

STRUCTURAL ENGINEERING SPECIFICATION

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GENERAL
(Clauses G1 to G10 inclusive)

G1	The Engineer is Datrys Consulting Engineers Ltd, Yr Aelwyd, 3-5 Church Street, Caernarfon, Gwynedd. LL55 1SW.	Engineer
G2	As required by the Conditions of Contract, the Contractor shall submit for approval a programme of operations for the works. Preferably the programme shall be based on network analysis, but presented in the form of a bar chart.	Programme
G3	All work shall be carried out in accordance with this specification, Codes of Practice, British Standards, and Eurocodes as appropriate, current at the date of tender. Where this specification is in conflict with Codes of Practice, British Standards, or Eurocodes, this specification shall take precedence.	British Standards
G4	The Contractor shall take all precautions necessary and provide all temporary works to ensure the stability of the structure at all stages of construction.	Stability during Construction
G5	Facilities for the inspection of materials and workmanship shall be afforded to the Engineer at all reasonable times and during all stages of construction. The Contractor shall give reasonable notice to the Engineer when any item of structural work is ready for inspection.	Inspection
G6	The Contractor shall notify the Engineer of all conditions found on site which are at variance with the working drawings. The works shall be carried out strictly in accordance with the details given by the Engineer. No variations from the details shall be carried out without the Engineer's consent. The Contractor shall inform the Engineer of all discrepancies in the setting out of working drawings.	Working Drawings
G7	The Engineer may call for tests over and above those included in the specification on any of the materials, to be carried out at an independent testing house. The Engineer shall be empowered to reject any materials, which in his opinion are substandard. Payment for such tasks shall be in accordance with the contract.	Tests on Materials
G8	Any approval given by the Engineer does not remove or diminish responsibility from the Contractor.	Approvals
G9	The accuracy of the works shall be as defined in BS 5606:1990 Guide to Accuracy in Building, unless otherwise specified.	Accuracy
G10	For contractor designed items the following approval procedures shall apply: • All design calculations shall be submitted to the Engineer in advance of their being required for detailing. • A minimum period of 1 week from receipt of calculations should be allowed for the Engineer to comment on the design calculations. • Drawings shall be submitted to the Engineer in advance of their	Contractor's Design

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being required for manufacture or fabrication.

- A minimum period of 1 week from receipt of drawings should be allowed for the Engineer to comment on their content.

EXCAVATION AND FOUNDATIONS
(Clauses E1 – E4.2 inclusive)**E1 General**

- E1.1 For general clauses relating to this specification refer to the Specification for Structural Work - General. **General Clause**

E2 Excavation

- E2.1 All turf vegetation and top soil shall be removed from the areas to be levelled or excavated. **Surface Strip**
- E2.2 The Contractor shall be responsible for providing, maintaining and the subsequent removal of all necessary sheeting, timbering, strutting and shoring to excavations to ensure the safety of the work force and freedom from damage to any structures, buildings, roads, pavements or services etc. Where temporary supports are ordered by the Engineer to be left in, they shall be measured and paid for, unless in the opinion of the Engineer it is required by reason of the Contractor's negligence. **Temporary shoring and support**
- E2.3 All excavations shall be carried out to the required lines and levels, widths and depths so that the dimensions of the permanent work shall not be less than shown on the working drawings or as otherwise directed by the Engineer. If, in the opinion of the Engineer, the ground at the required depth is not suitable for the designed foundation pressure, further excavation or widening will be required. Excavations shall be left open for as short a period as possible. **Excavation**
- E2.4 The bottom of all excavations shall be trimmed, levelled and compacted prior to the placing of concrete. The last 150-mm of excavation shall not be carried out until all preparations for obtaining approval have been made. If, through the operations of the Contractor, any excavated surface is cut up by traffic, softened or otherwise made unsuitable, the Contractor shall at his own expense re-excavate to an approved formation and backfill with concrete as required by the Engineer. **Bottom of Excavation**
- E2.5 Where water is encountered in an excavation a sump shall be formed outside the limits of the excavations and the water pumped out. The Engineer shall be notified whenever water is encountered. **Water in Excavation**
- E2.6 Suitable excavated material for re-use shall be carefully stockpiled separately from material for disposal. Such material shall be protected from the effects of weather so that its condition does not deteriorate. If material that was suitable as excavated becomes unsuitable due to its storage the Contractor will delay his operations or work the material within the stockpile until suitable. The costs of making up the quantities of suitable material that has deteriorated so as to become unsuitable for inclusion in the works in the opinion of the Engineer, including its disposal and importation of new material will be borne by the Contractor. **Re-Use of Excavated Material**
- E2.7 All material for disposal shall be disposed of off site. Any material that is contaminated shall be disposed of to a tip licensed to accept the material in question. **Disposal of Excavated Material**

E3 Filling

- E3.1 The filling material under buildings shall be class 6N or 6P selected well graded granular material in accordance with table 6/1 of Specification For Highway Works Document – Volume 1. **Under Slabs**

All filling material shall be free of deleterious material such as lime mortar, plaster or any source of sulphate contamination. The material shall be deposited and consolidated in layers not exceeding 150mm thick, using methods given in table 6/4 (Specification For Highway Works) to achieve the compaction requirements shown in table 6/1.

