5998

RAWLINGS
LIMITED
structural design

HIGHFIELDS
WHEMPSTEAD
WARE

SPECIFICATION

for

STRUCTURAL MATERIALS and WORKMANSHIP

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1 GENERAL

1.1 Engineer

The Engineer shall mean Rawlings Structural Design Ltd, Dryden, Rock Lane, Leighton Buzzard, Bedfordshire LU7 2QQ

1.2 Works

The Works shall mean the construction of the alterations to Highfields, Whempstead, Ware

1.3 Temporary Works

Whilst not shown or specified on the Engineer's drawings the Contractor shall be responsible for the design of all temporary works, including timbering and strutting and the like required to carry out the Works included in this Specification. It is to be noted that any timber used in the temporary works must be removed before any backfilling or covering up takes place.

1.4 British Standards

References to British Standards in this Specification include the latest amendment. Where a British Standard has been superseded by a new Standard, the new Standard shall be used.

2 EXCAVATION

2.1 Sub Strata Survey

The depths of the foundations shown on the drawings are based on information obtained from a sub-strata survey which is issued as part of the documents. The Engineer and Architect shall be notified immediately if the conditions found do not correspond with the results of this survey or the information shown on the drawings. Failure to do so may either require the foundation to be removed at the Contractors expense or that no consideration will be given to claims for additional costs

2.2 Existing Services

The Contractor shall ascertain the position of and divert as necessary, in compliance with the Service Suppliers requirements, all existing services and ensure their safety during all stages of the construction.

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2.3 Tolerances

The excavation shall at all times be completed in such a manner that ensures that the overlying structural elements can be constructed to the correct line and level. A tolerance of +00 to +75mm to the sides of excavations with the extra width being made up with concrete as specified for the foundations.

2.4 Granular Fill

Granular fill shall be deposited in layers not exceeding 150mm thick measured loose and shall be compacted with a power rammer or vibrating roller.

2.5 Hardcore Fill up to 75mm

Shall consist of either clean hard brick broken down to a nominal 75mm size, old road metal, gravel or ballast together with approximately equal bulk of fine hard material.

2.6 Surplus and Unsuitable Materials

Excavated material which is surplus to requirements or which is considered unsuitable for fill shall be carted away. Organic material shall be considered unsuitable.

2.7 Additional Material

Additional material for backfilling shall comply with Clauses 2.4 or 2.5.

3 LOADBEARING MASONRY

3.1 Materials

3.1.1 Bricks are to be as specified by the Architect with a minimum strength of 20N/mm^2.

3.1.2 Blocks Loadbearing blockwork shall have a minimum crushing strength of 3.5N/mm^2 or as noted on the drawings.

3.1.3 Mortars are to be Class (iii) as defined in BS 5628 with all proportions being gauged by volume.

3.1.4 Cement used in mortars shall be Portland Cement to BS 12 or Sulphate Resisting Cement to BS 4027 the latter being used in all walls below ground.

3.1.5 Lime used in mortar shall be high-calcium or semi-hydraulic lime conforming with the requirements of BS 890.

3.1.6 Sand for mortar shall comply with the requirements of BS 1200 Table 1.

3.1.7 Water shall be clean potable water and shall be free from any harmful impurity which may affect the strength or quality of the mortar.

3.1.8 Additives shall only be used with the written agreement of the Engineer and shall be used strictly in accordance with the manufacturer's instructions.

3.1.9 Ancillary Components Masonry ties shall conform with the requirements of BS 1243. Austentitic stainless steel ties shall be used in all cavity walls and where ties are in contact with the external leaf of cavity walls or external solid walls.

3.1.10 Bed joint reinforcement shall be stainless steel and constructed from individual rods, i.e., "Murfor", "Brickforce" or a similarly approved proprietary product.

3.2 Workmanship

3.2.1 General Workmanship shall be constructed as fair-faced masonry and shall be in accordance with section 4 of BS 5628:Part 3:1985 "Use of masonry".

