

# SPECIFICATION

## LTA KARAVI BRIDGE

**Issue** : **Tender Issue**  
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**SPECIFICATION FOR WORKMANSHIP AND BUILDING MATERIAL TO BE SUPPLIED FOR  
LTA KARAVI BRIDGE STATION**

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## **SECTION 1 PRELIMINARY & GENERAL**

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### **1.1 GENERAL CONDITIONS**

The Contractor shall comply with the applicable Fiji Standard Form Of Building Contract which forms part of this specification and may be viewed at the office of the Engineer.

### **1.2 TENDER DOCUMENTS**

Conditions relating to the tendering procedure are covered by the general Conditions Of Tender. Tender form and appendices attached to this specification (where applicable).

### **1.3 TENDERER TO INFORM HIMSELF FULLY**

1.3.1 All tenderers shall inspect and examine the site, its surroundings, and shall satisfy himself before submitting his tender, as to the nature of the ground and subsoil, the form and nature of the site, the quantities and natures of the work and materials necessary for the site, the accommodation he may require, the availability, conditions and rates of pay of labour and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his tender.

1.3.2 In particular, each tenderer shall make all allowance he sees necessary to ensure the works are completed within the contract time, including all overtime, double time, weekend work, and other incidental allowance as required.

1.3.3 If a tenderer has any doubt as to the meaning of any portion of the works, he shall, when submitting his tender, include a statement of the interpretation upon which he relies and upon which his tender has been prepared and submitted.

### **1.4 DRAWINGS, SPECIFICATION & SCHEDULE OF QUANTITIES**

#### **1.4.1 GENERAL**

The drawings and specifications shall be carried out to the letter and are intended to be co-operative, i.e. Any work shown on the drawings are not mentioned in the specification or work or material if specifically shown or mentioned by both.

#### **1.4.2 SITE DRAWINGS**

The Contractor will maintain one complete set of bound documents to be kept on the site office. Drawings for use on the site shall be mounted on hardboard sheets and covered with clear varnish or alternatively clear polythene sheet.

#### **1.4.3 STANDARD DETAILS**

Although standard details are listed in the index under the predominant trades to which they apply, all trades should be fully conversant with them.

#### **1.4.4 SCHEDULE OF QUANTITIES (Where applicable)**

The schedule is deemed to be for the assistance of the tenderers in making up his price and for the purpose of adjusting variations. It may form part of the contract. Within 14 days of the acceptance of his tender, the Contractor shall forward to the Engineer a fully priced Schedule of quantities.



1.5 **OWNERSHIP OF DRAWINGS**

Drawings and specifications, and copies thereof, which are furnished to the Contractor, are the property of the owner. They are not to be used on other work and are to be returned to the Engineer if so requested except for one copy which may be retained by the Contractor as part of the Contract Documents.

1.6 **INFERRED WORK**

All work reasonable is to be included as fundamentally necessary for the proper erection and completion of the works shall be deemed to be included, and no variation to the contract sum will be allowed for any such items.

1.7 **AMBIGUITY**

Any errors of discrepancies between drawings and specifications that are notified in writing by the tenderer to the Engineer at the time of tendering shall be interpreted by the Engineer in accordance with the contract.

1.8 **BY-LAWS & PERMITS**

The whole of the work shall be carried out in accordance with the By-Laws and regulations of the Local Authority. The Building Permit will be supplied by the Engineer but other necessary permits and fees required shall be obtained immediately and the costs borne by the Contractor. This includes permits and fees for all utility connections.

1.9 **PROJECT MANAGEMENT**

1.9.1 **GENERAL**

The Main Contractor shall be responsible for all work, executed under the contract including the work of subcontractor, nominated or otherwise. The Main Contractor shall be responsible for the proper supervision of all works for which he is responsible and shall take all necessary measures to ensure quality control and faithful workmanship.

1.9.2 **PROJECT MANAGER**

Immediately after signing the Contract, the Contractor shall appoint an experienced Project Manager. The appointment shall be confirmed in writing with details of his experience and the authority delegated to him.

1.9.3 **FOREMAN**

A competent Foreman shall also be appointed and shall be in-charge of the work for the duration of the Contract. Instructions given to him shall be deemed to have been given to the Contractor. The Foreman must be able to speak English and be able to understand fully the drawings and instructions he has to administer.

