Annex B

MAFF – UNDP REPAIR AND RECONSTRUCTION OF EXPORT BUILDING AND FUMIGATION FACILITY

SPECIFICATION

FOR TENDER

Contents

1 Nature and Extend of Contract

This Contract is a Lump Sum Contract. The Contract Sum shall include all applicable charges and be full compensation for the complete construction of all works under this Contract, including any items of work not specifically mentioned but necessary to complete the works of the Contract in accordance with the intention of the Drawings and Specifications. The Contract Sum shall be a fixed sum **not** subject to adjustment for Rise and Fall.

1.1 Scope of Work

The work to be performed under this Contract comprises the provision of all materials, plant and labour and the performance of all operations of whatever kind necessary for the complete and proper construction of the Works associated with the construction of the **MAFF EXPORT BUILDING AND FUMIGATION FACILITY** as specified herein and the drawings.

2 Preliminary and General

The Preliminary and General section is to be read in conjunction with all other sections of this specification and the Drawings.

2.1 Permit and Regulations

The contractor and all subcontractors shall comply with the By Laws and Regulations of the local Territorial Authority, the Regional Council, the Department of Labour, the Department of Health, Ministry of Transport, Railways Corporation, any other Statutory Authority, and the Construction Act.

The Contractor shall apply MOI and pay for the Permit accordingly. All other permits for the construction of the Contract Works shall be obtained and paid for by the Contractor before work commences.

Before any sub-contract is let, the name of the proposed sub-contractor shall be submitted to the Engineers for approval. Sub-contractors shall be bound by all clauses in the Conditions of Contract, and acceptance of previous work by other sub-contractors.

2.2 Setting Out

The Contractor shall be responsible for the setting out of the work from the dimensions and levels given on the drawings. Land and survey bench marks are to be used for origin of levels.

Where new work abuts existing work, the Contractor shall check and confirm all dimensions before commencing any section of the work - where there are any discrepancies these shall be referred to the Engineer for his direction.

2.3 Hours of Work

For the purpose of this contract, "Normal Working Hours" are defined as those between the hours of 7.30 a.m. to 5.00 p.m. Monday to Saturday. Some areas of work may be required to be carried out on Sundays. Any work outside Normal working hours shall be arranged with the Engineer and Owner.

Generally, work shall not be carried out during the hours of darkness unless special written permission is given by the Engineer, who may impose special conditions or where work has to be carried out in the interests of public safety.

2.4 Programme of Work

In addition to the programme of works submitted with the tender, the Contractor shall submit within seven days of acceptance of his tender a detailed written programme of work for approval by the Engineer. The contract shall be carried out in accordance with, and in the sequence of, the approved programme.

The Contractor shall update the programme when so directed by the Engineer.

2.5 Performance of Work

The work as a whole and its parts, shall be carried out in a manner approved by the Engineers. After its commencement, the work shall proceed continuously and with such despatch as the Engineers may consider necessary for its completion, in accordance with the provisions of the Contract.

2.6 Materials and Labour

The Contractor shall provide all materials, labour and plant of every description, except where otherwise specified, and other requisites whatsoever necessary for the proper and effectual carrying on, execution and completion of the whole works described in this specification. He shall finish the work to the true intent and meaning of the drawings and specification taken together, whether a portion of the same may or may not be particularly shown on the drawings or described in this specification, provided the same is to be reasonably inferred therefrom.

2.7 Plant and Organisation

The Contractor shall provide and maintain in good and reliable order and condition all plant and tools necessary for the successful completion of the contract within the contract period. Should the Engineer consider any plant placed on the works by the Contractor to be inadequate or inefficient, he may order its removal and its replacement by more suitable plant.

Vehicles and mobile plant used by the Contractor for the works shall not exceed any restriction as to weight, size or other matter imposed by the Ministry of Transport and the local authorities and the Contractor shall indemnify the Principal against any liability that may devolve upon the Principal through failure by the Contractor to observe any such restriction, and any monies paid by the Principal to meet such liability may be deducted from monies due under the Contract.

All work shall be adequately supervised by a competent foreman who shall be stationed full time on the site while construction is in progress.

All workmen employed on the works shall have sufficient skill and experience, to the satisfaction of the Engineers, to properly perform the work assigned to them.

2.8 Protection of Work

The Contractor shall take all necessary action to protect all new work during its construction and until each particular section is handed over to the Principal as complete. Each Sub-contractor shall take all the necessary actions to prevent damage to the finished work of other Sub-Contractors and shall be responsible for the cost of restoring any work damaged.

2.9 Protection of Excavations

The Contractor shall, at his own expense, supply and install all sheet piling, shoring, strutting or any other means required or necessary for the adequate and safe support of the sides of all excavations.

Such supports shall be maintained until they are no longer required.

2.10 Existing Buildings and Plant

The Contractor shall take all reasonable care and precautions when working on or about the existing buildings or property. Any damage caused by the Contractor to the buildings or property shall be reinstated at his cost to the original condition and as approved by the Engineer. Such reinstatement shall be carried out by the Contractor within a period acceptable to the Principal.

During the progress of the works, the Contractor shall keep all roads affected by the Contract accessible and clean and as clear from obstruction as possible.

2.11 Existing Services

The Contractor shall be wholly responsible for determining the location of all public and private services which are in the vicinity of, or may be affected by, his works and shall take all necessary precautions to avoid damage to these services. He shall arrange and keep on site his own up-to-date copies of services plans from the various controlling Service Authorities and if necessary, consult with them on site to determine exact locations and any restrictions imposed by them.

Should any damage be done to any underground or overhead services, the Contractor shall, without delay, arrange with the appropriate Authority to make good and repair the same, and the cost of such repairs shall be borne by the Contractor. Where information concerning any of these services is given on the drawings, it is given in good faith, but only for the information of the Contractor, and no guarantee is given or implied as to its accuracy and no extra payment will be made should it prove to be incorrect.