3.2.2 Storage All materials shall be stored and handled in a manner which will avoid damage and deterioration through weathering, contamination or any other cause. All batches of materials having differing qualities eg blocks of differing strengths shall be stacked separately and suitably marked.

3.2.3 Tolerances All work shall be laid with even thickness of horizontal joints with structural walls being constructed within the tolerances given in BS 5606:1990 "Guide to accuracy in building".

3.3 Cavity or Double Skin Walls

Cavities shall be as specified on the Architects drawings and shall be tied with staggered wall ties at 900mm centres horizontally and 450mm vertically.

Additional ties shall be provided within 150mm of the edge of openings at 225mm centres vertically.

Ties shall be placed as work proceeds and set with a slight slope towards the outside leaf. As the wall is built one leaf shall not rise higher than 1200mm above the other, and the maximum lift shall be 1500mm per day.

The cavity shall be kept clear of mortar as the work proceeds and droppings reaching the base of the cavity shall be removed.

1.1 Strength of Laid Work

The mortar shall have attained sufficient strength to support any load applied to the wall from suspended floors, roofs and the like.

3.4 Formation of Chases and Holes

Sleeves, chases and holes shall, as far as possible, be provided or formed during the erection of the walls. Chasing of completed walls or the formation of holes shall only be carried out with a tool designed to cut cleanly. No horizontal or diagonal chases will be permitted. Timber pallet strips or other material intended for fixing shall not be built into walls without the agreement of the Engineer.

3.5 Extreme Climatic Conditions

All new work shall be adequately protected from frost, rain or rapid drying out for a minimum period of seven days. No walls are to be constructed in the open during frosty weather,rain or when the temperature is below 2ºC.

4 CONCRETE

4.1 British Standards

The Contractor is advised that BS8110 applies to this Specification together with any amendments.

4.2 Materials

4.2.1 Cement shall comply with the requirements of BS12 in the case of Ordinary Portland Cement and BS4027 in the case of Sulphate Resisting Cement. Storage shall in sealed containers such that the mixing of different types does not occur.

The Contractor is to note that the alkali content of the cement is to be compatible with the proposed aggregate.

4.2.2 Aggregates used in the manufacture of concrete shall comply with the requirements of BS 882:1992 "Specification for aggregates from natural sources for concrete". The Contractor shall obtain an undertaking from the suppliers that sufficient quantities are available to complete the contract. Marine aggregates may be used provided they comply with the requirements of this Specification.

4.2.3 Water shall be clean potable water and shall be free from harmful impurity which may affect the strength or quality of the concrete.

4.2.4 Admixtures in accordance with the requirements of BS1014, BS3892, BS5075 may be used with the written consent of the Engineer.Under no circumstances shall admixtures containing calcium chloride be used.

4.2.5 Concrete Mixes The design concrete mixes shall be as follows and in accordance with BS5328 except that agreement shall be obtained for any change of contents:-

Grade	C35	C30
Max Coarse Aggregate Size	20mm	20mm
Min Cement Content	330kg/m^3	330kg/m^3
Max Cement Content	450kg/m^3	400kg/m^3
Max Free Water/Cement Ratio	0.55	0.55
Min Crushing Strength at 28 days	35N/mm^2	30N/mm^2

4.2.6 Ready Mixed Concrete The Contractor shall submit to the Engineer details of the source of supply of concrete prior to the commencement of work on site.

The concrete from a Ready Mix supplier shall be manufactured from a depot included in the Quality Scheme for Ready Mixed Concrete. Evidence of such inclusion will be required on submission of the mix details and in particular concrete shall comply with the requirements within the Scheme for design mixes.

All the constituents for each load shall be added at the suppliers depot and no extra water or other material shall be added after the concrete has left the depot. Concrete shall be delivered and placed within one and a half hours of the water being added.

4.2.7 Blinding Concrete shall be a nominal mix of 1:10 with a minimum crushing strength of 10N/mm^2 at 28 days and a volume of 0.30m^3 of "all in" ballast per 50kg of cement. Blinding concrete shall be used for all reinforced concrete in contact with the ground.