Compaction shall continue beyond that given above until there is no creep of the fill ahead of the roller, all voids are filled and the surface is smooth and even. Screenings of the fill material or blinding dust shall be added where necessary to even out local imperfections of level and to fill voids.

- E3.2 Additional excavations shall be filled up to the formation level shown on the Engineer's drawings with C16/20 concrete backfill unless otherwise directed by the Engineer (see also Clause E4.2). **Additional Excavation**

E4 Concrete for Foundations

- E4.1 All concrete for foundations shall be of the class specified on the drawings and shall be mixed, transported and placed in accordance with the Specification for Structural Work – Concrete.
- E4.2 In sulphate bearing ground, concrete for blinding and backfill required under Clause E3.2 shall be of the same grade as that specified for the main foundation supported by the blinding or backfill. All as shown on the drawings. **Sulphate bearing ground**

FORMWORK
(Clauses F1 to F12)

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| F1 | The Contractor shall be responsible for the sufficiency of the formwork, but if required by the Engineer he shall before commencing work, submit for approval details of the formwork (timber or metal) and method of supporting same. | Formwork Contractors Responsibility |
| F2 | <p>All formwork shall be securely braced and supported to prevent any sagging or bulging during construction. The vertical strutting shall be carried down to construction, which is sufficiently strong to afford the required support. All forms shall be fixed to proper grade and trued up immediately before depositing the concrete. The maximum tolerance shall normally not exceed $\pm 3\text{mm}$.</p> <p>The formwork and struts shall be so arranged as to permit easing and removal without jarring the concrete. Wedges, clamps and bolts shall be used wherever practicable for securing the true position of the forms.</p> | Construction of Formwork |
| F3 | Top shuttering shall be used when the slope is such as will otherwise prevent sufficient consolidation. | Inclined Work |
| F4 | All joints shall be close enough to prevent undue leakage of liquid from the concrete. | Joints in Forms |
| F5 | All wrot formwork for fair face work shall be formed with a facing of well aligned plywood sheeting with all joints sealed. The finish is Class 2 Type A to clause 6.2.7.3 of BS 8110. | Wrot Formwork for Fair Face Work |
| F6 | Special formwork to give a specified surface effect such as random board marking etc. shall be formed with an additional lining of approved materials to give the required effect, to the entire satisfaction of the Engineer and Architect. | Special Formwork for Boardmarked Finishes |
| F7 | The inside of the forms shall be treated with approved vegetable base mould oil or other material approved in writing by the Engineer. In dry weather the inside of the moulds, unless otherwise treated, shall be wetted shortly before concreting is put in place. | Prevention of Adhesion |
| F8 | The full responsibility for releasing or removing formwork shall remain with the Contractor whether or not a minimum period or concrete strength is specified. Minimum striking times shall be agreed with the Engineer and shall take the ambient temperature into consideration together with any relevant cube strength test results. | Formwork - Responsibility for Removal |

The following may be taken as a guide to time applicable during normal weather conditions (approx 15°C):-

Column and beam sides	2 days
Slab soffits	7 days
Beam soffits	14 days

When special provision is made for the striking of the majority of a soffit shutter but the props are left undisturbed, the above times may be taken as referring to the removal of props and earlier times for the

remainder agreed with the Engineer.

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| F9 | Care shall be taken to ensure that when any formwork is re-used, its surfaces are smooth and clear. | Re-use of
Formwork |
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CONCRETE WORK
(Clauses C1 to C12)

- C1** Concrete shall be produced, mixed, transported and tested in accordance with BS EN 206-1:2000. **Concrete**

Concrete shall be designed mixes of grade as shown on the drawings. Moderate exposure shall apply to the concrete for the foundations.

The Contractor shall not less than 7 days prior to concreting obtain the Engineer's approval of the nature and source of materials including concrete mix design details, aggregate grading analyses, and chloride content calculations.

- C2** Ready-mix concrete from a supplier certified in accordance with BS 5750 is preferred but site batched or non-ready mixed concrete may be allowed with the prior written approval of the Engineer. In such cases the Contractor shall satisfy the Engineer that an effective system of quality control is maintained. **Sampling and Testing**

Sampling, curing and testing of concrete shall be carried out in accordance with the relevant parts of BS 1881 and BS EN 206-1:2000.

Slump tests shall be carried out as often as the Engineer deems necessary to monitor workability. The Contractor shall provide the necessary equipment and carry out the tests in the presence of the Engineer.

