contract.

Additionally to the above drawings, the Engineer have the right to issue during construction, supplementary or explanatory drawing which shall be binding and constitute part of the Contract provided they are not different from original drawings.

All shop drawings of temporary works (scaffolding, formwork etc.) reinforcement drawings and reinforcement bending schedules shall be prepared by the Contractor and submitted to the Engineer for approval at least 4 weeks prior to the execution of the works.

All drawings / schedules prepared by the Contractor must be in the metric system (SI Units). The approval or modification of the above drawings / schedules by the Engineer shall not relieve the Contractor of any of his obligations or responsibilities.

A.8 Levels

The Contractor before carrying out any excavations must verify all the levels and contours shown in drawings and must report any discrepancies to the Engineer.

The Contractor shall prepare full architectural drawings and details in order to finalize the full view and final height of the post. Min. post height 1.50m near the steel doors. Drawing and samples to be submitted for the approval of the Engineer. Height of the post shall increase according to the natural soil formation, but shall remain horizontal o top.

A.9 Measurements and rates generally

The Contractor is to allow in his pricing and rates for all items mentioned in the specifications sections and/or in all other sections of the Bills of Quantities and which have a cost and are not specifically mentioned in the items description in the Schedules of Quantities section, and irrespective whether mentioned or not the “measurement and rates” for each trade.

All work has been measured net as fixed in position. The order of stating dimensions in the description is generally in the sequence of length, width and height. Where that sequence is not appropriate or where ambiguity could arise, the dimensions have been specifically identified.

Where the unit of billing is the meter, quantities have been billed to the nearest whole unit. Fractions or a unit less than half have been disregarded and all other fractions have been regarded as whole units.

Unless otherwise specifically stated herein, the following are deemed to be included with all items:

- a) Labour and all costs in connection therewith.
- b) Materials, goods and costs in connection therewith (e.g. conveyance, delivery, unloading, storing, handling, hoisting, lowering).
- c) Fitting and fixing materials and goods in position.
- d) Use of plant.
- e) All straight, raking and circular cutting and notching.

- f) Establishment charges, overhead charges and profit.

Junctions between straight and curved and straight and raking works are in all cases deemed to be included with the work in which they occur.

Each trade name shall be read as if it contained the phrase “equal and approved”.

The contractor needs to keep a photographic archive of the works performed. This he will deliver to the Engineer at the beginning of the work and with the completion of the work as well.

B. 1.0 SET UP OF SITE

Set up of site, including provisional works to protect the site and provide functional devices, cleaning, demolition and removal of inappropriate additions (water and septic tanks, concrete slabs, etc.).

1.1 PROVISIONAL AND PROTECTION WORKS

1.1.1 Temporary Fencing:

Temporary fences have to guarantee security and prevent access to unauthorized persons. Erection of corrugated sheet fences around the building will be completed before any initialization of work. The access to the yard will be provided by demolishing partly the existing wired fence and inserting a temporary entrance door.

Temporary new fences of at least 2m tall will be placed distanced min 3,5m from the building.

Standard aluminum 5”/10” warning plates with refracting adhesive film on square or rectangular support on a white background will be installed.

1.2 REMOVAL OF DEBRIS, INAPPROPRIATE ADDITIONS AND VEGETATION

1.2.1 It includes the use of equipment of a size appropriate to the structures to be demolished; the adoption of all the measures to ensure the safety of workmen and the general public; signs; the work of temporary fencing; demolition, taking all due precautions and in small sections, of the structures connected to or abutting the structures not to be demolished, where necessary cutting material with oxy-acetylene flame or manual or mechanical saws; repair of any damage caused to third parties as a result of this work; loading, transportation and discharge at any distance of waste material. It also includes anything else required to finish the work.

1.2.2 Removal of non-compacted debris, not related stones, rubbish etc. Stones of historical value are to be preserved and stored near the site. The inventory list is to be provided to the Engineer.

1.2.3 Removal of all vegetation (trees and shrubs) and general cleaning of the area to set up the site specially for the ground beam works and erection of the fencing.

1.2.4 Removal of the existing fencing. The contractor is responsible to verify this action with the appropriate legislative authorities.

C. 1.0 CONCRETE, STEEL & INSULATION WORK

1.1. Concrete – Quality

Ordinary Portland cement shall be used.

Natural or crushed aggregates shall conform to the requirements of the BS EN 12620.

Reinforced concrete, in general shall be grade C25 in accordance with the requirements of the BS 8110.