The cost of any work required for the temporary support, diversion and maintenance of pipes, wires, cables, etc., whether shown on the drawings or not, shall be borne by the Contractor as part of this Contract. In particular, the water and power supply to all properties shall be maintained. Any permanent diversion, support or alteration to pipes, wires, cables other than those specified, which may be ordered in writing by the Engineer to be carried out by the Contractor.

2.12 Noise

Noise shall be kept to a minimum and works shall be carried out within the requirements of NZS 6803:1999. “Acoustics – Construction Noise”.

2.13 Dust

The contractor shall take all necessary actions to prevent dust/grit/sand entering any premises. The contractor should allow for watering all the access roads he uses to prevent dust.

2.14 Access

Access for the plant shall be considered at all times. Unless otherwise authorised, traffic shall be permitted to pass through the work, unless a detour is possible. The contractor shall notify the principal of his intention to interrupt vehicular access to parts of the site before such access is curtailed.

The Contractor shall, at all times, co-operate with the principal to minimise the inconvenience caused by any obstruction of vehicular access during the execution of the works.

Should the subgrade of a road be deleteriously affected by the passage of traffic during construction the Contractor shall, at his own expense, undertake such remedial measures as directed by the Engineer.

2.15 Co-operate with Client

The Owner will be operating the plant throughout the period of the contract and requires access to the various items of plant and buildings during working hours.

The contractor shall obtain approval for a specified period of time before closing off any access-way or entranceway to plant or buildings. The contractor shall give at least one-week written notice of his requirement to have any area cleared for access.

The Contractor shall make provision for continual access through those areas.

2.16 Site Security

The Contractor shall provide temporary fencing and access gates where existing security fences are removed so as to ensure continuing security to the remainder of the site to an equivalent standard and/or to the satisfaction of the Principal.

2.17 Traffic and Public Safety

During the progress of works the Contractor shall keep all roads and footpaths affected by the contract clean and as clear from obstruction as possible, and shall at all times keep all fire hydrants, service boxes and valves in an accessible and immediately operable condition and keep indicators clearly visible in correct positions.

The Contractor shall ensure that pedestrians have safe and convenient access-ways and that they are protected from the works and working construction plant.

Temporary roadways if required shall be adequately signposted so as to be obvious to other traffic. All traffic ways shall be well maintained and readily negotiable to other traffic under all weather conditions. Where the nature of the Contractor's operations necessitates one-way road over the whole or any part of the traffic way, the Contractor shall provide a flagman to ensure proper and safe traffic control. The flag man shall be distinctively clothed.

Adequate warning signs and barricades shall be maintained to warn and protect pedestrians and traffic. Temporary speed restriction signs in accordance with current traffic regulations shall be erected. During darkness all warning signs and all barricades, plant or other obstructions on the roadway and footpaths shall be rendered visible by warning lights. As soon as the need for signs, barricades or similar devices ceases, they shall be removed forthwith.

2.18 Storage of Equipment and Materials

Construction equipment shall not be stored at the work site before its actual use on the work or for more than 5 days after it is no longer needed on the work unless approved by the Principal. Time necessary for repair or assembly of equipment maybe authorized by the Engineer. Construction materials may be stored in areas designated by the Principal.

No material or equipment shall be stored where it will interfere with the free and safe passage of traffic including pedestrians, and at the end of each day's work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the access-way open for use by the Principal's traffic.

Excavation material, except that which is to be used as backfill in the adjacent trench, may not be stored in roadways, unless otherwise permitted. After placing backfill, all excess material shall be removed immediately off site.

2.19 Co-operate with Others

Allow to co-operate in all respects with the Principal, property owners and other contractors working in the area with regard to access, use of roads and to ensure the smooth uninterrupted progress of this and any other concurrent contracts.

2.20 Temporary Services and Facilities

The Contractor shall liaise with the Principal for any temporary service such as power and water which he may require.

The Contractor shall provide for his own and his sub-contractors use all lunchrooms, toilets and wash-rooms as required by the Construction Regulations, the Health Department and the Local Authority By-Laws or any other relevant regulations.

Areas available adjacent to the site for offices and temporary buildings will be indicated by the Principal. All temporary buildings shall be removed on completion of the contract.

2.21 Health and Safety (For Reference Only)

The Contractor shall comply with all relevant legislation including the Health and Safety in Employment Act 1992 and regulations (For Reference Only), Guidelines and Approved Code of Practices for Safety published by Department of Labour's OSH Service and the like thereunder, and all prior relevant regulations where these have not yet been replaced, including the Construction Regulations. *The Contractor shall comply with the appropriate Tonga Health and Safety Regulations.*

The Contractor and his Sub-Contractors shall take all practicable steps to ensure the safety of employees while at work and have a suitable health and safety programme for this site and shall monitor this programme throughout the Contract period.

The system required under the Health and Safety in Employment Ace shall include, but not be limited to, the following:

company safety policy

system(s) for identifying, managing and monitoring hazards

system(s) for recording investigating and reporting accidents

system(s) for informing, training and supervising their employees regarding hazards

system(s) for managing the safety of any other Contractors, subcontractors and visitors to the site

system(s) for dealing with emergencies.

The Contractor shall co-ordinate with and comply with any safety and health programmes of the Principal and the Owner existing on site.

The Contractor shall nominate a person who shall be responsible for occupational health and safety and for compliance with the provisions of the Health and Safety Act 1992.

The Contractor shall supply the following into his tender:

a) confirmation that he will be implementing a health and safety system

b) a record to date in respect of the health and safety requirements and any accidents (including near misses) which have occurred on sites.

c) hazards they may create on site and how they will be managed

The contractor shall supply the following information within 1 week of granting of the contract:

a health and safety plan for the site

confirmation that he has reviewed the Principals and the Owners health and safety plan (if applicable) and will comply with it.

name the person nominated to be the Safety Officer on the site and his/her previous relevant experience.

During the contract the contractor shall regularly supply the following:

a) updates on review of hazards on the site and accident management systems

b) record of any accidents (including near misses)

c) report any accidents (including near misses) to OSH.

The Engineer, Principal and the Owner shall have the right to inspect the Contractor's provisions for occupational health and safety.

The Contractor and his Sub-Contractors shall provide first aid facilities, and appropriate safety equipment.

