STRUCTURAL SPECIFICATION.

INDEX.

1. EXCAVATION AND HARDFILL.

1.1 GENERAL

Refer to the General and Special Conditions of Contract Clauses which shall apply to all work in this section of the Specification.

1.2 SCOPE

This section of the Specification includes:-

1. Excavation for foundations.
2. Excavation under ground slabs.
3. Backfill around foundations.

1.3 NATURE OF THE SITE

The Contractor shall visit the site to confirm details shown on the drawings. The site is generally level with a surface layer of hardfill, and is being used as a car park.
Beneath this level there are varying layers of silt and sand overlying gravel at various depths.
The foundation beams are to be poured in the silt layers.
The water table at the time of excavation was about 2.8 metres below ground level.

1.4 EXCAVATION FOR FOUNDATIONS

Excavation may be by bulk excavation over the building area or excavation for each footing. Batter or shore faces of excavation as necessary.
Allow for formwork for full depth of all footings.
Consolidate bases of all excavations to the Engineer's approval, using suitable mechanical equipment.

1.5 INSPECTION

No reinforcing or site concrete shall be placed in foundations until they have been inspected by the Engineer.
No backfilling shall be placed against reinforced concrete footings until they have been inspected by the Engineer.

1.6 DEPTH OF EXCAVATIONS

Any soft spots found in excavations shall be reported to the Engineer. Should it be found necessary to excavate toa greater depth than shown on the drawings, the Contractor shall be paid for such greater excavations at a rate approved by the Engineer in writing, before such additional work is carried out.

1.7 MAINTAIN EXCAVATIONS

Secure and maintain excavations free from slips, erosion, water and other fluids or fallen materials.
Provide and maintain all shoring, strutting, sheet piling, planking, pumps, and other materials or plant necessary for carrying out and maintaining excavations and remove them when no longer necessary.

1.8 BACKFILLING

Backfill around foundations and thoroughly consolidate. Remove all timber, rubbish and other loose material before backfilling. Backfill and consolidate in 300mm layers using suitable mechanical equipment to the Engineer's approval. Backfilling material shall be pitrun hardfill as described in 1.10 or where approved by the Engineer excavated material such as sand or gravel with limited clay content. Material approved for backfilling shall be carefully stockpiled and kept free from soil, clay, peat, or other unsuitable material. Material used from stockpiles shall not be excessively wet, but shall, if necessary, be allowed to dry out to the satisfaction of the Engineer before use.

1.9 SURPLUS MATERIAL

Remove from site and dispose of all surplus material from the excavations.
Take every precaution to minimise dust nuisance from stripping loading and transporting surplus material.

1.10 HARDFILL

Supply, lay and consolidate and hardfill layers beneath all floor slabs against ground.
Hardfill shall be wet graded sand and gravel river-run, free of stones larger than 65mm, blinded with sand ready to receive dampcourse.
The minimum consolidated depth of the hardfill shall be 200mm.
Consolidate hardfill thoroughly in 200mm layers with vibrating steel roller or similar approved.

1.11 CO-OPERATION

Co-operate with drainlayer and plumber who will be laying drains and pipes and wastes, and with concretor who will be laying site concrete and constructing all concrete work.

2. CONCRETE & REINFORCING STEELWORK.

2.1 GENERAL

Refer to the General and Special Conditions of Contract Clauses which shall apply to all work in this section of the Specification.

2.2 SCOPE

This section of the specification includes the supply, forming and casting of all cast-in-place, plain and reinforced concrete including all items necessary to complete the work indicated on the drawings and not specifically described elsewhere in this Specification.
This section of the Specification includes the supply, erection, reinforcing and casting of the components of the approved proprietary floor system specified in Clause 2.16 of this Specification.
This section of the Specification includes the erection of all precast concrete. The PRECAST CONCRETE section includes manufacture of precast concrete units as detailed and delivery to the site if necessary.

2.3 MATERIALS AND WORKMANSHIP

The Contractor shall comply with all requirements of NZS 3109:1980 except where specified otherwise herein or instructed otherwise by the Engineer. A copy of this standard shall be kept on the site and relevant parts read with the following clauses of the Specification.

2.4 CONCRETE

Site concrete and concrete required to make good excavations shall be 10 MPa at 28 days or better.
All other conrete shall be SPECIAL ro HIGH GRADE, from an approved ready-mix plant, and as defined in NZS 3109: Clause 6.2 and of the following strengths:-

Foundation beams and pads	20 MPa
Columns at Level 1	35 MPa
Columns at Level 2	30 MPa
Columns at Level 3	25 MPa
All other structural concrete including floors and walls	25 MPa

The maximum aggregate size shall be 19mm.