Ordinary Portland Cement (OPC) shall be in accordance with BS 12.

Sand: The sand shall conform to BS EN 12620 with such aggregate grading (particle size distribution) suitable for cement concrete, of natural or crushed aggregates. The sand shall be free from dust or large amounts of other fine granular materials and its chemical composition shall be such that it does not cause any undesirable effects on the cement concrete properties. If sea sand is required, it shall be well-cleaned. Sieve analysis and chemical analyses shall be conducted and furnished to the Engineer before and after concrete production.

Coarse aggregates/Gravel: Coarse aggregates for concrete shall conform to the BS EN 12620 and shall have a maximum size of 20 mm, consisting of natural or crushed aggregations (stone and gravel). They shall be clean and free of dust or other deleterious matter and their chemical composition shall be such that it does not affect the behavior of the cement, thus influencing the setting qualities/strength/staining corrosion/durability of concrete. If sea-dredged coarse aggregates are required, these shall be well cleaned and washed. Chemical analyses shall be conducted and furnished to the Engineer before concrete production.

Cement: Ordinary Portland Cement shall be used, which shall conform to BS 12. Unless otherwise specified in the relevant Conditions or Drawings or as otherwise approved in writing, the use of any other type of cement shall not be permitted.

Admixtures: Admixtures shall not be used without prior authorization.

Water: The suitability of concrete mixing water shall be ascertained by special analysis tests specified in RS5328, unless it is fit for drinking and comes from a public water system.

Mixing: Concrete mixing shall be carried out by equipment capable of properly mixing materials in sufficient quantities at the time and place of application. For accurate concrete mixture proportioning to be achieved, materials shall have to be measured by weight. Volume batching, measurements by handfuls of the aggregate constituents or any other such methods shall not be permitted and adopted. Cement quantities for each batch of concrete shall be decided in terms of a whole number of cement bags. Quantities of water shall be measured by volume.

Ratios: The ratios of materials used in the production of various types of concrete shall be adjusted, depending on the appropriate mix design of aggregates, to meet both quality and strength requirements of the particular class of concrete specified. By way of illustration, the concrete mixture ratio shall approximately be within the limits indicated in the table hereunder:

Material: Quantities by Weight (kg) per cubic metre of concrete

	<i>C15/20</i>	<i>C20/25</i>	<i>25/30</i>
<i>Cement</i>	150	250	350
<i>Sand</i>	650	600	500
<i>Coarse aggregate</i>	1250	1100	1050

The selection of proportions of available materials to produce cement of required properties/any variations in concrete ingredients/any mix design should take into account the following criteria:

1. Fineness of concrete aggregates.
2. Degree of workability required, which shall range between 30mm – 100 mm.
3. Sand Moisture/The varying moisture content of the sand.

Fine and Coarse Aggregate Storage: All fine and coarse aggregates shall be kept in separate stock piles on hard surfaces (such as palettes or other suitable support) at the work site so as to prevent contamination by earth and/or other foreign matter or stored in properly constructed silos.

Concrete Storage: Cement may be stored in silos designed and configured for the purpose or in dry weather-tight and properly ventilated structures with floors raised above ground level with adequate provision to avoid absorption of moisture.

Water used for both mixing and curing concrete shall be clean, potable and completely free from foreign substances and impurities (organic or inorganic matter, acids, salt and other such deleterious matter.), which may affect the quality of the concrete. Where possible, a public water supply shall be used if available within a reasonable distance.

1.2. Ready-Mixed Concrete

Shall be considered and used if:

- Conforming to the specifications under the Conditions herein laid down;
- Records of delivery note orders are kept;
- The mix shall be capable of being applied within a maximum period of 30 minutes after mixing;
- The addition of water shall not be permitted at the mixing plant and therefore water shall be kept separate from the cement, allowing for concrete to be mixed immediately before placement on the Work Site;
- Colour of Undressed Concrete: No change in cementitious materials, proportions or way of mixing shall be made, where the concrete remains undressed.

1.3. Quality of Work

Transporting Concrete: Concrete shall in all cases be conveyed from the mixer to its place in the Works in such manner as to prevent inter mixing with foreign materials, segregation of its components and/ or loss of the concrete composite and ensure that the concrete is of the required workability at the time of placing.

Flooring Substrate: The Contractor shall carefully study the widths of the various floorings and elevations as determined and shown on the Drawings, in order to calculate and measure the different substrate elevation and grading of the substrata.