The Contractor shall, in addition to other reporting procedures, report all accidents and near misses that occur in relation to any works being carried out under this contract to OSH and the Engineer in writing within 24 hours of the accident.

The Contractor shall provide appropriate safety equipment that complies with approved New Zealand standards to his employees and shall ensure that those employees are adequately trained in the use of all such equipment and that they wear that safety equipment at all appropriate times.

The Contractor shall ensure that any Sub-contractor provides appropriate safety equipment that complies with approved New Zealand standards to any employees of that Sub-contractor and that the Sub-contractor ensures that those employees are adequately trained in the use of all such equipment and that they wear that safety equipment at all appropriate times.

Where specialist equipment (eg breathing apparatus) has to be used, the Contractor shall provide proof that appropriate training has been given to employees in the correct use of the equipment.

The Contractor shall, at all times, be under a duty to protect the public from harm.

The Contractor's emergencies plans shall be to the required standards, and shall be relevant to the Principal's and the Owner’s plans for the site.

The Principal and the Owner retain the right to have any person breaching these safety rules removed from site by the Contractor.

Failure to comply with any of the occupational safety and health provisions of the contract or to comply with any request in relation to this clause in writing to work site,

may require work to stop until such report/assurances are received in writing by the Engineer.

All contractor staff working on site must go to all Training Sessions and Induction Courses as required and provided by the owner of the site.

2.22 Producer Statements

The Contractor shall, if requested, supply for any part of, or the work as a whole, a "Producer Statement" which states that the work has been carried out in accordance with this specification, and if not carried out in accordance, where the work has varied from this specification and drawings.

2.23 Cleaning Up

The Contractor shall at frequent intervals clean up the site and remove all clay or loose material on the roads. On completion of the contract the Contractor shall leave the site clean and tidy and all loose metal to be sweep up and to the satisfaction of the Engineer.

2.24 'As-Built' Plans

Two additional copies of the plans will be supplied to the Contractor for use 'as-built' plans. The Contractor shall mark up one copy with information and dimensions to show the 'as-built' positions of all below ground services and the positions and levels of all other services crossed including notation of the type of service.

Measurements shall be taken from permanent features such as buildings and manholes. Connections and services shall be recorded as a distance from the downstream manhole to the principal line.

This marked up copy of the plans shall be forwarded to the Engineer within fourteen days of substantial completion.

3. Structural Timberwork

Note: Refer to Preliminary and General section of this specification which applies to all work and be read in conjunction with all other sections.

3.1 Scope

This section comprises the manufacture, supply and erection of structural timberwork, including glue-laminated components, structural plywood and roundwood.

3.2 Statutory Obligations

Comply with statutory obligations, Tonga National Building Code and the regulations to any Local Authority or other Statutory Body having jurisdiction over the area in which the works are situated.

On completion of the work covered by this section of the specification, the Contractor shall, if requested, supply a "Producer Statement" which states that the work has been carried out in accordance with this specification, and if not carried out in accordance, where the work has varied from this specification.

3.3 Materials And Specification

The various materials considered in this section shall comply with the following specifications and codes of practice as applicable.

NZS 3602: - Timber and Wood-Based Products for Use in Building.
NZS 3631: - New Zealand Timber Grading Rules.
NZS 3601: - Metric Dimensions for Timber.
NZS 3603: - Timber Structures Standard
NZS 3605: - Timber Piles and Poles for use in Building
NZS 3606: - The Manufacture of glue laminated timber.
NZS 3640: - Chemical Preservation of Round and Sawn Timber
AS/NZS 1604 - Specification for Preservative Treatment
AS/NZS 1859 - Reconstituted Wood-based Panels - Specifications
AS/NZS 2269: - Plywood – Structural
AS/NZS 4364: - Adhesives, phenolic and iminoplastic for load-bearing timber structures: Classification and performance requirements.

3.4 Specific Materials

Specific materials are to be used in this contract shall comply with the descriptions in the following schedules.

Item	Species	Grade	Preservative treatment	Finish
Internal wall framing	Rad. pine	MSG 8	H3	G4S
Glulam Rafters	Rad. pine or NZ Douglas fir	MSG 10	H3	D4S
External framing	Rad. pine	MSG 8	H5 as specified	G4S

3.5 Plywood

Structural plywood to be used for roof bracing diaphragms, sarking, flooring, and miscellaneous gussets and stiffeners shall be Radiata Pine Construction plywood manufactured by a NZS licensed manufacturer.

Thickness of plywood shall be as shown on the drawings.

Plywood for bracing diaphragm shall be to surface grade D-D, while plywood for gussets and stiffeners shall be to surface grade B-B.

Each sheet shall be clearly marked with the appropriate Standard Certification mark in accordance with the appropriate Standard.

3.6 Poles

Poles for retaining walls, building piles or other structural members shall be Radiata Pine poles treated to H5 classification and H6 classification where inbedded into ground.

All poles and piles shall be branded to show compliance.

The preparation seasoning and preservation treatment for the piles shall be as set down above. Where the contractor wishes to supply poles differing from that specification he must apply in writing to the Engineer with full details of the proposed alternative including species, age, preparation, seasoning and preservative treatment. The Engineers approval in writing must be gained before making the substitution.

Care shall be taken at all times when handling saturated piles fresh from preservation treatment to prevent structural or mechanical damage.

3.7 Mechanical Fasteners

Mechanical fasteners used in construction shall be as specified or indicated on the drawings and shall be appropriate to the situation in which they are used.

Such fasteners shall include nails (smooth shanked or improved), screws, bolts, coach-screws, split ring, shear plate, round and square toothed-plate connectors framing anchors and punched light metal plate connectors.

All fasteners shall be hot dip galvanizing or an approved protective system. Light metal plate connectors in such situation should be made from a suitable grade of stainless steel.

It should be noted that there is a corrosion hazard when metal connectors are used with multi-salt treated timber in exposed exterior situations in areas of high humidity.

3.8 Preservative Treatment

All timber shall be preservative treated to NZS 3640.