2.5 CONCRETE TESTS

The ready-mix supplier shall make control tests in accordance with NZS 3104, and shall pay the costs of such tests. Tests shall be made either at the ready-mix plant or at the site, except that if the Engineer specifically calls for tests at the site as a result of any dissatisfaction with the plant testing procedure, these shall be done by the ready-mix supplier.

2.6 REINFORCEMENT
All reinforcement shall comply with NZS 3402 (1973). Bars prefixed with a 'D' on the drawings shall be deformed Grade 275 steel.
Bars prefixed with a 'R' on the drawings shall be plain Grade 275 steel.
Bars prefixed with an 'H' on the drawings shall be deformed Grade 380 steel.
Mesh shall be hard drawn steel wire fabric to NZS 3422 (1972). All reinforcement and workmanship shall conform to the requirements of NZS 3109:1980.

2.7 FAIRFACE FINISHES
All concrete surfaces that will be visible in the finished job, or covered with paint, Enduit plaster, or tiles, shall be finished fairface.
All concrete required to have a fairface finish shall be cast to a high standard using accurately constructed form work and to a high standard of workmanship. In addition to surface tolerances specified below, the finished surface shall conform for blowholes with illustration 4 in the NZ Standard NZS 3114:1980 "Specification for Concrete Surface Finishes."
Refer to the Architect's drawings for the finish required on concrete surfaces.

2.8 SLAB FINISH
Except as specified below, all slabs have a steel trowelled finish. Screed off and lightly wood float. Finish slabs with approved power floating and compacting machines to leave a dense, level surface which does not vary more than 6mm from a 3 metre straight edge, and not more than ± 15mm from true level.

2.9 SITE CONCRETE
Form and cast 50mm site concrete beneath main foundations and elsewhere as necessary to provide a clean, dry working platform. Ensure ground surface is clean and dry and there is no evidence of soft spots.

2.10 FOUNDATIONS
Form and cast main foundation beams as detailed. It is envisaged that the beams will be cast in stages with construction joints.
Allow to scrabble or green cut the faces of these joints. The exact location and details of all construction joints are to be agreed with the Engineer before pouring concrete.

2.11 LIFT PIT
Form and cast lift pit walls and floor with sump as detailed. Build in PVC 140mm HYDROFOIL waterstop or similar to all construction joints in floor and walls. Waterproof the concrete with SIKA Plastocrete-N-Waterproofer or approved equivalent.

2.12 GROUND FLOOR SLAB

Form and cast ground floor slab on damp proof course on compacted hardfill. Cast in strips and sawcut into panels where agreed by the Engineer on site. The maximum spacing of sawcuts or construction joints shall not exceed 3.75 metres.

2.13 PROPPING OF PRECAST BEAMS

Precast beams shall be propped to support the dead weight of the beam until the floor concrete has reached 20 MPa.

2.14 CHASES, HOLES AND NIBS

Form all chases, holes, upstands and nibs as shown on the drawings or required by other trades. Chases and holes shall be accurately positioned and formed at the time of casting the concrete.
Set concrete shall not be hacked unless specific approval is obtained from the Engineer.

2.15 BUILDING IN

As the work proceeds, build in all necessary bolts and other fixings. The Concretor shall ascertain from all other sub-contractors all particulars relating to their work with regard to order of its execution and details of all such provisions of fixings sleeves, chases, holes, etc., and of all necessary items to be built into concrete and shall ensure that all such items are provided for and/or positioned.

No claim will be recognized or allowed for at extra cost of cutting away or drilling concrete work already executed in consequence or any neglect of the Contractor to ascertain these particulars and make the necessary provision beforehand.

2.16 FLOOR SLABS

Concrete floors have been detailed to use the 'DIMOND HI-BOND H.S.' composite steel/concrete floor system. This has a profiled metal deck of 54mm overall depth, made from G500 steel, 0.75mm thick.

The floor shall be handled, laid, and fixed in accordance with the manufacturer's written "laying instructions",
Provide temporary propping to floors as shown on the drawings, with an upward camber to the propping lines as detailed. Floors shall be constructed of a uniform thickness, so that slab surfaces as constructed shall follow the cambered profile of the floor decking.
Propping shall extend over at least three levels at all times, to distribute the weight of the floor being poured into three lower floors, and to support mobile scaffolds being used to erect precast floor beams.

3. PRECAST CONCRETE

3.1 GENERAL

Refer to the General and Special Conditions of Contract clauses which shall apply to all work in this section of the Specification.

3.2 SCOPE

This section of the specification includes the manufacture and supply on site of the following precast units:-

1. Precast beams
2. Precast wall panels

The work includes the fabrication and supply of all structural steel fittings to be built into the units as detailed on the drawings.

3.3 MATERIALS AND WORKMANSHIP

All formwork, concrete and concreting and finishing shall be in accordance with the relevant clauses of Concrete and Reinforcing Steelwork Specification except where noted otherwise in this section.