For pipelines/conduits which exist on top of reinforced concrete floors, the full length of the piping or conduits shall be encased in cement paste and the rest of the area shall be covered with screed. Special attention must be paid so as not to disturb, distort, or cause any other damage to the pipes/conduits in the course of Work. Alternative methods and approaches of Work, whenever available and suitable to be adopted, are to be specified and incorporated into the supplementary conditions.

Cleanliness of Surfaces: All surfaces which will come into contact with concrete shall be clean and free from impurities and/or free water.

Inspection: The Contractor shall notify the Architect at least three (3) working days in advance of each concrete placement to allow for sufficient time to schedule required inspection and testing of all reinforcing work, formwork and bracing, inserts and other embedded items. Prior to the placement of concrete, all works, without exception and in all respects, shall have to be completed. Any inspection on the part of the Engineer shall not relieve the Contractor of the responsibility to perform the Work in accordance with approved Drawings and Conditions/specifications.

Records of Concreting: The Contractor shall maintain an accurate and up to date record in respect of the conditions of the pouring of concrete, showing:

Date and time of concrete pouring; Weather and temperatures; and Sampling, when each part of Works was concreted.

Sampling and Testing of Concrete: Except otherwise approved, during concrete works one set of cubes (three cubes per set) per 20m³ shall be taken from a randomly selected batch/sample taken of concrete at the worksite for testing and evaluation of the strength of the concrete.

Cubes: Cube test moulds shall be 150X150X150 mm in size. The cube moulds shall be manufactured with the level of precision and stiffness required for test samples to provide a fair representation of the quality of concrete used in the construction. The Contractor shall ensure that sufficient representative test cubes are produced to enable the concrete quality to be monitored properly, and in any case no less than six (6).

A minimum of three (3) cubes shall be made from batches of concrete for each particular grade sampled at each time concreting is in progress at the Site (from a different drum), which shall be cured and kept submerged in water and maintained at a controlled temperature of 20°C for a period of 28 days until ready for testing. Cube specimens shall be crushed at a laboratory approved by the Engineer. All incidental charges/costs shall be borne by the Contractor.

The concrete specimen moulds shall be made by the Contractor in the presence of the site supervision.

Expected strength of the specimens shall be:

Grades of Concrete	Average volume of 4 concrete cubes/ Minimum strength at 28 days
C15/20	20.0 MPa
C20/25	28.0 MPa
C25/30	33.0 MPa
C30/37	40.0 MPa

Placement: All concrete shall be placed in final position strictly within a period of not more than half an hour (30 minutes) after the introduction of water to the cement and aggregates to ensure the sufficient plasticity and workability required for proper placing and full compaction of the concrete, thus achieving maximum strength and durability.

Workability and Slump: The workability of each concrete mixture shall be determined and measured at frequent intervals during the progress of corresponding Work, by means of the slump test carried out by a mould in the shape of a frustum of a mould, called the slump cone (apparatus). Any concrete mix that exceeds the maximum slump of 125 mm shall be rejected.

Placing: At no time shall concrete be deposited directly, chute, caused to flow or even dropped freely from height into the place of work, if reinforcement or other obstacles are in the way, particularly in columns and thin walls, so as not to cause segregation, uneven spreading or loss of the concrete composite.

Compaction: All concrete places in situ shall be compacted at all times:

With power driver internal type vibrators

Throughout the whole volume being compacted, until the concrete has been consolidated to the maximum practicable density, properly and thoroughly so as to form a solid mass free of voids, and fit tightly against all form surfaces, reinforcement and embedded fixtures;

Until the concrete surface is free of air pockets and blisters of coarse aggregates;

Particular care shall be taken to ensure that all concrete placed against the form faces and into corners of forms or against hardened concrete at joints and holes is free from voids or cavities.

Concreting in Cold Weather/Monitoring of Temperature Changes: On no account shall concrete be placed during cold periods, when the air temperature falls at or below 5°C. Sets of thermometers for regular monitoring and recording temperatures shall be placed at the Work Site at positions in the concrete near to each exposed face.

Protection of Concrete Surfaces: As soon as practicable after the initial set has taken place in the slabs or following the removal of formwork in columns and walls, all form surfaces shall be covered at once.

Period of Protection: All concrete surfaces shall remain covered for a continuous period of at least seven (7) days.

Period of Protection: For flooring surfaces which shall not have any other finish, the concrete shall remain protected and covered for a continuous period of at least ten (10) days.

Method of Protection: The method of protection adopted shall need the prior approval of the Architect-in-Charge and shall:

1. Not cause damage to the appearance of the undressed surfaces.
2. Shall not affect the cohesion with the paints, mortars or other finishes.