All treated timber or plywood shall be branded in accordance with the requirements of the New Zealand Timber Preservation Council (N.Z.T.P.C).

Exposed ends and faces of timber members or plywood sheets cut, trimmed or drilled after treatment shall be protected by a liberal brush application of a suitable approved preservative e.g. “Ensele”.

3.9 East 221 Structural Epoxy for Glulam Upgrades (UR)

East 221 Resin with Endurabond.

All Glulam Upgrades (RU) shall use the East 221 Resin with Endurabond 2489 Hardner - A Structural Epoxy Bolt Grouting System.

PROCESSING AND PROPERTIES DATA

PROCESSING Mix Ratio	**Parts by Weight**

East 221 Resin		2.1
Endurabond 2489 Hardener		1.0
Working time (150 grams)	10°C	70-80 minutes
25°C		20-30 minutes

Note: Large volumes will have correspondingly shorter useable life.

TYPICAL CURED PROPERTIES	
Maximum operating temperature °C	60-65
Tensile strength MPa	65-70
Compressive strength MPa	70-75
Flexural strength MPa	100-120
Water Absorbtion wt%	0.4-0.5

3.10 Workmanship

Work generally shall be in accordance with the best trade practice, and this shall be deemed to include those methods, practices and processes contained in current syllabuses for the NZ Trade Certificates in carpentry, joinery and timber machinery.

3.11 Erection and Handling

Care shall be taken during handling and erection of glulam and other fabricated members to avoid damage to the member surface. Belt slings shall be used during loading, unloading, and erection with padding or blocking between sling and member. Particular care shall be taken to avoid damage to glued cleats.

In the event that members are damaged or broken during handling or member surfaces are significantly damaged, the damaged member shall be returned to the manufacturer for repair or replacement as directed by the Engineer. Such repair or replacement will be at the Contractor's expense.

Lifting and assembly of glulam members and frames shall be carried out in such a way that members are not over stressed during these operations.

Members stored on site shall be placed on solid bearers clear of ground and vegetation, with wrappings left intact.

3.12 Purlin Fixings

Purlin fixings to be 2No x CPC 40 per connection, refer Lumberlok datasheet in Annex A for details.

3.13 Connections

Make end connections to timberwork as detailed on the drawings on site. All nails, bolts, timber connectors, and fabricated steel fittings shall be hot-dipped galvanised to provide a zinc coating of 600 gm/m² and painted as specified below.

Nail holes may be pre-drilled up to 80% of the nail diameter but nail spacings given on the drawings should not be decreased. Approval by the Engineer shall be obtained before using power driving in any location. Power driving will not be permitted for nail and glued joints.

Bolt holes shall be drilled not less than the bolt shank diameter, nor more than 1.5 mm larger than the bolt diameter, unless shown otherwise on the drawings. Bolts shall be fitted with galvanised washers at each end of the following minimum sizes.

M12 bolts - 50 x 50 x 3 mm

M16 and M20 bolts- 65 x 65 x 5 mm

M24 bolts - 75 x 75 x 8 mm

Where bolt heads are shown recessed a standard round washer shall be used under the recessed head.

Split ring and shear plate connectors shall be accurately installed using approved grooving tools.

Locknuts shall be provided where required on the drawings. Fabrication and protection of all steel fittings for timber connections shall conform in all respects with the Metalwork section of this specification.

3.14 Painting of Metalwork

The surfaces of galvanised metalwork which remain permanently exposed to the atmosphere after fabrication shall be given the following paint treatment.

Unless specified otherwise, all metalwork items shall be hot dip galvanised with a minimum coating of 600 gm/m^2.

Where the installation of metalwork items requires site-welding the metal surface in the area of the welding shall be masked to prevent galvanising.

These areas shall instead be painted with one coat of ‘Carbonzinc 11’, inorganic zinc priming paint to achieve a dry film thickness of 75 microns.

All metalwork items shall, after galvanising, have the specified surface preparation and painting system complying with AS/NZS 2312:2002 for the respective classification of environment and durability of 25 years minimum to first major maintenance. For hidden metalwork, metalwork embedded in concrete foundations or within 600mm of the ground, a durability of 50 years is required.

4. Concrete

4.1 Scope

This section of work includes the completion of all concrete work as shown on the drawings and described in these specifications.

4.2 Statutory Obligations

Comply with statutory obligations, New Zealand Building Code and the regulations to any Local Authority or other Statutory Body having jurisdiction over the area in which the works are situated.

On completion of the work covered by this section of the specification, the Contractor shall, if requested, supply a "Producer Statement" which states that the work has been carried out in accordance with this specification, and if not carried out in accordance, where the work has varied from this specification.

The Contractor shall adhere to all requirements of the following standards except where specified herein or as instructed by the Engineer.

NZS 3101:	-	Concrete Structures Standards
Part 1:	-	The design of concrete structures
NZS 3104:	-	Specification for concrete production
NZS 3109:	-	Concrete Construction
NZS 3112:	-	Methods of test for concrete
Part 1:	-	Tests relating to fresh concrete
Part 2:	-	Tests relating to determination of strength of concrete
NZS 3114:	-	Specification for concrete surfaces finishes
NZS 4210:	-	Masonry Construction: materials and workmanship
AS/NZS 4671:	-	Steel reinforcing materials

4.3 Materials and Workmanship

The Contractor shall adhere to all the requirements of NZS 3109 except where specified otherwise herein or instructed otherwise by the Engineer.

A copy of NZS 3109 "Concrete Construction" shall be available for the site at all times.

4.4 Supervision and Inspection

The Contractor shall ensure that all reinforced concrete work is adequately supervised by a competent foreman and to the satisfaction of the Engineer.

The contractor shall arrange for the Engineer or his representative to inspect and approve all reinforcement prior to the placing of concrete for any portion of the work. The Engineer is to be given at least 24 hours notice of any such inspection.

4.5 Concrete Grade

Ordinary Grade concrete, having a minimum compressive strength of 10 MPa, may be used for 'site concrete' and 'mass concrete' only.

All structural concrete shall be Special Grade and shall have a minimum compressive strength at 28 days and maximum slump at time of despatch as follows unless shown or specified otherwise.