Sampling for strength tests shall be carried out at the rate of 1 sample per 20m³ or part thereof for each day that grade of concrete is used. Two cubes for 28 day testing shall be produced from each sample and their average strength will be the result for the sample.

Testing shall be carried out by a laboratory accredited for the test by the National Measurement Accreditation Service (NMAS).

- C3** Steel bar and fabric reinforcement shall comply with BS 8110: Part 1: Section Seven. **Reinforcement**

Site cutting or welding of reinforcement shall not be carried out without the prior agreement of the Engineer.

The Contractor shall protect existing surfaces from staining by reinforcement stored on site.

All reinforcement which has been contaminated by sea water either by immersion or spray shall be thoroughly washed with fresh water prior to encapsulation in concrete.

The Contractor shall obtain the approval of the Engineer of the reinforcement as fixed before any concrete is deposited.

The Contractor shall provide a cover meter to enable checking of the position of reinforcement in the hardened concrete if so required by the Engineer.

C4	Formwork shall comply with BS 8110: Part 1: Section Six clauses 6.2.6. The Contractor shall ensure that release agents are compatible with any subsequently applied finish and, where the concrete surface is to be permanently exposed, only one release agent is used throughout the area. Surface finishes produced with formwork shall be Type A (rough) or as described in Clause 6.2.7 of BS 8110 or as noted on the drawings. The Contractor shall obtain the Engineer's approval of the fixed formwork before concrete is placed.	Formwork
C5	Concrete shall be transported, placed, compacted, and cured in accordance with BS 8110: Part 1: Section Six clauses 6.2.1 to 6.2.5. All concrete shall be fully compacted using vibrating poker.	Placing Concrete & Compaction
C6	The Contractor shall keep up-to-date records of the dates and times when concreting is carried out and of weather and temperature conditions at the time. The extent of each day's concreting shall be marked on the drawings and cross-referenced with test cubes. Such records shall be available for inspection by the Engineer.	Records
C7	Surface finishes produced without formwork shall be as follows: Wood Float Finish For concrete not exposed to view such as top surface of foundations. The surface should be generally uniform and to the specified dimensional tolerances. Power Floated Finish A power float may be used as a preliminary to power trowelling to regulate and close the surface on an exposed concrete slab. Power floating must not be carried out until the concrete has sufficiently hardened and surface water has evaporated. Power Trowelled Finish If required, and after floating has been carried out and the surface allowed to stiffen again, the floor is power trowelled at intervals until it is smooth and cannot be marked by further trowelling. Brushed Finish Where improved slip resistance is required, a brushed texture may be applied with a bristle beam drawn transversely across the slab, after power floating. Scabbled Finish A scabbled finish is required for in-situ concrete slabs when a separately laid bonded screed is to be placed on top. All loose debris and dirt should be removed (preferably by vacuum) to ensure that the coarse aggregate is cleanly exposed in the slab. Chamfers, Surface Features, etc. The Contractor shall take special care in forming chamfers, surface features, etc. as shown in the drawings and to protect them against damage.	Surface Finishes Produced Without Formwork

In forming chamfers, rebates etc. care must be taken to obtain a neat finish, any irregularities being accurately ground off.

Any arises badly formed or damaged must be cut out and reformed using a resin mortar of a good colour match to the parent concrete, to the Engineer's approval.

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| C8 | Construction and movement joints shall be in accordance with BS 8110 Sections 6.2.9 and 6.2.10 and shall be incorporated in the work at any position shown on the drawings, or otherwise at positions proposed by the Contractor and approved by the Engineer. Details of all such joints shall be submitted to the Engineer at least five working days before they are formed, and the work concerned shall not proceed without the Engineer's agreement. | Joints |
| | Compressible joint filler shall be Korkpak by Serviced Ltd. (tel. 01753 692 929) or similar approved. | |
| C9 | The concrete shall be inspected after removal of the formwork and any remedial treatment necessary shall be agreed with the Engineer. Any bagging or facing up done without the prior approval of the Engineer shall be cut out, and a suitable repair carried out as he directs. | Remedial Treatment |
| | Concrete, which is honeycombed, not fully compacted, or is in any way defective shall be cut to a depth sufficient to remove the defect and to give a key. The cutting out shall be approved by the Engineer before repairs are carried out. | |
| | Unless otherwise sanctioned, repair concrete shall be rammed behind forms and shall be of proportions not less strong than those specified for the parent concrete. Before the repair concrete is placed the parent concrete shall be washed clean and given a coat of thick cement grout. | |
| | Concrete Slab is to be inspected by Engineer or Engineers representative (Minimum 1 week after casting) and areas of cracking noted. Following repairs to be carried out after 28 days:
Cracks less than 1mm wide to be repaired with standard epoxy plus injection resign.
Cracks greater than 1mm wide to be repaired with thixotropic epoxy plus injection resign. All by SBD limited (Tel: 01525 718877). | |
| C10 | Tolerances for works shall generally be as given in BS 5606 except where qualified on the drawings or elsewhere in the specification. | Tolerances |
| C11 | Pre-cast concrete units shall be manufactured, handled and assembled in accordance with BS 8110: Part 1: Clause 6.14 with tolerances to BS 8110 Clause 5.2.4. | Pre-cast Concrete |
| | Pre-cast concrete floors slabs shall be as shown on the drawings to manufacturers design and be capable of carrying characteristics imposed dead and imposed live loadings as shown on the drawing. Where applicable slabs shall receive a structural topping of RC30 concrete with reinforcement and to thickness shown on drawings. | |