Methods of Curing Concrete: If no other requirements are affected, the curing shall be applied as soon as practicable after completion of placing and shall include one or more of the following methods as may best suit the circumstances:

- by maintaining the formwork in position and/or;
- by covering the surface with a layer of nylon sheet or;
- by using a chemical compound membrane that has been approved by the Architect, or;
- by use of a wet covering.

Protection: Concrete must continuously be protected as follows:

1. All surfaces in general shall be protected against harmful effects of weather elements, including rain, cold/frost, hail, heat, rapid temperature changes, against physical damage or defacement of any nature.
2. All surfaces shall be protected against rust, stains or other results of corrosion.
3. Protection of immature concrete from physical damage or movement.
4. Protection of immature concrete from rapid temperature changes, particularly against wetting by cold water.

1.4. Steel

1. Reinforcing Bars: High-tensile steel deformed bars conforming to the requirements of BS4449. Minimum Leakage Limit: 500 MPa (steel grade B500S).
2. Welded Mesh Reinforcement: Welded steel mesh reinforcement conforming to the requirements of BS4483.
3. Cover Blocks : Types of covering blocks include:
 Concrete cover blocks : shall be made with 10 mm gravel,
 Cement cover blocks : shall be made with sand clay and cement at a 2:1 ratio
 Plastic cover blocks : shall be sufficiently rigid and approved by the Engineer.
4. Cleanliness: Prior to the placing of concrete, all reinforcement shall be thoroughly clean and free from rust, scale, dust, oil or any other objectionable foreign substances that may adversely affect either the steel, concrete or the bond between them.
5. Protection from rust: Reinforcing steels projecting from the concrete shall be properly protected at all times against the adverse effects of weather conditions to prevent rust and other results of corrosion forming on the concrete surfaces.
6. Cutting and Bending: Cutting and bending of reinforcement steel shall be carried out with a precision of +/- 50 mm and performed by mechanical methods using equipment designed for the purpose and approved by the Engineer.
7. Straightening and Re-Bending: Straightening or re-bending of reinforcement shall not be permitted without prior approval.
8. Protruding Reinforcing Steel: All protruding reinforcing steel shall not be bended without prior approval.
9. Steel Joints: Wherever instructions are not provided, all steel joints shall not exceed sixty (60) times the diameter of the smallest reinforcing bar.
10. Profile Joints: Wherever special instructions are not provided, the joints in the profiles shall be thirty (30) times the diameter of the smallest reinforcing bar.
11. Welded joints for welded mesh: For welded meshes, all welded joints shall be 400 mm in length and 200 mm in width.

Fastening Reinforcing Steel: All steel shall be satisfactorily fastened and secured in position by the use of rib laths. All ends by the use of flexible metallic reinforcing wires shall be turned inwards and diverted away from the form.

Rebar Spacers: The upper reinforcement steel shall be secured in position by spacers per at least one (1) meter distance, unless otherwise specified.

Mesh Panel Fixing Clips: All mesh panels shall be joined together with mesh clips with diameter of eight (8) mm per one (1) meter, unless otherwise specified,

Cover Blocks: Cover blocks shall be positioned at relatively close distances from one another so as to ensure sufficient stability and cover all around the reinforcement.

Cover Blocks: In case of undressed concrete surfaces, the cover blocks shall be made of plastic or other material, which shall remain hidden from view underneath the final surface layer.

Steel Placement: All reinforcement steel shall be placed and secured in their position prior to pouring the concrete. No steel shall be placed after the depositing of concrete.

1.5. Formwork

Ordinary timber formwork shall be used, constructed of rough-cut timber boards intended for concrete surfaces which are to be dressed.

Timber formwork used for fair-face concrete surfaces shall be sheathed with waterproof oiled hardboard sheet or plywood or sheet metal or marine plywood or other such approved materials which are certain to ensure a perfectly smooth –visibly- and fine surface.

It is noted that wherever moulds for fair-face concrete are to be placed, all panels shall be of such new material so as not to cause any defects to the surface of the concrete.

Formworks need to be of rigid construction true to shape and dimensions shown on Drawings. Formworks need to be sufficiently strong enough to withstand all the dead and live loads and forces, such as the weights of equipment, labour, ramming etc. required for placing and compacting the concrete. Forms shall be of good quality, designed and built accurately so that the desired shape, size and finish of the concrete are attained.