Foundations and columns	30 MPa	100 mm slump
Piles	30 MPa	120 mm slump

Concrete for blockwork filling shall have a minimum compressive strength of 17.5 MPa at 28 days and a maximum aggregate size of 10mm.

All concrete shall be ready mixed and supplied by a member of the N.Z Ready Mixed Concrete Association.

The concrete supplier shall furnish duplicate delivery dockets with each load of concrete delivered. These dockets shall indicate the delivery date, time of despatch, name of project, truck number, type and name of cement, admixtures used if any, ordered concrete strength and slump.

4.6 Concrete Tests

Tests shall be carried out by the concrete supplier to determine the strength on the concrete supplied to the Contract, and certified records of the results obtained shall be forwarded to the Engineer at not more than fortnightly intervals. The Contractor shall at all times keep a slump cone on site for the checking of concrete when requested by the Engineer.

Additional to the above requirements, the Contractor shall take test cylinders on site when directed by the Engineer and have these cylinders tested.

The cost of testing shall be borne by the Contractor. Additional core samples necessitated through failure of original tests to meet the specification shall also be at the contractor's expense.

4.7 Formwork

Formwork shall be constructed in accordance with relevant standards and to give the finishes specified or shown on the drawing.

Ties and spreaders shall be of an approved with drawable type so as to leave a regular pattern on the surface when withdrawn and filled. Wire ties shall not be used.

Stripping times shall be 24 hours for keyed construction joints in the floor and 48 hours for all other vertical formed surfaces. For beams, columns, walls and suspended slabs, formwork and prop removal times shall comply with the relevant standard. Any request for a decrease in stripping times will have to be substantiated by on-site tests showing the following strengths have been achieved.

Columns	5 MPa below specified 28 day strength

Should the contractor wish to strip at the strength given above rather than the time he shall arrange for test cylinders to be crushed at his own expense and the results forwarded to the Engineer.

The contractor is to note that the above times relate to individual members and their ability to support their own weight only. After stripping tie rod holes shall be filled by ramming in a stiff mortar grout comprising 1 part cement and 1.5 to 2 parts sand by

volume, blended to match the colour of the surrounding concrete. Rub down on completion to remove fins and rough edges.

Unless instructed otherwise provide a nominal 20 mm x 20 mm chamfer or fillet at the intersection of all faces of any exposed concrete surfaces.

Pouring shall be continuous between properly positioned stops of the type specified or shown on the drawing.

Formwork to permanently visible surfaces shall provide a fair faced finish, forms shall be of dressed timber thoroughly oiled with an approved form oil. Ties and spreaders shall be of an approved withdrawable type so as to leave a regular pattern on the surface when withdrawn and filled. Wire ties shall not be used.

The maximum deviation of the surface of fair faced concrete measured from a 2m straight edge shall be 6 mm gradual deviation and 2 mm abrupt deviation.

4.8 Reinforcement

All reinforcement used shall comply with the standard appropriate to the type of reinforcement specified on the drawings.

All reinforcement shall be manufactured from post consumer recycled steel.

QT reinforcement shall not be used.

Reinforcement shall be bent and placed in accordance with NZS 3109. All bar laps shall be a minimum of 40 diameters for plain mild steel, 32 diameters for deformed mild steel, and 200mm for mesh, (1 square plus 50mm), unless shown or stated otherwise.

No reinforcement shall be re-bent or have previous bends straightened. No bends shall be permitted in the vicinity of welds.

All high tensile steel shall be Grade 500E steel with special markings to ensure easy identification in place on site. Bar laps shall be increased by 65% for Grade 500E reinforcement.

All mesh shall be Grade 500E, or approved equivalent.

The following notations define the reinforcing type:

- R = round mild steel bars
- D = deformed mild steel bars, Grade 300E
- H = deformed high tensile steel bars, Grade 500E

Proprietary reinforcing bar splicing systems may be used, but only with the Engineers' prior approval.

4.9 Concrete Cover to Reinforcement

The minimum concrete cover to all reinforcement shall be the greater of that as specified in NZS 3101 or as follows:

- 75 mm where concrete is cast against ground, or
- 50mm where concrete is cast against ground on a dpm, or

EXPOSURE	CONCRETE STRENGTH, MPa			
	20	25	30	40
For exterior surfaces (B1)	50	40	35	30
For exterior surfaces in coastal areas (B2)	-	50	45	40
For interior surfaces (A1)	25	25	20	20
For formed surfaces below ground protected with dpm (A1)	40	35	30	25

The Contractor shall request the Engineer to confirm the exposure classification and required covers prior to bending or placing the reinforcing.

The correct cover shall be maintained by using approved stools or wired-on specially cast concrete blocks of the same strength as the final surrounding concrete. Beam and slab reinforcement shall be supported by not less than two blocks or stools per square metre. Wall and column reinforcement shall be supported by not less than one block per two square metres. For deep raft foundations provide suitable chairs made up from r.m.s rod to correctly space apart the top and bottom layers of reinforcement. Provide at least two chairs per square metre of raft surface.

4.10 Concreting

All concrete shall be transported, handled and placed free from segregation. No concrete which has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used.

Pouring of each section of work shall be made in one continuous operation. Approved high frequency immersion type vibrators shall be used to compact the freshly placed concrete. For pours in excess of four cubic metres one vibrator shall be kept in reserve as an emergency item.

4.11 Finishes

Concrete finishes shall comply with NZS 3114.

The following classes of surface finish taken from Table 1 and 2 of NZS 3114 shall be employed on this Contract:

Surfaces which are to be concealed in foundations below finished ground level shall have an F1 finish or as appropriate to table 1.

Surfaces above finished ground level that are concealed shall have an F3 finish

Surfaces which are permanently visible shall have an F5 finish, unless noted otherwise.

Honeycombing and other defects revealed in any concrete surface shall be referred to the Engineer for direction as to repair. Serious honeycombing and the like shall be repaired by cutting out the affected area and making good with Expandite "Expocrete" epoxy mortar or similar material, to match adjacent areas. Such repair work is to be at the Contractor's expense.