Pre-cast units shall not be de-moulded until the concrete has achieved at least 1/3 of its design strength, and shall not be moved or stacked until the concrete has reached at least ½ of its design strength.

Pre-cast units shall be lifted by means of spreader beams with final lifting to be applied at ends and the mid point. Extreme care

shall be taken to prevent damage to and distortion of immature units from movement, vibration, overloading, physical shock, rapid cooling and thermal shock.

All units shall be clearly marked on both ends with a unit reference number and the date of casting.

Records shall be kept for inspection by the Engineer to allow correlation with records of mixes and all tests, checks and inspections. Each unit shall be checked for compliance with the specified dimensional accuracy.

All units which become damaged as a result of premature or inappropriate handling prior to or during incorporation into the final works shall be removed from site and replaced at the Contractor's expense.

Variation in levels of longitudinal beams is to be made up by bedding the deck planks as they pass over the central beam on Nitomortar PE polyester resin jointing compound by FOSROC EXPANDITE LTD or similar approved.

Once in place re-bar bolt holes are to be accurately drilled in the longitudinal beams and re-bar bolts secured by quick setting Lokset capsules.

When secured, annulus around bolt in depth of deck planks to be filled with Lockset S40 resin anchor grout and the plank immediately secured by tightening the locating nut assembly in the counter bore. The nut assembly shall subsequently be covered with non-shrink sand cement grout.

- C12** Beam and block floors will be to the contractor's design and be capable of carrying the imposed dead and live loadings as shown on/or derived from the drawings.

Beam And Block

Beams shall be prestressed and manufactured by a slip form method on a long line casting principle.

Design is to be in accordance with B.S.8110 1985 using grade C60 concrete with a cover to reinforcement to satisfy the 'moderate' exposure condition as defined in B.S.8110.

Blocks

Infill blocks shall be standard walling or flooring blocks to meet the following specification:

100mm thick, manufactured in accordance with BS EN772-2:1998, and BS EN771-3:2011. Block strength shall be a minimum of 7.0 N/mm² with a transverse point load capacity of 3.5 KN on a span.

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Block densities may be between 650 kg/m³ and 1900 kg/m³ to give the specified density of the floor.

Floor Finishes

The top surface of a beam and block floor is to be suitable for the applications of a concrete screed in accordance with B.S.8000 and B.S.8204 as a directly bonded screed or on a separating membrane.

It is recommended that temporary protection is provided where heavy construction loads from stacked materials, barrow or bogie run etc are expected during the construction operation.

Quality Assurance

Manufacturers of the beam and block flooring shall be members of the BSI Registered firms Scheme for Quality Assurance to ISO 9001. Proof of compliance shall be supplied.

LOADBEARING MASONRY
(Clauses B1 to B4.1 inclusive)

B1	All loadbearing brickwork or blockwork shall be in accordance with the requirements of BS EN 1996 "Design of Masonry Structures".	British Standards
B2	Materials	
B2.1	All bricks and blockwork shall have compressive strengths equal to that noted on the drawings. If required by the Engineer, Manufacturer's test certificates shall be provided for examination. If required by the Engineer, the crushing strength of the bricks or blocks shall be determined by an independent testing laboratory on a group of ten bricks or blocks selected at random. The sampling and testing procedure shall be as recommended in BS 3921 "Bricks and Blocks of Fire Brickearth, Clay or Shale" or BS 6073 "Precast Concrete Masonry Units" Parts 1 and 2 as appropriate. The cost of satisfactory tests will be reimbursed. Bricks and blocks having different compressive strengths or other qualities shall be stacked on site separately and be clearly identified.	Bricks & Blocks
B2.2	Ordinary Portland Cement shall be used unless otherwise specified and shall comply with BS 12. Rapid hardening, sulphate resisting or high alumina cement shall comply with the relevant British Standards but shall not be used without the Engineer's consent or unless specified.	Cement
B2.3	Sand shall comply with requirements of BS 1200	Sand
B2.4	Unless the water is taken from a public water supply and complies with BS 3148 the source shall be approved by the Engineer. Samples shall be tested by an approved laboratory before the commencement of the Contract and the costs incurred shall be borne by the Contractor.	Water
B2.5	Lime shall be hydrated and shall comply with BS 890.	Lime
B2.6	Wall ties shall be of stainless steel and shall comply with the requirements of BS 1243	Wall ties
B3	Workmanship	
B3.1	Mortar designation 2 shall be used below dpc and designation 3 elsewhere unless otherwise noted on the drawings.	Mortar
B3.2	Care must be taken to ensure that all joints are well filled with mortar. All the bricks shall be laid with the frog side up and the frog shall be filled. Raking out of joints for plaster or render will not be permitted. Brickwork shall gauge four courses including joints to 300 mm in height except where matching or bonding to existing walls.	Joints