1.9.4 **REPLACEMENT**

Once approved the Contractor shall not replace or withdraw these appointments without the consent of the Engineer.



#### 1.9.5 **SUBCONTRACTOR'S FOREMAN**

Each trade shall be under the constant and special direction of a trade foreman fully licensed, authorised and approved by all relevant authorities and the Engineers, for that particular trade for which he is responsible.

Each trade foreman shall be constantly on the works during the progress of the same, while work on that trade is being carried out.

#### 1.10 **PROGRESS BAR CHART**

The Contractor shall, within ten days or earlier if required of acceptance of his tender submit three copies of his fully detailed construction programme and order of work for approval. The work of all trades including ordering of materials, plant and equipment shall be clearly shown.

One copy of the approved programme shall be kept on site at all times and shall indicate thereon the actual progress throughout the construction period.

#### 1.11 **SITE MEETINGS**

A regular programme of site meetings shall be established by the Contractor at which the Engineer, Client, all subcontractors and all consultants will attend as necessary.

#### 1.12 **INSPECTION OF WORK**

Engineer or the authorised representatives of employer shall at all times during its progress have full access to all phases of the work. Contractor shall provide adequate means to facilitate inspection by the Engineer.

#### 1.13 **PROTECTION AND STORAGE**

The Main Contractor shall be responsible for all protection and shall provide and fix all necessary temporary protection and adequate weatherproof storage for all components of subcontractors. Separate subcontractors shall be responsible for protection from date of their acceptance of such work to completion of the contract.

#### 1.14 **CLEANING AND REMOVAL OF RUBBISH**

The Main Contractor shall remove all rubbish caused by the operation of all trades at regular intervals during building operations. Allow to protect all finished surfaces from damage and discolouration caused by adjacent building operations and foot traffic etc.

The Contractor shall, when directed by the Engineers, clean any public or private road or any area of drain, watercourse, or canal, or any area of private land, that are considered by the Engineer to be noticeably sullied or damaged by reason of the Contractor carrying out the works.

#### 1.15 **PROTECTION OF PROPERTY**

The Contractor will be responsible for the adequate protection and where necessary making good of all public and private property adjoining the site. The Contractor will not assume any rights of access over adjoining property unless approval is given at the end of this section.

#### 1.16 **DEFECTS AND LIABILITY PERIOD**

Maintain the works specified in this contract including preventive maintenance as required by this specification for a period as stated in Appendix to the Fiji Standard Form Of Building Contract and which shall apply from the date of Certificate Of Practical Completion in accordance with Clause 15 of Fiji Standard Form Of Building Contract.



1.17 **MATERIALS, WORKMANSHIP AND PLANT**

Materials in all trades shall be new and the best of their respective kinds specified and where necessary complying with relevant standards mentioned herein and subject to approval or rejection by the Engineer.

Supply all materials, labour, plant, and tools as necessary for the works. The work shall be carried out in a first class tradesman like manner in all respects to the reasonable satisfaction of the Engineer in accordance with relevancy standards mentioned herein and with the plans and specifications, and such further drawings and detail drawings as may be provided and in accordance with such instructions, directions and explanations as from time to time may be given by the Engineer and subject to approval and rejection by him.

1.18 **DEFECTIVE MATERIAL AND / OR WORKMANSHIP**

Should materials be used or work done contrary and / or not up to standard herein specified then the Engineer may instruct, that this work be dismantled and rebuilt at the expense of the Contractor.

However, should the materials used or work done in accordance with the specification, but which the Engineers do not feel expedient to have corrected, the Engineer shall have the power to deduct such sums of money as they shall consider a proper equivalent from the amount due to the Contractor.

1.19 **MATERIALS ON SITE**

Any materials delivered to the site for this Contract are to be considered as part of the construction and shall not be removed unless approved by the Engineer. However, the Contractor has the right upon completion of the works to remove all his surplus materials.

1.20 **ORDERING OF MATERIALS**

All materials including those to be imported must be ordered with 21 working days of acceptance of tender. Materials not ordered within this period shall not be used for extension of time claims.

1.21 **GUARANTEES**

Where required by this specification, guarantees shall be submitted in accordance with the Fiji Standard Form Of Building Contract and handed to the Engineer before issue of the final payment.