Isolated pin hole air voids of 5mm max, surface dimension and 3mm max, depth may be accepted but in any case shall be referred to the Engineers before any work is commended.

4.12 Curing

Immediately following the completion of concreting all exposed surfaces shall be moist cured for not less than seven days.

Curing compounds shall NOT be used on areas where further concrete is to be placed or where adhesion of applied finishes may be jeopardised.

Unless otherwise approved, curing of the machine bases and columns shall be achieved by wrapping and sealing with polythene.

Special care must be taken to ensure that the concrete is correctly cured so that shrinkage cracking is eliminated. Plastic cracking of the surface before finishing is completed shall be avoided by concreting in suitable weather and by shading the work or providing a fog spray if this is considered necessary.

4.13 Repair of Imperfections

The contractor shall immediately inform the Engineer of any defective or honeycombed areas, projecting fins, bulges or other blemishes and shall under no circumstances undertake any remedial measures without the prior instruction of the Engineer. All defective areas shall be explored and repaired as directed by the Engineer. Any defective areas rejected by the Engineer shall be demolished and replaced and all repair work shall conform with this specification.

All repairs shall be made to match adjacent work. Sample panels of the proposed mix to be used on fairfaced concrete work may be required by the Engineer.

All repairs and replacements shall be executed by the contractor at his own expense, and as and when directed by the Engineer.

4.14 Joints

General

Joints shall be either

Expansion / movement joints or sawcut joints constructed to the details and in the locations shown on the drawings, or

Construction joints to accommodate concrete pour breaks, to be at locations chosen by the Contractor and agreed with the Engineer and to the details shown or alternatively agreed details, and to take into account maximum pour dimensions if specified or shown on the drawings.

Columns and walls should generally be poured full height between floor levels.

A joint shall be prepared by removing all laitance from the surface against which new concrete is to be poured so that clean metal is exposed. Immediately before new concrete is poured the existing concrete surface shall be thoroughly wetted

and all excess water removed. Vertical joints shall be formed with approved bulkheads and shear keys where required.

Reinforcement shall run continuously through joints unless detailed otherwise. Concrete shall be placed in one continuous pour between property constructed construction joints and 'tailing out' is forbidden. Concrete shall not be allowed to free fall more than 2m amongst connected reinforcement, or 3m overall, to avoid segregation.

iii) Joints in Foundations and Bases

All construction joints in the foundations or bases shall be at locations agreed with the Engineer. Where joints are formed they shall be finished as for beams below. Concrete shall be cast in one pour between construction joints.

iv) New to Existing

In all areas where new concrete is to be poured against existing concrete the existing concrete shall be cleaned of all dirt, grease, laitence etc and mechanically scabbled to give a rough bonding surface.

v) Back-up Material

A suitable back-up material e.g. polythene tube or polythene rigid foam shall be placed in the sawcuts or joint prior to filling.

vi) Joint Filling

Near completion of the job thoroughly clean out all dirt and debris where specified in sawcuts by blowing with compressed air and brushing or grit blasting. Prime and clean, dry joint with a system primer and allow to dry. Apply an approved sealant with an appropriate hand gun or air gun. The sealant is to be mixed and applied strictly in accordance with the manufacturer's printed instructions.

Only sawcuts exposed on completion shall be joint filled.

4.15 New Hold Down Bolts and Starter Bars in Existing Concrete

Holes shall be drilled with a suitable drill such as a sharp diamond or tungsten carbide tip to provide a clean hole free from loose or fractured material on the surface. All dust and dross should be removed from the holes. All free water shall be removed from the hole and surface water allowed to dry.

Steel surfaces must be free of grease and rust. A wire brush may be used if necessary to remove corrosion then wipe dry with a clean cloth.

The portion of the bolt or bar to be grouted should be thoroughly degreased with lint free cloth saturated with EPIGLASS cleaning fluid/epoxy thinners. Once prepared, the bolt shanks should not be handled again, prior to installation.

Mixing and placing of the grout, and subsequent locating of bolts or bars shall be strictly according to manufacturer’s instructions. Grout shall be as shown on the drawings or of a two-pot epoxy system and shall be approved by the Engineer.

Bolts or bars shall not be disturbed for 36-48 hours or longer time as may be specified by the manufacturer, at which time baseplates may be carefully slotted over bolts.

Fixings may be tightened after 7 days curing or longer time as may be specified by the manufacturer.

4.16 Casting in Fittings

The Contractor shall allow for casting in or forming for all fittings, fixtures, bolts, sockets, ground sleeve pockets etc. as required by himself or other trades and subcontractors. Maintain all cast-in items securely in position during placement of concrete.

Great care shall be exercised in the placing of bolts or bars and other fixings and the Contractor shall allow for supplying all necessary templates and temporary supports for their accurate positioning and verticality. The centre lines of any bolt or bars shall not be more than 3mm out of position in any direction. Bolts must be vertical.

Any bolts not complying with these requirements shall be either: (a) cut out and replaced at the Contractor's expense, or (b) all costs involved in modifying plant or equipment to suit the out of position bolts, together with the cost of making templates, will be a charge against the Contractor.

The Engineer's decision will be binding regarding the option of remedy (a) or (b) above.

Other than where shown on the drawings no holes shall be permitted in floor slabs or beams or walls without the prior approval of the Engineer.

4.17 Pockets

The Contractor should note that the location of individual pockets within a group and the location of pocket groups is important.

It should be noted that pockets defined as 'temporary pockets' shall be formed without cutting, bending or altering the reinforcement in any way.

The contractor shall co-operate with all other trades for building in of any items required by them to be built into concrete work.

4.18 Pumping Concrete

The use of concrete pumps for placing insitu concrete may be approved by the Engineer. Written approval shall be obtained before using this procedure.

Mix designs, aggregate sizes, water contents, consistency and pumping plant used for placing must be proven suitable for achieving a finished result equivalent to that from placing the concrete by traditional accepted methods. Due allowance shall be made in mix design and manufacture for effects on 28 days and ultimate strengths caused by addition of air entraining agents, plasticisers etc.