4.2.8 Workability of the concrete shall be such that it can be readily compacted around the reinforcement and into the corners and angles of the formwork. The water content of the mix shall be the lowest possible compatible with the workability required.

4.2.9 Reinforcement shall be free any substance which can adversely affect the steel or concrete or reduce the bond. Mild steel shall comply with BS4449, high yield steel with BS4449 and BS8110 type 2 and mesh with BS4483

4.2.10 Storage of Materials All materials shall be stored in such a manner that will not cause them to be detrimental to their use in the Works. Reinforcement shall be stored clear of the ground.

4.3 Workmanship and Construction

4.3.1 Formwork shall be constructed and propped such that it can support the concrete in its fluid state together with all subsequently imposed construction loads without appreciable movement or deflection. It shall be sufficiently tight to prevent loss of grout from the concrete and be free from undulations and distortions and stiff enough to prevent damage due to vibration of the concrete.

The formwork shall, unless otherwise directed, have a smooth even face and be so supported to provide a plain surface with clean and true arrises.

Release agents shall be materials marketed as such and shall be cream emulsion or chemical release agent and these shall be stored and used strictly in accordance with the manufacturers instructions. Cream emulsions shall not be used in conditions where they may be subject to freezing and under no circumstances shall release agents be allowed to come into contact with the reinforcement

4.3.2 Construction Joints Concrete at construction joints is to be bush hammered and cleaned or the surface wire brushed to expose the aggregate before pouring the adjacent concrete. In general, construction joints in beams shall be at one third point of the span.

4.3.3 Reinforcement shall be cut, bent cold, and fixed in accordance with BS8110 and from the information shown on the Engineers drawings with all bending being carried out on a machine designed for that purpose. Clear tags indicating the schedule and mark numbers shall be applied to each bundle of bars these being replaced immediately in the event of loss or damage. Reinforcement shall be anchored in place and shall be tied with ample use of annealed 16SWG iron wire.

4.3.4 Cover The reinforcement shall be fixed such that the covers noted on the drawings can be achieved. Where spacers are required these may be of either concrete or plastic.

4.3.5 Concrete Mixing and Transportation Concrete is to be produced in accordance with BS 5328.

The concrete shall be transported from the place of mixing or supply to the place of final deposit as rapidly as practicable by means which will prevent segregation and/or loss of ingredients and shall be deposited in the forms within one and a half hours of water being added.

Runs or gangways for concrete transporters and main runs for foot traffic shall not be supported or allowed to bear on the fixed reinforcement.

4.3.6 Concrete Compaction and Placing shall be in one continuous operation up to construction joints whilst it is sufficiently plastic for adequate compaction by vibrators of the appropriate type, carefully worked around the reinforcement, embedded fixtures and into the corners of the formwork. Compaction shall start as soon as there is sufficient concrete within the formwork to immerse the vibrator. Placing shall continue so that at no time shall there be a large volume of uncompacted concrete in the formwork.

Compaction shall be continued until the concrete reaches a state where air bubbles cease to break the surface, all loose stones are absorbed into the mass and the surface is free from pockets. Internal vibrators shall not be permitted to touch the formwork and they shall not be used to push the concrete along the forms.

Immediately before the concrete is placed the formwork shall be thoroughly cleaned removing all rubbish, chippings, sawdust, tying wire and any deleterious material from the interior of the formwork.

4.3.7 Curing The method and duration of curing shall be such that the concrete sections will remain free of cracks or distortion and that the concrete will have satisfactory durability and strength. Any applied sprayed application must contain a fugitive dye and must not be harmful to applied finishes. Table 6.5 of BS8110 gives guidelines on curing periods.

4.3.8 Cold Weather Concreting The Contractor shall ensure that the temperature of the concrete when placed is not less than 5ºC regardless of air temperature and that the temperature of the placed concrete does not fall below 5ºC for 42 hours for C35 concrete and 50 hours for C30 concrete. The Contractor shall be responsible for the proper protection of the concrete in cold weather.