1.22 **CURRENCY**

Tender shall only be submitted in Fiji Currency and payments by the Contractor in terms of his Contract will be in Fiji Currency.

1.23 **PROGRESS PAYMENTS & RETENTIONS**

No progress claims shall be made for the sum less than stated in appendix to the Fiji Standard Form Of Building Contract Item 12 except for the claim at the time of Practical Completion and Final Payment.

A retention of 5% shall be held upon progress payments up to the issue of the practical completion certificate. The retention will than be reduced to 2.5% to cover the Defects Liability Period (refer Clause 15 of the Fiji Standard Form Of Building Contract).

1.24 **PROCEDURE FOR VARIATION**

Reference should be made to Clause 11 of the Fiji Standard Form Of Building Contract.



1.25 **CONTINGENCY SUM**

Allow a contingency sum as set out in Schedule Of Monetary Allowances Section. The expenditure of the amount being solely at the discretion of the Engineer in accordance with the Fiji Standard Form Of Building Contract. Any unexpended balance from this sum shall be deducted from the Contract sum.

1.26 **LIQUIDATED DAMAGES FOR DELAY IN COMPLETION**

Refer to the appendix of the Fiji Standard Form Of Building Contract Item 8 for the amount of Liquidated and Ascertained Damages for delay in completion. Refer also to clause 22 of the Fiji Standard Form Of Building Contract 1.27.

1.27 **INSURANCE**

This should read in conjunction with Clause 18, 19 and 20 of the Fiji Standard Form Of Building Contract and appendix Items 2, 3, 4 and 5.

1.28 In lieu of the policy as referred to in the Fiji Standard Form Of Building Contract, a “Contractor’s All Risks” policy may be accepted only with approval of the Engineer. The policies shall include the following special risks:

1. Aircraft and articles dropped there from.
2. Damage to works by windstorm.
3. Damage by concussion, fire ensues or not.
4. Riots, strikes, civil commotion and vandalism.
5. Water damage.
6. Storm and / or tempest.

Prior to the first Progress Payment being authorised a cover note or proof that an Insurance Cover has been arranged must be produced in the form of a cover note.

1.29 **ROYALTIES & PATENTS**

The Contractor shall pay all royalties and license fees. The Contractor shall defend all suits or claims for infringement of any patent rights and shall save the Owner harmless from loss on account thereof.

1.30 **TENDER DEPOSIT**

Refer to the Memorandum on General Conditions Of Tender for tender deposit amount.

1.31 **CONTRACT COMPLETION TIME**

Application has been made for Development Permission and a Building Permit.

The Contractor shall apply for all other permits immediately upon acceptance of his tender and the Contractor shall be granted access to the site one (1) working day after acceptance of his tender.

Tenderers shall undertake to complete all works included herein plus any additional authorised works to a value of not more than 10% of the Contract Sum before the date for completion stated in appendix to the Fiji Standard Form Of Building Contract Item 21.1.31.

Extension of time may be authorised as set out in Clause 23 of the Fiji Standard Form Of Building Contract.

Claims for extensions of time in respect to additional works not covered by Clause 23, Fiji Standard Form Of Building Contract, may be claimed when pricing the Variation Price Request. Extensions of time not claimed at this stage will not be recognised.



1.32 **WET WEATHER**

Extensions of time to the Contract period for wet weather will be allowed only on working days on which there is four or more hours of continuous rain which affects the progress of the works. Extensions of time due to wet weather as herein specified should be applied for within seven days stating parts of the work affected and man / hour losses.

1.33 **SIGNBOARD**

Allow to provide signboard where directed and as detailed. No other advertising will be permitted on site.

1.34 **TRADE RELATIONS**

The Contractor shall ensure that proper provision is made for the requirements of subcontractors, separate Contractors, nominated Contractors and other personnel on site.

All subcontractors shall attend upon the job and inspect the work of any trade against which his materials are to be placed and report immediately to the General Contractor any defect that would prevent the satisfactory execution, finish or permanency of his work.

1.35 **TEMPORARY FACILITIES**

1.34.1 **BUILDING**

The Contractor will provide all necessary temporary buildings required for his own use and that of subcontractors and specialist Contractors.  
Hoarding night lighting will also be provided.