The formwork used shall be removed with utmost care, avoiding shock or vibration that may cause damage to the cast concrete.

The responsibility for the adequacy and safety of all formwork shall rest entirely with the Contractor and the Contractor shall be held liable for any defects incurred or damage done to the formwork and shall have to make good the same at his own expenses.

Joints between sections of the formwork shall be firmed and secured so as not to permit leakage of cement paste through the joints.

The inside surface of wooden surfaces of the formwork which come into contact with the concrete shall be smooth and shall be applied with crude oil or other oily solutions that do not dilute with water to make the removal of formwork easy.

Mould removal work shall commence only after prior authorization of the Engineer, at minimum periods of time elapsed between the placing of the concrete and the striking of the mould as described below hereunder:

D. 1.0. STEEL STRUCTURES

General

The design, fabrication and erection of all steel structures will be carried out in accordance with the provisions of EC3 and EC8 which will be deemed to form part of the present specifications.

The Contractor is obliged to employ expert staff who possess the required skills and training for structural steelworks and who will be in a position to implement the requirements of these specifications.

The contractor will be responsible to prepare his own manufacturing drawings and cutting list in timely manner to be submitted and approved by the engineer.

The following work is included in the structural steelworks: the supply, transportation to site, assembly, erection, adjustment and stabilisation in the correct position and the painting of all metal structures, and roof and column coverings, all as shown on the drawings and described in the specifications.

Four weeks prior to the commencement of any work related to structural steelworks, the Contractor will submit to the Engineer the name and details of the independent quality control laboratory with expertise in Non-Destructive Testing – NDT, that is proposed to undertake the qualitative testing of the structural steelworks.

The materials to be supplied by the Contractor will be identical, equivalent or of higher quality with regards to structure, performance, execution and strength, in relation to the materials described in the drawings and the specifications.

In the event the Contractor intends to use alternative materials with respect to the ones specified, then the Contractor must submit to the Engineer for approval the description of the manufacturing details, the manufacturer's name and details, and full technical description of the alternative materials for which approval is sought.

In the event that, during the defects liability period provided for in the contract, the alternative materials proposed by the Contractor fail for any reason to fulfil the requirements of the specifications, then the Contractor will, at his own expense, replace the said materials with the materials described in the drawings and specifications.

1.1. Submission of samples

The Contractor is required to submit to the Engineer for approval, samples of all the materials that will be used, at least two months prior to the commencement of the work related to structural steelworks.

These samples will be used as prototypes for the materials that will be installed in the works. In the event that any materials prove to be of inferior quality with respect to the approved prototype samples, then such materials will be immediately replaced. The Engineer reserves the right to request, at any time during execution, the submission of samples of the materials used in construction.

1.2. In situ measurements of dimensions

The Contractor will, before the construction of any part of the work, satisfy himself that all the members fit and connect accurately and correctly in the structure's available space. In the event that the Contractor locates deviations, he will timely inform the Engineer in order to take the required actions.

1.3. Fabrication drawings

The Contractor will furnish the Engineer with the fabrication methodology. This will include detailed suggestions in respect of:

- (a). The general schedule of welding both in the factory and in the site.

- (b). The category, type and method of the electrodes. In the case of automatic welding, the type of the materials used in this process.
- (c). For automatic or semi-automatic welding, the size of the electrode, the current wattage and voltage, the movement speed, the gas flow quantity and the consumption of materials that will be used in this process.
- (d). The number and alignment of passes where multiple pass welds are required. These are required to be shown diagrammatically.
- (e). The locations of the welds.
- (f). The frequency of the welding.
- (g). The surface preparation prior to welding.
- (h). Directions for usage and storage of electrodes.

The Contractor will furnish the Engineer with the methodology that will include detailed suggestions in respect of:

- (a). The schedule for erection on structural steelworks.
- (b). The methodology of erection, supported with drawings should this be considered necessary.

1.4. Materials

Steel sections

The steel plates, sections, bars and hollow sections of the structural steelwork will be in accordance with BS 4360, BSEN 10025, BSEN 10013, EN 10210 and will be category S 325 JR and S355JR, Bolts Grade 10.9 and 8.8.

Manufacturer's Certificates – Samples and Tests

The Contractor, at his own expense, will submit manufacturer's certificates to confirm that the steel chemical composition and mechanical properties are in accordance with the relevant European standards.

The Engineer reserves the right to inspect the fabrication of the steel members at the workshop, to take samples for testing, BS4360, paragraph 24.1, and to be present at the testing process for the mechanical properties determination.