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B3.3	All loadbearing walls shall be built plumb and true to line and level to a tolerance of ± 6 mm in any storey height or six metre length.	Line and Level
B3.4	The two leaves of all loadbearing cavity walls shall be held together with stainless steel wall ties (see Clause B2.6) at the maximum spacings of 900 mm horizontally and 450 mm vertically, staggered. The ties shall be embedded into each leaf by not less than 50 mm. All cavities and ties shall be kept free from mortar droppings and debris.	Cavities and ties
B3.5	All loadbearing walls shall be built prior to the floor above being cast, unless otherwise detailed or agreed with the Engineers. Where a slab is to continue over a cavity the cavity shall be sealed with one course of slates.	Floors cast onto walls
B3.6	The insertion of breeze or similar fixing blocks will not be permitted in loadbearing walls without the consent of the Engineer.	Inserts
B3.7	The method of forming holes and chases for services etc. in loadbearing walls shall be agreed with the Engineer. Horizontal or diagonal chases will not be permitted in loadbearing walls. All holes and chases shall be the minimum size necessary.	Holes and Chases
B3.8	All walls are to be covered at night and other times when necessary, with felt and boards to protect the green work from rain and frost.	Protection
B3.9	No brickwork is to be built when the temperature is below 2°C nor after the temperature has risen until the Engineer's sanction has been obtained. In the event of frost affecting the brickwork, all the brickwork so affected shall be removed and rebuilt at the Contractor's expense.	Cold Weather

STEELWORK
(Clauses S1 to S18)

S1	General	
S1.1	Except as modified here under the requirements of the latest edition of the National Structural Steelwork Specification for Building Construction (NSSS) published by BCSA shall apply.	General Clauses
S2	Materials	
S2.1	Unless otherwise indicated, the steelwork shall consist of hot rolled sections, structural hollow sections, plates and bars in steel to grade S275 JR. All material used shall be tested in accordance with this standard, and the Contractor shall obtain certificates of compliance.	
S2.2	Hot-rolled sections shall comply with the current standards as given in BS 5950 Part 1	Hot-rolled
S2.3	Cold formed steel sections shall be to current standards as given in BS 5950 Part 1	Cold formed
S3	The section size, position of steel members and connection design shall be as shown on the Engineer's drawings. The Contractor shall confirm the overall length of beams and columns prior to ordering, and shall advise the Engineer of any discrepancies.	Member Sizes and Connections
S4	The Engineer may at his discretion call for drawings showing the Contractor's proposals for site assembly and erection of the steelwork.	Erection Proposals
S5	The Contractor shall provide all facilities required by the Engineer for him to carry out inspection and testing of materials and fabrication, including any handling of materials or non-destructive testing of welds he may require.	Facilities for testing
S6	Fabrication of structural steelwork shall be carried out in accordance with BS 5950: Part 2 or such other British Standard as may be named on the Engineer's drawings.	Fabrication
S7	Hand flame cutting shall not be permitted without the Engineer's prior agreement in writing.	Hand Flame Cutting
S8	All pieces shall be clearly marked so as to ensure that they are correctly located in the structure. Marks must be of a type not subject to obliteration by shot blasting, pickling or galvanising, where these operations are to be carried out. Marks must be positioned so as to remain visible after the installation of the component they identify.	Component Marking
S9	Before the ends of hollow sections, or openings in their sides, are sealed, a check shall be carried out to ensure that the interior is clean, dry and free from debris.	Sealing of Hollow Sections
S10	Components once fabricated must be stored clear of the ground, in a clean condition, and with their identifying marks clearly visible.	Component Storage
S11	Bolted connections shall be made using min grade 8.8 bolts to BS	

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3692, but with dimensions, tolerance and thread length to BS 4190.

Bolted Connections

Washers are to be plain black metal washers to Form E of BS 4320.

Ordinary bolts not exceeding 24mm in diameter shall be set in 2mm clearance holes, and bolts of diameter greater than 24mm shall be set in 3mm clearance holes. Subject to the Engineer's approval, larger holes may be provided in the case of holding down bolts which are detailed to allow positional adjustment. Bolt holes shall be formed by drilling unless otherwise agreed in writing by the Engineer.

Where nuts or bolt heads bear on sloping surfaces, suitably tapered washers must be interposed.

Members shall be aligned at erection so that bolts can be fitted without being driven. Instances where hole positions do not match shall be reported to the Engineer, and remedial measures agreed with him.