1.34.2 **SERVICES**

All temporary water, electrical and telephone services required to be provided by the Contractor. The Contractor shall pay for all temporary charges.

1.34.3 Contractor to allow to arrange for a surveyors certificate as to the proper set out of the building



## **SECTION 2 EXCAVATOR**

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### **2.1 PRELIMINARY**

#### **2.1.1 GENERAL**

Refer to the General Conditions of contract and the Preliminary & General Clauses that will also apply to this section of the work.

#### **2.1.2 STANDARDS**

The following standards shall form part of this specification:

TNZ M/4 and M/4 Notes	Crushed basecourse aggregate.
BS 1377	Methods of test for soils for civil engineering purposes.
BS 8000	Workmanship on building sites Part 1: Excavation and filling.
BS 1377	Methods of Tests for Soil for Civil Engineering Purposes including Supplement No. 1: 1988
NZS 4402: 1988	Methods of testing soils for Civil Engineering Purposes
NZS 4431: 1996	Code of Practice for Earth Fill for Residential Development
NZS 4404:	Land Development and Sub-Division Infrastructure

### **2.2 WORKMANSHIP**

All work is to be carried out in a safe and competent manner by capable workmen.

#### **2.2.1 SCOPE**

The scope of this section includes the excavation of all footings, foundations and trenches etc. And the filling and backfilling necessary to retaining walls, paved areas, floor slabs etc. Including general and granular fill as specified herein or shown on drawings where applicable.

#### **2.2.2 EXISTING SITE LEVELS**

The Contractor is to check all levels before commencing work. If the levels on Project Drawings appear to be incorrect, the Contractor will notify the Principals Representative and obtain an instruction prior to proceeding with the works. Before using survey control marks, the Contractor is to confirm that they correspond to the marks shown on the Project Drawings, that they have not been disturbed and that their levels are correct. Should the Contractor fail to undertake these checks prior to commencing work, establishing or disturbing the site, no claim will be considered from the Contractor in relation to variations associated with differences in existing surface levels or disturbed bench marks.

#### **2.2.3 SETTING OUT**

The Contractor shall be responsible for all setting out of all excavations necessary for the work to be carried out accurately.



#### 2.2.4 EXISTING SERVICES

Notwithstanding that some existing services are shown on the Drawings, the Contractor will consult with the Principals Representative to ascertain the position of all existing services. The Contractor will take every precaution to protect existing water or drain pipes, electricity conduits, telephone or power poles or cables and all other existing works. All damage to existing works or services will be repaired immediately to the satisfaction of the Principals Representative at the Contractor's cost. The cost of protection and maintenance of existing works and services is deemed to be Contractor's responsibility. Should the removal or alteration of any existing service necessitate any variation of the work shown on the Drawings or included in the Specification, the Contractor will give the Principal's Representative written notice specifying the variation proposed to be made and the reason for making it and request instructions thereon.

#### 2.2.5 PROVISION FOR TRAFFIC

The Contractor shall provide and maintain all necessary temporary bridges, footpaths, sidetracks, drains, and pipes so as to ensure continuity and safety of all vehicular and pedestrian traffic.

The Contractor will be held entirely responsible for the safety of all pedestrian and vehicular traffic and will provide all necessary watchmen, lights, barriers, notices and signs and will provide any maintenance to same to the satisfaction of the Principals Representative.

In the event of the Contractor failing to comply with his responsibilities under this clause of the Specification, the Principals Representative will have the power, without further notice, to take such steps as the Principals Representative considers necessary, to provide for the safe passage and safety of traffic or pedestrians, or to remove any obstruction or to repair any damage including, if he considers it necessary, the employment of workmen and watchmen. The cost thereof will be deducted from any monies due to the Contractor under this Contract. All signs, lights, barricades shall be provided, erected and maintained in accordance with the requirement of The Fiji Roads Authority. The Contractor will be responsible for any necessary approvals for the transport of any materials.

#### 2.2.6 TESTING

All the testing of soils, gravels and concrete to verify compliance with the Standards set down in the Specification will be at the Contractor's expense and deemed to be included in the Contract Sum.