Dimensions and Fabrication Tolerances of Steel Sections

The hollow and angle sections will be in accordance to the dimensions and fabrication tolerances of BS 4848: Part 2 and 4, respectively.

Surface Defects

Repairs of surface defects on steel sections will not be allowed in the cases covered under BS 4360, paragraph 10.3, unless the Engineer issues special approval.

Fabrication Tolerances of Steel Plates

The fabrication tolerances of the steel plates dimensions will be in accordance to BS 4360, chapter 2. For the plate thickness, the only tolerance acceptable will be in excess to the dimensions shown on the drawings.

Welding Steel

To avoid weld cracking, the carbon equivalent quantity of the members to be welded will not exceed the quantity specified for their steel grade, as shown in BS 4360, table 3, unless the contractor suggests an appropriate welding procedure that may not require meeting the above mentioned requirements. The connecting plates at the visible nodes will be laser cut, and the edges will be rounded. A sample will be presented to the Engineer for approval.

Ultra Sound Testing for Steel Plates

Steel plates, that due to their welding and thickness may show lamellae tearing, will be grade A01 and will undergo ultrasound testing. The equipment used for the testing will be in accordance to the relevant British or other accredited equivalent Standards.

1.5. Fabrication

General

The Engineer and his representatives will have access to all the sites that steelwork related work is executed. The Contractor will provide all the necessary facilities to the Engineer for inspection during fabrication and assembly.

At all stages of fabrication, every steel member will have a visible distinct marking. The approved marking format will make the member recognition and position identification easy.

Steel Cutting

The edges of the compression members will be cold sawn and evened out with the use of a grinder, so that smooth surfaces will be formed for the even distribution of loads across the area of the section. The connecting plates at the visible nodes will be laser cut, and the edges will be rounded. A sample will be presented to the Engineer for approval.

Notches or other shaping to the ends of the members will be cold or hot sawn. Machine flame cutting will only be allowed with the Engineer approval. In no case will manual flame cutting be allowed.

The member edges will be free of any defects which may adversely affect the serviceability of the member. All small ridges or similar flaws will be mechanically evened out.

Clearances

Care will be taken to ensure the defined clearances between the members. The erection clearance at the ends of beams will be 3mm, except in the cases which for practical reasons

The clearance has to be increased. In cases as such, the Engineer's approval is necessary.

Base Plates

Base plates will be grounded and placed accurately on bearing surfaces. Base plates in contact with columns will not be required to be grounded. Small holes on the bearing plates will be essential for trapped air to escape during grouting.

Marking

All the steel members will be visibly marked before their delivery on site. The marking format will be such as to identify the exact position of the member in the structure during assembly.

Transport

The materials will be protected from damage and any deformation during their transport. All the surfaces will be protected. All straight parts, except for small sections, will be transported in bundles, tied up together with steel wire.

On-site connections for the roof trusses should be kept to the minimum, so the sections to be assembled will not be shorter than 20m.

All bolts, pins, rivets, and other small piece, should be packed in boxes.

Every box or bundle will be distinctly and visibly marked before their dispatch from the workshop.

Connections

All the connecting parts will be firmly drawn together so that the metal components will

Undergo no movement or deformation. When necessary, the washers will be tapered or be in an appropriate shape for the bolts and nuts to be adequately tight. Washers will be used under every bolt head and nut, except where differently specified.

The bolt and thread length will be such as a minimum of 6mm of thread to project from the nut. The bolt end will project from the nut a length equal to one bolt diameter. A full thread should remain clear between the nut and the unthreaded shank.

The bolts will always be installed vertically to the connecting parts. The shifting of the connecting parts for the bolt holes alignment should not affect in any way the steel or widen the bolt holes.

The friction bolts will be in accordance with the manufacturer's specifications. The tension on the bolt should not be smaller than the one necessary for the bolt diameter and strength.

In general all friction bolts will be in accordance to BS 4359 and will be installed in accordance to BS 4604.

1.6. Welding

General

Welding will be in accordance to BS 5135. The method of welding will be in accordance to BS 4870: Part 1, BS 4871: Part 1 and BS 4872: Part 1.

The Contractor will submit for the Engineer's approval detailed methodologies for each type of welded connection that he will use, and for the fusion faces preparation. The different types of weld connection will be tested in accordance to BS 4870: Part 1, unless there is authentic documentation relating to the experience gained with the welding of similar connections.

All welding sets to be used will be tested with approved testing methods; unless they were tested 6 months prior to the commencement of the steelworks and it was proven by Non Destructive Testing that they can produce satisfactory welds in accordance to the specifications.