Any concrete which in the opinion of the Engineer is damaged by frost will not be accepted and shall be removed immediately and replaced before any further construction takes place. A max-min thermometer shall be kept on site in a suitable position sheltered from the sun with temperatures being regularly recorded by the Contractor.

4.3.9 Hot Weather Concreting In high temperature and/or drying wind conditions the concrete shall be protected by polythene sheeting immediately after final tamping. This sheeting shall remain in position until the free bleeding water has evaporated after which the concrete can be cured.

4.3.10 Striking of Formwork The minimum periods for striking formwork shall be in accordance with Table 6.6 of BS8110.

4.4 Performance and Tests

4.4.1 General The Contractor shall be responsible for carrying out all tests required by this Specification and for ensuring that copies of test results are supplied to the Engineer immediately they are available.

4.4.2 Testing Facilities Before concreting commences the Contractor shall submit the name of the independent NAMAS accredited testing authority he proposes to use.

4.4.3 Concrete For each delivery at least two sets of cubes shall be made, one set for test at 7

days and the other for test at 28 days. The results of these tests shall be submitted direct to the Engineer by the testing authority.

The concrete shall be deemed to satisfy the requirements of this Specification if the test results comply with Section 16 of BS5328.

4.4.4 Defective Work Where in the opinion of the Architect or the Engineer any of the finished work or the materials or workmanship in any part of Works fails to comply with this Specification that part of the Works shall be classed as defective and shall be cut out and removed from the Works and replaced or otherwise dealt with in an agreed manner.

Any special tests not covered by this Specification and proposed by the Contractor as a result of failure to comply or failure of works cubes to achieve 85% of the required strength shall be at the Contractors expense together with any consequential delay.

5 STRUCTURAL STEELWORK

5.1 British Standards

All design and workmanship shall be in accordance with the requirements of BS449 and any other relevant British Standard.

5.2 Design

The Steelwork Supplier acting as a domestic Sub-contractor to the Main Contractor, shall be responsible for the design of all connections and other details not shown on the Engineers drawings and shall submit calculations to the Engineer.

All site connections are to be bolted unless stated otherwise and are to be made with the minimum of two bolts per connection.

5.3 Drawings

The Steelwork Suppler shall prepare all working plans and shop detail drawings required for the proper execution of the works as shown on the Engineers drawings and this Specification. Duplicate copies of these drawings shall, after being checked by the Supplier, be submitted to the Architect and Engineer for review at least four weeks before fabrication is due to commence.

The review of drawings shall not relieve the Supplier of his responsibilities under the Contract.

5.4 Materials

All rolled steel plates and sections shall be new and of British manufacture and in accordance with Grades 43A and 50C to BS4360 or BS2994.

Grout by the Contractor placed under steel sections where they are supported by packing plates on concrete surfaces shall be 3:1 sand/cement mortar mixed with as little water as will form a thick dense bed after being well rammed into the space.

5.5 Workmanship and Fabrication

5.5.1 Identification Marking All fabricated steelwork must be marked in paint in accordance with the steel marking plan prepared and supplied by the Steelwork Supplier.

5.5.2 Profiles The profile of beams, channels and angles shall be in accordance with the current edition of the relevant British Standard.

5.5.3 Shape All finished members shall be free from twist, true to profile and be dead straight with the ends of members abutting against or upon other parts shall be cut to exact lengths and be true and square so as to provide a good bed or joint as the case may be. Proper cover plates must be provided where necessary.

5.5.4 Holes, Drilling and Notches All holes shall be drilled and shall be cleaned of burrs and rough edges. The diameter of all holes must not exceed the bolt diameter by more than 2mm. Where holes are drilled through two or more separate parts, the parts shall be separated after drilling and the burrs removed.

The roots of all notches to the ends of members shall be given a radius.

5.5.5 Bolts and Washers All bolts shall be Strength Grade 8.8 in Grade 43 steel with the transition from barrel to thread being contained within the flat washer.