The frequency of field density testing shall be in accordance with NZS4402 for large scale operation. The Contractor shall engage a registered Geotechnical Engineer to undertake geotechnical testing to confirm subgrade bearing capacities. The Contractor shall be responsible for recording the position and level of the tests.

The Geotechnical Engineer shall show the location of the tests on their test certificates.

The Principals Representative will have the right to be present at, or have a representative present at all tests, at the time of taking of samples and specimens and at the time of preparation of material for testing. The Principals Representative may reject the results of tests carried out without reasonable notice to him and may direct that such tests will be repeated at the Contractor's expense.

If any portion of the work fails to reach the specified testing requirements, that portion of the works so affected will be re-tested after rectification by the Contractor at the Contractor's expense. The only reimbursable testing costs are those tests directed by the Principals Representative in excess of the testing requirements contained in the Specification whose results meet the requirements.

The Contractor is to provide, free of charge, any materials, labour, compressed air and equipment that may be necessary to carry out tests.



### 2.2.7 CLEARING & GRUBBING

Prior to the commencement of earthworks, all areas subject to earthworks operations will be cleared and grubbed.

All concrete slabs, drains and other structures, services or debris are to be removed from site as necessary to properly construct the works.

Excavations as a result of debris removal will be backfilled and compacted to the standard appropriate for the relevant location of the works.

### 2.2.8 DEMOLITION AND REMOVAL OF EXISTING ROADS

Existing roads that are to be demolished shall have the bituminous surface removed and disposed off site. Where the road is in an area to be excavated the pavement materials can be removed as part of the earthworks operations and reincorporated within the general fill materials.

Where the road is under a fill the pavement material can be left intact.

Where the road is in area not under the earthworks footprint, the existing pavement shall be tyned and removed to a depth of 100mm. The 100mm void shall be replaced with stripped topsoil and regressed or top soiled as per the landscaping plan.

### 2.2.9 REMOVAL OF UNSUITABLE AND EXCESS MATERIAL

Unsuitable material will be as described in NZS4431. The Contractor will gain the agreement of the Principals Representative prior to classifying any material as being unsuitable.

Measurement for payment under this item will be by volumetric measurement in cubic metres of the excavation resulting from the removal of unsuitable material.

The Contractor will keep records of the volumes of unsuitable material removed.

Excess materials from excavations and from backfilling shall be distributed on the site where directed by the Principals representative (where applicable), or if not required then remove from site at the Contractor's expense.

Any water interfering with the progress of the works will be dewatered, trenches are to be kept free from water and any damage to the works due to flood or other causes is to be prevented. Any work or material damaged by water will, if ordered, be taken up and replaced with new material. The contractor shall provide, where necessary a sand trap on the discharge line of any pump to prevent the deposit of material in downstream channels and stormwater drains.

### 2.2.10 DUST NUISANCE

The Contractor will take measures to minimise the generation of dust that may degrade the environment of the adjoining lands, create a work place to traffic safety hazard or cause discomfort or nuisance to the general public. The Contractor will regularly apply water to all exposed soils to minimise the generation of dust.

The Principals Representative may request application of water to exposed soils if he is not satisfied with the amount of dust being generated from the site. This requested application of water will be done at no additional cost.

All permits and costs associated with the supply of water used for dust suppression works are deemed to be included in the Contract Sum.



## 2.3 **EXCAVATION**

2.3.1 Excavate for all foundations, footings etc. to the levels shown. Minimum depth shall be in accordance with the structural drawings, into solid ground but should satisfactory bearing not be found at this depth excavation shall be carried further down until satisfactory ground is reached. All subsoil from the foundations etc. shall be removed from the building working area. All footing excavations to be approved by the Principals representative before concreting. Allow to excavate the site to levels as necessary for the proper construction of the structure. Allow to cart all surplus fill etc. Any damages etc. caused by excavation will be the contractor's responsibility.

### 2.3.2 **TIMBERING**

Provide all necessary timbering, shoring sheet piling etc. necessary to keep the excavation open and safe for working at all times.

### 2.3.3 **PUMPING**

It is the Contractor's responsibility to keep excavations free of water during building operations.

## 2.4 **BACKFILLING**

### 2.4.1 **GENERAL**

Backfilling where required shall be carried out neatly to the levels indicated. Sound granular material or other approved material only shall be used for this purpose unless otherwise specified. All materials used shall not contain silt or clay and topsoil. Thoroughly compact in 200mm layers using vibrating roller or other method approved by the Principals representative.