Unless specified differently, butt welds will be full penetration welds made between prepared fusion faces. All butt welds will be completed before the final steel structure assembly.

Any welding traces will be removed from the metal surface and the protective lining using an approved method.

Welding Consumables

The electrodes for manual arc welding, of grades of steel according to BS4360 or ENIO 025, will be in accordance to BS 639. All the electrodes, wire and fluxes for arc welding of steel grades according to BS 43025 or EN150 025, will be in accordance to BS 4165. Fillers, rods and wires for gas welding will be in accordance to BS 2901.

Every batch of welding consumables will be accompanied by the manufacturer's certificate -on which the date of production will be stated, initial test results certificates, and the most recent of the periodic testing results. A copy of all the above will be given to the Engineer.

The welding consumables will be stored, in their initial packaging, in a warm, dry and well aerated room, in which the Engineer will have access. The use of damp electrodes will not be allowed. Electrodes of which the flux covering is broken, or electrodes that are damaged in any other way, will not be used.

Dirty, rusted or defective electrodes will be removed from site.

Quality Control

Welds that are considered critical will be tested in their whole length with radiography, ultrasound or other approved, by the Engineer, non-destructive testing method, appropriate for the weld type. The rest of the welds will be visually inspected and will be tested with the appropriate non-destructive method.

In addition to the structural steel tests that are mentioned in the contract documents, it is clarified that the following tests must be carried out by an accredited independent quality control test laboratory.

- (a) Welding tests
- (b) Qualification tests for welders in accordance to BS EN 287
- (c) Welding procedure tests for the arc welding of steels in accordance to BS EN 288: Part 3
- (d) Non destructive testing of welds
- (e) Visual inspection in accordance with the instructions of BS 5289
- (f) Surface testing with MPI in accordance to BS 6072
- (g) Ultrasound testing in accordance to BS 3923: Part 1 (2B)

Weld Quality

The welded steel will be correctly fused to the mother metal without showing any corrosion or overlap at the edge of the weld. The weld will not show cracking of any form. The welded joints will be rejected if any of the above mentioned defects are present. They will also be rejected if the weld testing shows reduced penetration, inadequate fusion, pores, impurities or rust.

Weld Repairs

Defective welding will be removed, including the mother metal, and the welding will be reformed with an approved method by the Engineer. The repaired welding will be tested with a non destructing testing method.

Care will be taken not to distort or damage the joining members. All the hollow sections will be protected against humidity.

Quality Control Cost

The cost for all 3rd party testing, inspections, technical documents, retesting, certifications for expert personnel, procedure verification, and non destructive testing will be on the Contractors expense who will be liable to the client / engineer to approve the relevant conformity report.

1.7. Erection

The Contractor will be responsible for the preparation in a timely manner and submission to the Engineer for approval, of erection drawings at least ten weeks before the commencement of any work related to structural steelworks.

The scheme will include shop drawings, calculations, description of erection and generally everything necessary to enable the Engineer to assess the suitability and sufficiency of the materials and erection procedure.

All steel components will be transported, stored and handled in such a way as to avoid any additional unforeseen loading that may cause damage.

All plant and equipment to be used for erection will have adequate capacity and be suitable for the Contractor's erection procedure.

Where steelwork has been painted or received any other protective coating prior to delivery to the site, the maximum precautions will be taken to avoid damage to the paint or the protective coating during loading, transporting, unloading, stacking and erection. Slings, ropes and chains will be rubber sheathed or with similar material. Steelwork stored on site, will not be in contact with the ground to avoid damage to the protective coating.

The Contractor will take provisions to grease and tape the threading of the bolts. Tape will be removed at erection of the steelworks.

Before commencing erection of the steelwork, the Contractor will check the setting out and levels of the concrete supporting structure, fixing bolts and other bearings for the steelwork. If discrepancies or inaccuracies in site works are found, which affect the steel frame erection and its correct position in relation to the concrete work, these will be drawn to the attention of the Project Manager. The erection, levelling and alignment of the steelworks will be in accordance to the specified tolerances.

Each part of the structure will be aligned as soon as possible after it has been erected. Members will not be permanently connected until a sufficient part of the structure has been erected. This is to ensure that they will not be displaced during the erection or alignment of the remainder of the structure. Special attention will be taken in erecting cantilever beams. Their ends must be well aligned after erection.