5.5.6 Welding All welding shall be in accordance with the provisions of BS5135 and shall be carried out in such a manner that will minimise distortion and locked in stresses in accord with modern practice.

Welds shall be laid to regular profile and be dressed to give smooth finish and neat appearance. In the making of butt welds "run on" and "run off" plates shall be used wherever possible.

Where required all welds shall be inspected by an independent specialist NAMAS accredited testing authority agreed by the Engineer. The results of these tests and report shall be submitted directly to the Engineer by the testing authority.

The cost of examination and retesting of any defective work shall be borne by the Steelwork Supplier. Site welding will not be permitted without the agreement of the Engineer.

5.6 Surface Preparation and Protection Scheme

Surface preparation and protection shall be in accordance with the Engineer's drawings.

5.7 Erection

5.7.1 Procedure The Steelwork Supplier shall be responsible for the method of erection, any temporary works he considers necessary and the overall stability of the steel and supporting structure during erection. He shall also be responsible for the suitability and capacity of all plant and equipment used for the erection of the steelwork.

5.7.2 Handling and Storage All structural steel shall be stored and handled in such a manner such that members are not subject to excessive stress or undue corrosive conditions and with the minimum damage to the applied coatings

The Steelwork Supplier shall be responsible for the correct positioning, lining, plumbing and levelling of the steelwork in accordance with the drawings.

5.7.3 Tolerances On plan the tolerance of overall length or width of the structure shall not exceed:-

plus or minus 3mm up to 8.0 m in length

plus or minus 5mm over 8.0 m and up to 15.0 m

plus or minus 8mm over 15.0 m and up to 25.0 m

The tolerance between the theoretical and actual levels of two meeting beams shall be plus or minus 2mm

The steelwork Supplier is to note that any errors found in the alignment or levels of the steelwork shall be corrected at his own cost.

6 STRUCTURAL TIMBER

6.1 British Standards

All materials and workmanship shall be in accordance with BS5628 and any other relevant British Standard.

6.2 Materials

6.2.1 Structural Timber. All structural timber shall have the strength class indicated on the drawings, having been graded and bearing the mark of a certification body approved for that purpose by the UK Timber Grading Committee. Grading shall be in accordance with BS4978.

No cross dimension shall vary more than plus or minus 0.5mm

The moisture content of the timber shall not exceed 20%.

6.2.2 Preservative. All timber to be treated with a double vacuum treatment organic solvent preservative to BS5268 which is to include a colouring agent and which is to be compatible with the material used in the connectors and the like. Preservation treatment shall be carried out prior to fabrication and to be in accordance with the manufacturer's recommendations. Untreated surfaces exposed by cross cutting, notching or boring of the timber shall be treated by brush application of the preservative. Certificates of preservative treatment shall be provided with every batch of timber and shall be available to the Engineer for inspection at his request.

6.2.3 Bolts. All bolts to be black bolts complying with BSEN 20898-1 and are to be supplied with washers or washer plates.

6.2.4 Connectors. All toothplate connectors shall comply with BS1579.

6.3 Workmanship

6.3.1 Timber. Workmanship shall be in accordance with section 7 of BS5268: Part 2. Workmanship in connection with fabrication, preparation and installation shall conform in all respects with good practice. Timber that is damaged, crushed or split beyond the limits permitted for similar defects in the grading shall be rejected or repaired to the satisfaction of the Engineer.

6.3.2 Bolts. Holes for bolts shall be drilled and shall have a diameter no greater than 2mm larger than the diameter of the bolt. The bearing area shall not include any of the threaded length of the bolt. Washers shall have the full bearing area and the bolts tightened such that the membrane fit tightly together.

6.3.3 Connectors. In addition to the requirements for bolts, connectors shall not be allowed to bear on the threaded length of the bolt.

6.4 Storage.

Materials and components shall be stored on dry bases and stacks, evenly supported on bearers with spacer sticks at regular interval. Stacks shall be covered with tarpaulins until required for the Works.