### 2.4.2 **FOUNDATION SUPPORT**

Care shall be taken when placing backfilling against foundation wall. It is the Contractor's responsibility to brace wall should this be necessary or where directed.

### 2.4.3 **RETAINING WALLS** (Where indicated on the drawings)

Retaining walls shall be back filled with clean well graded free draining material to be approved by the Principals representative after the application of a damp proof course as specified later. Behind such wall, lay where indicated "Nova flow" or similar approved field drains of the sizes and positions indicated on the drawings.

#### 2.4.3.1 **General Fill**

All existing fill shall be removed from the work area and stockpiled where designated by the Principals representative.

2.4.4 General fill shall consist of ripped soapstone free of organic, clay and silt pockets. If this is not available then clean, well-graded granular fill shall be used. All fill is to be approved by the Principals representative prior to placing (preferably at source). General fill shall be compacted in horizontal layers not exceeding 200mm in thickness. This material is to be compacted to 100% maximum density (standard) and tested by a laboratory approved by the Principals representative, at the Contractors Cost.

#### 2.4.5 **Hardcore Fill**

After compaction cover all general fill with 200mm minimum of 75mm crushed rock, compacted and tested as given above, unless other thickness specified.

## 2.5 **DAMP PROOFING** (where applicable)

Where retaining walls are indicated coat wall with 3 coats Flintstone DPC and protect from damage with second grade pinex soft board or similar.



2.6 **TRENCHES**

Co-operate with the various trades in the excavation of all trenches for drains, electrical and telephone conduits, septic tanks, rubble drains etc. Prior to backfilling ensure that pipes have adequate cover and protection in accordance with the regulations and that the respective authorities have carried out all necessary tests.

2.7 **TOPSOIL** (where applicable)

Prior to commencing all topsoil shall be stripped from the building site and stockpiled. Check with Principals representative where topsoil may be stored.

At completion to the works, stockpiled topsoil shall be spread around the building area as directed by the Principals representative and as necessary to provide even surrounding ground area by rolling if required.

2.8 **DEWATERING**

The Contractor shall allow in his tender for any de-watering required to allow him to excavate the area necessary for the construction of foundations.

2.9 **BATTERS**

All batters shall be clean of loose or unstable material immediately prior to backfilling.

2.10 **BENCHING AND SLOPE PREPARATION**

Where filling is to be placed on a slope steeper than one vertical to five horizontal, it shall be continuously benched before any filling is placed on it unless directed otherwise by the Principals representative. All benches shall be sufficiently wide to accommodate compaction equipment and in no case shall be less than 2700mm in width. Benching shall be started on the lowest areas and constructed as the filling proceeds. Excavated material from the higher benches may be used as filling on the lowest ones only if approved by the Principals representative. The benches shall have a longitudinal fall of not less than one in fifty (1:50) towards drainage outlets. Each bench shall also have a cross-fall of approximately one in twenty (1:20) to drain towards the hillside.

Filling shall on no account be placed during heavy rain or under wet conditions following rain.

2.11 **FORMING OF FILL AREAS**

2.11.1 Generally the quality of fill material and the nature of frequency of test to check and control this quality shall be determined and specified before fill placing commences.

2.11.2 All earthworks material placed in or below fill areas below formation level in cut areas or elsewhere in the works shall be deposited and compacted as soon as practicable after excavation in a systematic manner with near horizontal layers, each being deposited progressively across the full area of a fill in 200mm layers or in layers of thickness appropriate to the compaction plant used.

The surface shall be maintained at all times with sufficient falls and sufficiently even to enable surface water to drain readily from them.

During the construction of fill areas the Contractor shall control / and direct construction traffic uniformly over the whole area of the filling. The Contractor shall make damage to compacted layers by construction traffic good.



## 2.12 **COMPACTION**

2.12.1 Separate compaction machinery shall be required. Construction traffic, by itself, will not be accepted as providing adequate compaction. A sheeps foot or tamping tyre of roller or mechanical equipment that produces a similar effect shall be used to penetrate loose material and compact the layers from the bottom upwards in order to produce uniformity throughout its thickness.