Permanent bolts may not be used as service bolts during erection if this involves damage to their protective finish.

S12

Welding of steelwork shall generally be a metal arc process carried out in accordance with BS 5135.

Welded Connections

The properties of the deposited metal shall be at least equivalent to those of the parent metal.

Site welding will be permitted only where the Engineer gives prior agreement or direction.

Welding shall be carried out under the continuous direction of an experienced and competent supervisor. Welders shall have passed tests appropriate to the type of work being carried out, as specified in BS 4871 or BS 4872 as appropriate.

Unless otherwise indicated, all butt welds shall be full penetration welds made between prepared fusion faces, using run-on and run-off plates of the same thickness and profile as the parent metal clamped at either end of the weld. On completion, the plates shall be removed and the surfaces to which they were attached ground smooth without loss of parent metal.

Fillet welds shall be continuous throughout unless otherwise indicated on the drawings.

Any weld which the Engineer considers defective shall either receive appropriate corrective work, or be cut out and replaced, in either case to his satisfaction.

S13

The Contractor shall ensure that the finished structure, with all finishing and surfacings added, is correct to the dimensions given on the drawings. He shall maintain deviations of the steelwork from the specified levels and positions within the margins given in the NSSS.

Dimensional Accuracy (Line & level)

All erected steelwork shall be checked for line and level before being accepted. A report giving the as-surveyed steel positions shall be

supplied to the Engineer for acceptance.

S14	<u>General (Internal) steelwork</u> Steelwork to be blast cleaned to ISO Sa. 2½ after fabrication and receive minimum DFT of 125 microns of INTERGARD 251 EPOXY PRIMER. Final finish to be 50 microns of INTERTHANE 990 (different colours). All to BS5493 u.n.o. on drawings. Steelwork in cavities shall receive additional coat of INTERTUF 16 BITUMEN, instead of INTERTHANE 990 (All by Cromadex, Tel. 0161 848 7056) <u>Exposed (External) steelwork</u> Steelwork to be blast cleaned to ISO Sa. 2½ with G24 angular iron grit after fabrication, and galvanised in accordance with BS EN 1461 & BS EN 14713. Steel members with plate thickness less than 6mm to have 100 microns & steel members with plate thickness greater than 6mm to have 140 microns.	Steelwork Paint Protection (Heated Building, coastal environment)
S14.1	All paintwork to be in accordance with BS EN ISO 12944-5:1998. Dry film measurements to be in accordance with procedure 15.4.2 and the rate of sampling as given in note 12 of 15.4.3: BS3900: part C5: 1997, ISO 2808: 1997. A report by an independent testing house is to be provided to BS 3900 using method 10.	Paint Testing
S15	Where a requirement is stated for steelwork to have a specific fire resistance, this resistance shall be conferred by the application of drawings. The system to be adopted shall be proposed by the Contractor for the Engineer's approval, and shall meet the following requirements: - it shall be compatible with any underlying galvanised finish - the majority of the constituent coatings shall be applied in the fabrication shop - the coatings shall be resistant to rain, frost etc during the period from erection of the steelwork to completion of the building envelope - the coatings shall be resistant to the periodic impact of water from a high pressure hose - the top coat shall be available in the colours specified by the Architect	Fire Protection
S16	In cases where the Contractor seeks the Engineer's agreement to site welding, he shall submit for approval a procedure for the subsequent preparation and coating of the weld areas. Early degradation of coatings in the form of blistering, peeling, cracking or lack of adhesion must be made good to the satisfaction of the Engineer by cutting back to bare metal, fresh preparation, and re-application of the coatings. Mechanical damage to coatings shall be made good by local cutting back, re-preparation of the surface, and re-application of the full coating system so that it extends at least 50mm beyond the affected area all round.	Damaged Coatings

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Wherever bare metal is exposed by damage or subsequent corrective work, it must be thoroughly cleaned and primed within 2 hours.

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| S17 | Not less than seven working days before erection commences, the Contractor shall send the Engineer a method statement stating the procedures, equipment and safety measures he proposes to adopt. He shall not proceed until the Engineer has approved this statement. | Method
Statement |
| S18 | All steelwork that is to receive metal tray and concrete deck construction shall either have;

A) Untreated upper surfaces so that shear studs can be site welded to the steel
B) Have shear studs pre-welded before the application of galvanized or paint protection. | Composite
Construction |

TIMBER

(Clauses T1 to T14.7 inclusive)