If start-up of pumping operations is preceded by priming of pumps and delivery lines with grout, excess priming grout shall be pumped to waste and not incorporated in structural concrete work.

Aluminium delivery pipes shall not be used.

Slump of concrete for pumping shall not be less than 50mm, or more than 125mm without the Engineer's express approval.

When ready mixed concrete is ordered, the supplier shall be advised of the type of pump to be used and the slump required, in addition to grade, strength quantity etc.

Pumping rates and/or number of vibrators used must be varied as necessary to ensure that sufficient vibration is given to placed concrete. At least one spare vibrator shall be available at all times for any one concrete pour.

5. Structural Steelwork

5.1 Scope

This section of work comprises the supply, fabrication, surface treatment, delivery & erection of structural steelwork and metalwork associated with the Building.

5.2 Statutory Obligations

Comply with statutory obligations, New Zealand Building Code and the regulations to any Local Authority or other Statutory Body having jurisdiction over the area in which the works are situated.

On completion of the work covered by this section of the specification, the Contractor shall, if requested, supply a "Producer Statement" which states that the work has been carried out in accordance with this specification, and if not carried out in accordance, where the work has varied from this specification.

The Contractor shall adhere to all requirements of the following standards except where specified otherwise herein or instructed otherwise by the Engineer.

NZS 3404: Part 1 & 2 : Steel Structures Standard
NZS 3404: 1: Structural Steel Structures – Materials, Fabrication, and Construction
NZS 4711: Qualification tests for metal - arc welders
AS/NZS 1252: High Strength Steel Bolts with Associated Nutsand Washers for Structural Engineering
AS/NZS 1554: Structural steel welding
AS/NZS 1554.1: Welding of steel structures
AS/NZS 2312: Guide to Protection of Structural Steel Against Atmospheric Corrosion by the Use of Protective Coatings
AS/NZS 4680: Hot Dip Galvanized (zinc) Coatings on Fabricated Ferrous Articles
AS 1111: ISO Metric hexagon bolts and Screws
AS 1112: ISO Metric Hexagon Nuts
AS 1214: Hot dip galvanised coatings on threaded Fasteners
AS 1627: Metal Finishing - Preparation and Pre-treatment of Surfaces
AS 3678: Hot Rolled Structural Steel Plates
AS 3679: Structural Steel: Part 1 Hot Rolled Bars& Sections; Part 2 Welded Sections
AS 3828: Abrasive blast cleaning
HERA R4-99: HERA Specification for the Fabrication, Erection and Surface Treatment of Structural Steel Work
HERA R4-133: HERA NZ Steelwork Coatings Guide

5.3 Material and Workmanship

All structural steel used shall be of New Zealand, British, Japanese or Australian origin unless otherwise approved. Sizes and shapes shall be as shown on the Drawings unless otherwise approved.

All workmanship shall be in accordance with NZS 3404.

5.4 Co-ordination

Refer to architectural, electrical and services drawings to ensure details and fixings required are provided for in the structural steelwork.

5.5 Verify Dimensions

Verify dimensions against site measurements prior to fabrication. For existing structures, verify grade of steel and dimensions against site measurement.

5.6 Shop Drawings

The Contractor shall prepare shop detail Drawings, two copies of the Drawings shall be submitted to the Engineer and confirmation of review of these drawings shall be obtained prior to commencing fabrication. Review of these drawings will not cover dimensions of layout.

The Contractor shall include suitable protective coating systems with the shop Drawings for review by the Engineer.

The responsibility for the accuracy of the shop Drawings for both structural adequacy and detail shall remain entirely with the Contractor. Should it be found at any stage that a shop Drawing does not comply with the Engineer's Drawings and Specification rectification to the Drawing and any work executed may be ordered by the Engineer. The entire cost of such rectification to be borne by the Contractor.

5.7 Tolerances

All sections, plates, flats, etc. shall be straight and within code specified tolerances. Where required steelwork shall be straightened in a manner approved by the Engineer before fabrication is commenced.

Each section of work shall be fabricated to the required degree of accuracy, suitable jigs, templates, and the like shall be used where practicable.

5.8 Welding Plant and Equipment

All welding plant and equipment shall be to approval and shall give adequate personal protection to the operators.

5.9 Welding Operators

All welding operators employed on the work shall have been tested and certified within the previous three months by an approved agency for the particular type of welding they are engaged upon. Alternatively, the welding operators shall not be employed on the work until they have passed tests in accordance with the requirements of NZS 4711 and to the satisfaction of the Engineer.

The Contractor shall supply the Engineer, before any fabrication commences, with copies of the above test results for welding operators he proposes to employ on the Contract.

Throughout the whole of the construction period the Contractor shall keep an accurate record of the sections of work carried out by each welding operator.

These records must be kept available on site for inspection by the Engineer when requested.

5.10 Welding and Electrodes

a) Welding

All welding carried out in connection with this Contract shall be done by a process as specified in AS/NZS 1554.5 to class SP as defined in NZS 3404.1.

b) Butt Welds

All butt welds shall be full penetration. No pin holes or slag inclusions shall be permitted. Great care must be taken when laying vertical butt welds, and a constant check must be kept to ensure complete fusion and freedom from slab inclusions.

c) Fillet Welds

All fillet welds not specified on the Drawings shall be taken as 6mm (nominal size) fillet, and unless the actual length of weld at each joint is stated, it shall be assumed to be the maximum obtainable along all lines of contact of the members jointed, to form a continuous weld.

5.11 Bolting

In general, all field connections shall be bolted as shown on the Drawings. Holes shall be drilled, or punched, not more than 2mm greater than the nominal bolt diameter for a bolt not exceeding 24mm and not more than 3mm for a bolt of greater nominal bolt diameter. Parallel washers shall be used under all nuts, and where required where channels and joists are bolted, tapered washers shall be used.

Bolts shall be Mild Steel Grade 4.6 or High strength grade 8.8 as shown on drawings and tightened snug tight unless shown or specified otherwise.

No grade 8.8 bolt or nut shall be welded, tack welded or in any way damaged.