3.4 CONCRETE

All concrete shall be HIGH or SPECIAL GRADE complying with NZS 3109 Clause 6.2.Concrete for all precast work shall be 25 MPa at 28 days with 18mm maximum size aggregate.

3.5 TOLERANCES

All precast units shall be manufactured to the following tolerances unless stated otherwise on the drawings:

- Length	± 6 mm
- Cross Section	± 3 mm
- Squareness (of cross section and ends)	± 3 mm
- Twist (dimensions from plane containing the other three corners	± 3 mm
- Built in Items	± 5 mm

The above tolerances are given as a guide. Their application in any particular case shall be subject to interpretation by the Engineer.

3.6 FINISHES

All precast concrete exposed in the finished building shall be cast to a high standard using accurately constructed formwork and a high standard of workmanship. Precast items that do not meet the required standard to the satisfaction of the Engineer will be rejected. Formwork shall be such as to produce a high quality fair face finish on all exposed surfaces. Formwork shall be made from sheet steel or dressed plywood treated with a polyurethane finish to a high quality smooth surface, or similar.

In general finished surfaces shall be smooth and formed with moulds or by careful trowelling. Surfaces shall be free from honeycombing, grout loss, excessive air holes or other imperfections. Arrises shall be straight clean and sharp and free from spalling or damage.
All exposed surfaces shall have a similar appearance and standard of finish. Surfaces finished by trowelling shall be finished to the same standard and uniformly match surfaces against formwork.
Formwork shall be sealed at all corners, joins and inserts to prevent all grout loss.
All surfaces against which concrete is later to be cast shall be left roughened by brooming the poured face while the concrete is still plastic. Clean surfaces thoroughly from all laitance and loose concrete.

3.7 HANDLING

A high standard of finish is required and handling shall be such as to prevent any damage to units.
Approved lifting devices or hooks shall be provided in all precast units and these shall be made available to the Contractor for erection purposes and removed cleanly after use. Units shall be handled only by the hooks or devices provided. They shall be loaded and transported so that no forces are applied in excess of those occurring during normal lifting. Twisting forces shall not be permitted to occur. Units shall be strapped and secured to prevent movement or damage during transportation.

Details of lifting hooks and devices, and their positions, shall be submitted to the Engineer for approval before manufacture commences. Care shall be exercised at all times, that hooks or devices suffer no bending or other damage. Lifting hooks or devices set permanently in the units shall have a safety factor of at least 4 and for repetitive use shall have a safety factor of at least 6.

3.8 STACKING

Units shall be stacked on timber dunnage and suitable soft packing placed under the lifting points. Stacking shall at all times be such as to minimise the effects of creep and to avoid undue distortion of units.
Stacking of units shall be carried out on an area capable of withstanding the bearing pressures involved and in such a way that damage to units, lifting hooks, and to other embedded fixtures and to other units shall not occur.

3.9 MARKING

Mark all units with a mark number, orientation in finished job, and date of casting. The marking shall not be permitted to affect the fairface finish.

3.10 INSPECTION

The Engineer or his representative will inspect the precast units at all stages of manufacture to ensure conformity with this specification. Units which do not conform to the required tolerances, which shown grout leakage, which have been damaged, or which are otherwise defective shall be liable to rejection and may be used in the structure only at the Engineer's discretion.

No repair work shall be done without specific instruction from the Engineer.

3.11 BUILDING IN

Supply and fix all lifting bolts, cast in sockets, timber grounds and other fixings as shown on the drawings or as required for the proper erection of the units in the finished work.

3.12 PRECAST SHELL BEAMS

Form and cast the beams as detailed including all reinforcing starters, structural steel fixings, holes for services, rebates, etc, as detailed.
The beams have been detailed to minimise their weight and hence crane capacity. The surface of the beams inside the stirrups shall be roughened to ensure good bond to the infill concrete. Outside the stirrups the surface shall be straight and level to receive the proprietary floor system.

Sides and soffits shall be finished as clause 3.6 where exposed in the completed building, otherwise to a reasonable fairface finish.

4. STRUCURAL STEELWORK

4.1 GENERAL

Refer to the General and Special Conditions of Contract clauses which shall apply to all work in this section of the Specification.

4.2 SCOPE

This section of the specification includes the following:-

(a) Supply, fabrication and erection of the main roof steelwork, machine room beams and posts, stairs, and other miscellaneous items.

4.3 WORKMANSHIP AND MATERIALS

The Contractor shall abide by all relevant requirements of NZS 3404:1977 "Code for Design of Steel Structures", and to NZS 4701 "Metal Arc Welding of Steel Structures".