All the precautions will be taken for the safety of all the involved parties. All the measures will be taken to avoid any damage to any erecting or already erected steel section, or damage to any part of the permanent structure.

The erection will be carried out in accordance with the Safety Code for steel structures erection, BS 5531. During erection of the structure, steelwork must be securely bolted or otherwise fastened so as to make adequate provision for all erection loads and conditions.

Any temporary supports such as bracing or props will remain in position until the structure is sufficiently far advanced for the temporary supports to be required. Connections for temporary supports and generally for the measures that will be facilitated for the erection of the steelwork, will be in such a manner as not to weaken the permanent structure or to impair its serviceability.

The Engineer will have access to all the sites that steelwork related work is executed. The Contractor will provide all the necessary facilities to the Engineer for inspection during erection.

Assembled steelwork will be stored, free of soil, in such a way as to make testing and inspection possible. It must be confirmed that no foreign body, water or dirt will be deposited or absorbed by the steelwork surface. In the cases which covers will be used, the steelwork must be well aerated. Moisture must be kept to the minimum.

Welding electrodes will be stored according to the manufacturer's specifications.

1.8. Protection during transport

The fabricated steelwork will resist, without permanent damage, all stresses induced by handling, storage and transport. It will be the contractor's responsibility to ensure that all fabricated steelwork will not be subjected to any stress or damage during transport.

All materials and members of fabricated steelwork will be distinctly marked and packaged, to the Project Manager's satisfaction, for transport.

1.9. Trial assembly

Before steelwork transport to the site, the Contractor will check the assembly of the fabricated components to be in accordance to the approved fabrication drawings. Any necessary straightening or shaping will be carried out by methods that do not weaken or distort the steelwork. It will be the contractor's requirement to ensure that all the fabricated steelwork delivered to site will meet the design requirements, approved fabrication drawings and technical specifications.

1.10. Payment for testing and inspection

The cost of all the non destructive tests for the welds, and of all the other tests and inspections that are required, will be the Contractor responsibility and is part of his tender price.

E.1.0 VISITOR PATHWAY

1.1. Construction and preparation of path

A visitor path will be around the church at a distance from the exterior walls as is shown on the drawings. This will be made with RHS cut and welded together to form a continuation and compacted soil filling using mini-excavators, small tractors or mini-mechanical shovels with a maximum head of 20 c. Works will be carried out for any material and consistency, dry or wet. Also included: removal from the excavation area of waste material; loading, transport and discharge of waste material at whatever distance. It also includes anything else required to finish the work. Filling or removal works include leveling, tamping and compaction in layers not exceeding 10 cm; sprinkling and any necessary refilling. It also includes anything else required to finish the work.

1.2 Edging and surfacing of path

Once soil is compacted, the path will be formed with RHS 200X100X6.3mm thickness cut and fillet welded 6mm all around, and will be buried in the soil 5 cm. The soil will be compacted under the RHS and compacted soil will be placed inside it at a thickness of 15cm. See also drawing details.

1.2 Fencing

Demolition of existing fencing and removal waste and making good of the area shall be done by the contractor. Construction of a new fencing system as indicated per drawings (numbers R.PI01, P.I00, P.I02, P.I03, P.I04). Steel fencing rope fence 1.5m height (cable railing) diameter of d=6mm with cable tensioner every two ropes, RSA (80x80x8mm) steel grade BS500C hot deep galvanize column raging in height, minimum 1.50 meter (contractor to calculate 2m average) and steel plate 8mm thick (steel grade B500C hot deep galvanized) as drawing P.I03 and P.I04, include all the equipment and fitting materials (welded steel plate 8mm, welded anchor plate 8mm etc.). SHS steel sections (steel grade B500C hot deep galvanized) of 100x100x6mm will be poisoned on both sides of the openings (pedestrian & car doors respectively as per drawings).

Open ends of the RHS and SHS will be capped with similar material.

Single slide steel door of 1.50m wide and 1.5m height as drawing P.I103 and P.I04, with hinges, steel plate 8mm thick (steel grade B500C hot deep galvanized), locker, include all the equipment and fitting materials (welded steel plate 8mm, welded anchor plate 8mm etc.).

Double slide steel door of 4m wide 1.5m height as drawing P.I03 and P.I04, with hinges, steel plate 8mm thick (steel grade B500C hot deep galvanized), locker, include all the equipment and fitting materials (welded steel plate 8mm, welded anchor plate 8mm etc.)

F. FINAL ARRANGEMENT OF SITE

Compacted earth (pouri) shall be selected earth obtained from an approved source off the site.