All bolts, nuts and washers shall be hot dipped galvanised.

5.12 Bolting Notation

Notation of bolting categories:

Bolting category	**Bolt standard**	**Bolt Grade**	**Tension method**	**Tensioned joint type**
4.6/S	AS 1111	4.6	Snug tight	
8.8/S	AS/NZS 1252	8.8	Snug tight	
8.8/TB	AS/NZS 1252	8.8	Full tension	Bearing
8.8/TF	AS/NZS 1252	8.8	Full tension	Tension

5.13 Transport

The Contractor shall transport all materials to the site taking all care and responsibility and making arrangements with the necessary Authorities. He shall insure or otherwise indemnify the Owner against loss, damage, accident or fire en route and any delays which may ensue for late completion arising from the damage.

5.14 Supervisors

The Contractor shall employ on the works a person or persons who has had suitable training and practical experience in the execution and supervision of this form of construction, and all fabrication and welding shall be carried out under his immediate and continuous supervision.

The Contractor shall supply the Engineer with the name(s) and details of the recent experience of the supervisor(s) he proposes to employ on the Contract. This information shall be supplied prior to starting fabrication work in the Contract.

The supervisor shall have qualifications acceptable to the Engineer and preferably be a person who holds a New Zealand Institute of Welding Supervisors' Certificate in Metal Arc welding or equivalent.

5.15 Inspection

The Engineer may appoint an inspector who will act as their representative on the works or in the shop.

The Contractor shall at all times during working hours allow the Engineers or their representatives full facilities for inspection and checking of the fabrication.

Should the Engineer find, on erection of the steelwork at the site, that the parts are not in accordance with the Engineer's drawings and specifications, the whole cost of altering the work shall be borne by the Contractor, not withstanding that the Engineer or his representative may have previously indicated that the work, including shop drawings, is satisfactory.

5.16 Galvanising

This specification covers the galvanised coating applied to steelwork required for protective coatings, including general steel articles, structural sections, angles, channels, beams, columns, fabricated steel assemblies, threaded fasteners, other steel components and all metalwork items cast in concrete.

This specification does not apply to the galvanised coating on semi-finished products such as wire, tube or sheet galvanised in specialised or automatic plants.

Fabrication

Care shall be taken to avoid fabrication techniques which could cause distortion or embrittlement of the steel.

All welding slag and burrs shall be removed prior to delivery to the galvaniser.

Holes and/or lifting lugs to facilitate handling, venting and draining during the galvanising process shall be provided at positions as agreed between the designer and the galvaniser.

Unsuitable marking paints shall be avoided and consultation by the fabricator with the galvaniser about removal of grease, oil, paint and other deleterious materials shall be undertaken prior to fabrication.

Surface Preparation

Surface contaminants and coatings, which cannot be removed by the normal chemical-cleaning process in the galvanising operation shall be removed by abrasive blast cleaning or some other suitable method.

Steelwork shall be pre cleaned in accordance with the requirements of AS 1627 Part 1 followed by acid pickling, in accordance with the requirements of AS 1627 Part 4 may be used.

Galvanising

All articles to be galvanised shall be handled in such a manner as to avoid any mechanical damage and to minimise distortion.

Design features that may lead to difficulties during galvanising should be pointed out prior to galvanising.

Galvanising parameters such as galvanising temperature, time of immersion, and withdrawal speed shall be employed to suit the requirements of the article.

The composition of the zinc in the galvanising bath shall not be less than 98.0% zinc.

Coating Requirements

Thickness

The thickness of the galvanised coating shall be a minimum to conform with Table 1 in AS/NZS 4680 and AS/NZS 2312 and shall achieve the required durability to first major maintenance for the respective classification of environment. For thin metals where the required galvanising thickness cannot be achieved, an additional paint system may be required. For hidden elements, elements cast in concrete foundations or within 600mm of the ground, a durability of 50 years is required. An additional paint system may be required to achieve the required durability.

The thickness of the galvanised coatings on threaded fasteners shall conform with Table 2 in AS 1214 and AS/NZS 2312 and shall achieve the required durability to first major maintenance for the respective classification of environment. For hidden elements, elements cast in concrete foundations or within 600mm of the ground, a durability of 50 years is required. Additional paint may be required to achieve the required durability.

The thickness of the galvanised coating shall first be tested by a approved testing agency at the galvaniser's works, using an approved magnetic measuring device. In the event of any dispute, an independent test shall be carried out in accordance with AS/NZS 4680, Appendix G.

Surface Finish

The galvanised coating shall be continuous, adherent, as smooth and evenly distributed as possible, and free from any defect that is detrimental to the stated end use of the coated article. On silicon killed steels, the coating may be dull grey, provided the coating is sound and continuous.

The integrity of the coating shall be determined by visual inspection and coating thickness measurements.

Where slip factors are required to enable high strength friction grip bolting, where shown, these shall be obtained after galvanising by suitable mechanical treatment of the faying surfaces.

Where a paint finish is to be applied to the galvanised coating, all spikes shall be removed and all edges shall be free from lumps and runs.

Adhesion

The galvanised coating shall be sufficiently adherent to withstand normal handling during transport and erection.

Inspection

Inspection shall be carried out at the galvaniser's works by an approved testing agency, or at some other place as agreed between fabricator and galvaniser.

Certificate

When requested by the Engineer, a certificate shall be provided stating that the galvanising complies with the requirements of AS/NZS 4680.

Transport and Storage

Galvanised components shall, wherever possible, be transported and stored under dry, well-ventilated conditions to prevent the formation of wet storage staining following the recommendations contained in AS/NZS 4680 Appendix F.

Welding

Where galvanised steel is to be welded adequate ventilation shall be provided. If adequate ventilation is not available, supplementary air circulation shall be provided. In confined spaces a respirator shall be used.

5.17 Steelwork Storage

Structural steelwork stored in the open shall be packed up clear of the ground and individual members shall be separated with timber dunnage to avoid damage to the paint system. Should it be necessary to store finished steelwork in the open for longer than one week, then waterproof cover shall be provided to protect the paint system.