T1	All timber used for structural work such as trusses, purlins, beams, joists, rafters etc. And other materials and workmanship shall comply with the requirements of BS 5268 "The structural Use of Timber" and this specification.	British Standards
T2	Trusses are to be designed and supplied by a specialist manufacturer. All 'loose' timber not supplied by the specialist truss manufacturer shall be of strength class C16 unless noted otherwise and the drawings and of the species/grade defined in BS 5268: Part 2: 2002. All graded Timber shall be graded at the cross sectional size at which it is to be used All timber shall be clear of all signs of rot, fungi and attack by wood – destroying insects	Strength Class
T3	All timber moisture contents to be in accordance with table 1, BS 5268: Part 2: 2002. At the time of erection, moisture content measurements shall be made of a sample of at least 5% of the timber using methods described in clause 7.2.2 BS 5268: Part 2: 2002, and documentation forwarded to Engineer prior to covering up the timber.	Moisture Contents
T4	The timber shall be seasoned so as to achieve the dimensions shown on the drawings. All materials for fixing such as metal straps, nails, bolts, timber connectors, screws etc. shall conform to the relevant British Standard specified in BS 5268.	Fixings
T5	All materials shall be protected from exposure to the weather and stored in such a manner that they are well protected from being subjected to wetting, damage, decay and insect attack.	Storage
T6	All timbers shall be treated with an approved wood preservative in accordance with BS 5268 Part 5. Timber for treatment shall be free from inner and outer bark, mud, sawdust, paint or varnish and shall be clear of all signs of rot, fungi and attack by wood-destroying insects. It shall be seasoned to an average moisture content not exceeding 18%. All cutting, planning, boring or other fabrications shall, where possible, be carried out on the timber prior to treatment. Timber shall be impregnated with the wood preservatives under pressure at a plant licensed by the preservative manufacturers. Impregnation shall be carried out in accordance with the preservative	Preservative treatment

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manufacturer's instructions, to their specific average net retention. Preserved timber shall, after impregnation, be open piled in such a way that full circulation of air takes place between all surfaces and be allowed to dry for not less than seven days, protection being provided from extremes of weather.

Preserved timber cut, notched, planed, bored or otherwise fabricated after treatment shall have an approved preservative in concentrated solution liberally applied to all newly exposed surfaces. Bored holes shall be plugged and be dry and clean and any efflorescence of surface salts removed by brushing or light shading before painting or varnishing.

A certificate shall be supplied by the treating firm for each batch of preserved timber to the effect that it has been impregnated in accordance with his specification and the recommendations of the preservative manufacturer, given the actual retention figures achieved.

T7	All workmanship shall be strictly in accordance with BS 5268.	Workmanship
	Facilities shall be made available to the engineer for the inspection of the works in progress on site or in any factory or workshop off site.	
T8	The contractor shall be responsible for making provision for stability during erection, any temporary works necessary.	Stability during erection
T9	The size, spacing, bearing, fixing, jointing etc. of each member shall be strictly in accordance with the drawings unless otherwise agreed with the engineer.	Size and Spacing
	For members subjected to bending, the larger of the cross sectional dimensions shall be the depth unless otherwise stated.	
T10	The contractor shall satisfy himself that the conditions necessary for the proper support and fixing of the floor or roof joists are attained before proceeding with the construction of the floor or roof.	
	Every member shall extend in one piece between its support of fixings without jointing, unless otherwise indicated on the drawings or agreed with the Engineer.	
	All members shall extend at least 75 mm beyond the nearest edge of supporting structure unless specifically detailed otherwise on the drawings.	
	All members shall be laid with the convex or crowning side of any camber upwards and the position of defects shall be such that they will not impair the strength or stiffness of the member.	

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Every plate shall, as far as possible, be in one piece between points of change of direction up to 6 metres in length. Joints between continuing lengths and at corners shall be halved if the plates are in one thickness, or sufficiently lapped if the plates are in two thicknesses. When they are to be laid over loadbearing walls of masonry or concrete, they shall be solidly bedded in cement mortar to the required level

T11	Where members are to be notched over supports, the depth of the notch shall be not more than two-fifths of the depth of the joist unless otherwise specified or detailed. The bearing surface of all notches shall be cut smooth and true in relation to the surface on which it bears.	Notches
T12	Holes or notches shall not be formed in structural members other than floor joists, ceiling joists or rafters without the approval of the Engineer. Where joists or rafters are to be cut the following rules shall be complied with:	Holes notches for services etc.
Holes:	- the diameter shall not exceed one-sixth of the member depth - they shall be made as close as possible to the mid depth of the member - no hole shall be cut within a distance of twice times the member depth from any adjacent hole, notch or face of supporting structure	
Notches:	- notches shall not be cut within the middle third of the span - the total depth to the notch shall not exceed one-sixth of the member depth - notches shall be U shaped and formed by parallel cuts to a previously drilled hole the diameter of which shall be equal to the width of notch required - no notch shall be cut within a distance of twice times the member depth from any adjacent notch, hole or face of supporting structure - no holes or notches larger or closer than specified above shall be cut without the consent of the Engineer.	
T13	All joints shall be constructed as specified or shall be designed and constructed so that they will transmit the loads and resist the stresses to which they shall be subjected. The execution of all jointing shall be to the satisfaction of the Engineer. Bearing surfaces shall be in good contact over the whole area of the joint before fastenings are applied. The details and number of nails, woodscrews, bolts, washers and other timber connectors shall be as specified on the drawings. No nails, screws or bolts shall be placed in any end split. If splitting is likely, holes for nails shall be pre-bored at diameters not exceeding 0.8 diameter of the nail. Clenched nails shall be bent at right angles to the grain. Lead holes shall be bored for all screws. Members to be connected with bolts shall be clamped and spiked together before drilling. A tolerance of 1.0 mm will be allowed in	

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positioning bolt holes. The bolt hole diameter shall not be more than 1.6 mm larger than the bolt diameter.