4.4. STEEL

Steel shall be mild steel of approved origin and conforming to BS 4360:1979. The Contractor shall ascertain, at the time of tendering, whether the steel sizes detailed on the drawings will be available to do the job. The Contractor shall supply with his tender, the source of supply, price list and substitute sizes for those detailed where shortage of supply is anticipated. Extra cost of substitute sizes required, but not notified at the time of tender, will be borne by the Contractor.
Butt welding of lengths will be permitted only with the approval of the Engineer.

4.5 CONNECTIONS

All connections shall be shown on the drawings. In general these are to be welded. Welding shall be done by qualified operators and strictly according to NZS 4701:1981. Preparations of any butt joints shall be discussed in advance. Welds exposed in the finished building and in particular butt welds of stock length shall be neatly finished.

4.6 WELDING INSPECTION

The Engineer shall be given reasonable notice when each section of the work is prepared and ready for welding, and shall be given every opportunity to arrange for inspection and to satisfy himself as to the competence of the operators and as to the quality of the work.
The Contractor shall supply all necessary facilities, ladders and light scaffolding necessary for adequate access, and he shall arrange his sequence of work to allow inspections and testing to be carried out.
Testing may include radiographic and ultrasonic testing.

4.7 WELDING DEFECTS

Welding defects disclosed by radiography or other investigation shall be assessed by the Engineer and if he so instructs to be cut out and remade. Joints cut out shall be examined and passed by the Engineer before rewelding. Welds will not be expected to attain an unreasonably high standard of perfection, but the weld metal, as deposited, shall be free from cracks, slag inclusion, gross porosity, cavities, and incomplete penetration. The weld metal shall be properly fused with the parent metal without serious undercutting or overlapping at the toes of the weld. The visible surfaces of all welds shall be clean, regular, and of consistently uniform colour.
When welding defects are disclosed, testing of further welds may be ordered at the Contrator's expense. If stiffeners or other concealing details have been added, these may be required to be removed to permit this additional testing.

4.8 SITE WELDING

Where site welding is required facilities shall be provided to obtain the same standard or workmanship here as in the shop. Welding in air shall be reduced to a minimum by assembly and erection procedure. All welding in the air shall be designed to avoid overhead welding. Parts to be welded shall be firmly held in jigs or clamps. Tacking bolts or cleats, other than those detailed, shall be provided as needed but only after discussion with the Engineer. If required, tacking cleats shall be removed after erection and bolt holes filled by welding.

4.9 BOLTS

Holes for bolts shall be drilled or punched and NOT gas cut. Bolts shall be of the correct length and with a flat or tapered washer under the nut.
Supply all bolts, nuts and washers for fixing steelwork and precast concrete including those to be built in by concrete subcontractors.

4.10 ERECTION

Erection procedure shall be agreed in advance with the Engineer. The Contractor shall provide temporary bracing as necessary to stabilise the structure until all permanent bracing and associated elements of the structural system such as purlins, are completed.
Every effort shall be made to keep steelwork true to dimension, plumb, and level. Final welding of erection connections shall be delayed until each section of the structure is proved true. Final welding up of all steelwork shall be completed before any further loads are added to the structure.
Packing under steel bases shall be steel.

4.11 STEELWORK FINISHES

All structural steel work exposed to the weather in the finished building shall be galvanised as specified in clause 4.12. All other steelwork shall be thoroughly cleaned by power wire brushing and hand scraping to remove all mill scale and rust in preparation for priming as in NZS 1900 Clause 9.4.69. Paint in all steelwork except weldplates and where built into concrete more than 5mm with two coats of primer in the shop, to a thickness of at least 0.1mm (4.0 thou). After erection all damaged areas shall be cleaned and painted with two coats of primer.

Primer shall be Dulux Red Zinc Chromate Primer applied in accordance with their recommendations. The first coat shall be applied in accordance with the makers' instructions and to the satisfaction of the Engineer. Avoid spills and runs. Where timber members are fixed during the erection of the steelwork the STRUCTURAL STEELWORKER shall ensure that any cleats of steelwork inaccessible after such fixing are clean and primed under the timber.

4.12 GALVANISING

Where indicated on the drawings, steelwork shall be hot dip galvanised. Clean by sand or grit blasting to Swedish Standard S.A.2½ and dip to leave a zinc coating of 600gm/m^2. Any galvanising subsequently damaged by welding or gas cutting shall be cleaned as above and primed with inorganic zinc silicate or similar.

4.13 MAIN ROOF FRAMING

Supply fabricate and erect the roof steelwork complete with all necessary cleats, holes and fixings as detailed on the drawings.

Allow to camber rafters as dimensioned. Ensure that the mortar packing has gained sufficient strength to fully tighten holding down nuts before any loads other than the purlins are applied.

4.14 PURLINS

Purlins are to be Fletcher GKN Brownbuilt members prepunched for bolt fixings and brace channels to standard details. All purlins shall be of 450 MPa galvanised steel.