For shop drilling, each member may be drilled separately from setting out assemblies or drilling templates.

All nuts and bolt heads shall be provided with washers.

Nuts are to be brought up tight, but care shall be taken not to crush the timber under the washers. A minimum of one complete thread shall protrude from the nut.

Specified patent connectors shall be fixed to the timber in accordance with the requirements of BS 5268 and the manufacturer's instructions.

TRUSSED RAFTERS

T14.1	<u>Roof trusses:</u> the trusses are to be designed and manufactured by a specialist firm approved by the architect and engineer. Structural calculations in respect of the trusses are to be submitted to the authority for building regulations approval.	Design and Manufacture
T14.2	The design of the trussed rafters shall be in accordance with code of practice Bs 5268 part 3, 1985. Minimum width of timber forming the rafter and tie members shall be 44mm. unless noted otherwise on the drawings the design Loadings for the trussed rafters are as follows:	Design conditions
	I) Roofing dead load (excl. SW Trusses) 0.75 kn/m ² on plan*	
	ii) ceiling dead load 0.25 " "	
	iii) roof superimposed load 0.75 " "	
	iv) ceiling (roof space) superimposed load 0.25 kn/m ² on plan	
	v) wind loading - design wind speed 48.0 m/s	
	vi) Roof trusses must be capable of supporting snow load calculated in accordance with BS 6399 Part 3. Designers to note that this will create high imposed loads in valleys and at interconnecting roofs. (BS 6399 Part 3 contains some anomalies and its interpretation must be agreed with the Local Authority under Building Regulations).	

* Excluding self-weight of trussed rafter.

The truss supplier shall prepare all necessary calculations and detail drawings for the fabrication of trusses and the stability of the overall roof. Duplicate copies of all calculations and detail drawings shall be submitted to the Engineer for general approval before fabrication commences. The Engineer's approval shall not relieve the supplier of

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responsibility for any error subsequently discovered.

All temporary and permanent bracing, their fixings and any other work to be carried out by the Main Contractor as required by the design of the roof is to be clearly shown on the fabricator's drawings. All loose timbers are to be clearly marked and cross-referenced on the drawings.

Drawings are to be in sufficient detail for the Architect to co-ordinate his work with other functions associated with the roofs. Drawings shall be dimensioned

And shall show the size and location all members and connections.

Nails for fixing roof trusses shall be square twisted or ring shanked and shall be hot-dip galvanized cadmium plated or sherardised. Skew nailing is not permitted. Metal straps, hangers, anchors, truss clips/plates etc. Shall be galvanized to Class Z1 or Z2 of BS 2989.

T14.3	The contractor shall provide the following information in duplicate to enable the engineer to assess the contractor's compliance with the design and construction requirements: i) all calculations ii) all drawings iii) information on the type and source of materials being specified by the supplier iv) mechanical properties of all materials including test certificates, in sufficient detail to prove the supplier's design assumptions	Information Required by
T14.4	Handling of prefabricated trusses is to be in accordance with the recommendations of the international truss plate manufacturers' association's leaflets 1 - 4 inclusive. The contractor must ensure that when stacked on site the trusses are supported off the ground in a vertical position allowing air to flow freely around the timber. He must also ensure that they are protected from rain and continuous bright sunlight.	Handling and site storage
T14.5	The contractor must ensure that all of his units are located in the correct position and fixed in accordance with the supplier's requirements.	Monitoring Erection
T14.6	Members will be rejected by the engineer when having any of the following defects: A) timber not kite marked B) timber damaged or split C) members warped D) incorrect timber for the purpose E) connections fixed incorrectly or insufficiently F) gaps between ends of timber at joints G) any deficiency in materials and/or workmanship	Rejection

Rejected units shall be replaced by the Contractor at his own expense and any delay caused by the rejection shall not in any way relieve the Contractor from his responsibility with regard to supply within the

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period specified.

T14.7

All timber shall be treated with protim prevac 80 or other equal and approved preservative in accordance with the specialist's requirements. Any timber cut after treatment shall receive a liberal application of the preservative. The contractor shall ensure that the preservative used on timber specified to receive clear finish is compatible with the finish to be applied. Treated timber must be allowed to return to a moisture content of less than 25% before final fixing.

**Timber
treatment**