Compaction tests will be carried out during the progress of the work, to determine if adequate compaction of the fill material is being achieved. The Principals representative may direct that work be suspended or methods altered, or additional machinery be brought into use if he considers that reasonable compaction is not being achieved due to weather, types of machinery, spread of earthmoving equipment across the fill, thickness of spread layers, soil type and /or moisture content or for any other reason.

No additional payment or rate adjustment shall be due by such directions, but permission to continue or to use accepted methods will not be unreasonably withheld by the Principals representative.

2.12.2 In all cases, the rate for excavation shall include the placing and compaction (or disposal) of the material to the specified standards elsewhere, notwithstanding that double handling may occur.



## **SECTION 3 CONCRETOR**

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### **3.1 PRELIMINARY**

#### **3.1.1 GENERAL**

Refer to the general conditions of the contract and the preliminary and general clauses, which will also apply to this section of the work.

#### **3.1.2 STANDARDS**

The following standards shall form part of this specification:

NZS 3101	Concrete structures standard
NZS 3104	Specification for Concrete production
NZS 3109	Concrete Construction
NZS 3114	Concrete surface finishes
NZS 3604	Timber framed buildings
NZS 3631	New Zealand timber grading rules
NZS 3122	Specification for Portland and blended cement
AS/NZS 2465	Unified Hexagon bolts, screws and nuts
AS/NZS 3111	Approved and test specification
AS/NZS 3112	Methods of test for concrete
AS/NZS 3121	Water and aggregate for concrete
AS/NZS 4671	Steel reinforcing material
AS/NZS ISO 9001	Quality Management Systems - Requirements
AS 2327	Composite Beams
AS 2870	Residential slab and footings
AS 3600	Concrete structures
AS 3610	Formwork for concrete
AS 3735	Concrete structures for retaining liquids
AS 6669	Plywood formwork

#### **3.1.3 CO-OPERATION**

Allow to co-operate with other trades to inspect position and build in all fixing bolts, pipes, sleeves, nailing grounds, chases, conduits, reinforcing starters, weather-bars, inspection chambers etc. Also co-operate with the Block layer in the filling of cavities.

### **3.2 FORMWORK**

#### **3.2.1 STANDARDS**

Formwork design and construction: To AS 3610.  
Reinforced concrete design and construction: To NZS 3101 and NZS 3109 respectively.  
Plywood formwork: To AS 6669.  
Profiled steel sheeting including shear connectors: To AS 2327.

#### **3.2.2 TOLERANCES**

Plumb of elements □ 8 m high: 1 in 1000.  
Plumb of elements □ 8 m high: To AS 3610.  
Position: Construct formwork so that finished concrete conforms to AS 3600 clause 17.5 and the Dimensional deviations schedule



### 3.3 **INSPECTION**

#### **Notice**

Inspection: Give notice so that inspection may be made of the following:

- Completed formwork before concrete placing.
- Used formwork, after cleaning and before re-use.

### 3.4 **SUBMISSIONS**

#### 3.4.1 **DESIGN - DOCUMENTATION**

Certification: For other than profiled steel sheeting composite formwork, submit certification by a qualified Structural Engineer experienced in formwork design verifying conformance of the design.

#### 3.4.2 **EXECUTION – DOCUMENTATION**

Calculations: Submit calculations by a qualified Structural Engineer experienced in formwork design to show that allowable concrete stresses will not be exceeded and formwork capability will be maintained if it is proposed that:

- Formwork procedures or loadings differ from the information included in the project documentation.
- Props above a floor do not coincide with the props below.
- Project documentation does not include formwork shoring or stripping procedures or allowable loadings from stacked materials.

Certification: Submit certification by a qualified Structural Engineer experienced in formwork design and construction verifying conformance of the completed formwork, including the suitability of the formwork for the documented surface finish class.

Moveable formwork: Show on formwork drawings for table forms, slip or jump forms the method of moving the forms and the sequence method. For slip forms show the average rate of movement. Demonstrate that the proposed procedures will permit the production of concrete of the specified quality and surface finish.

Stripping single storey suspended work: If the requirements of AS 3610 cannot be met, give notice. Surface repair method: If required, submit details of the proposed method before commencing repairs.

#### 3.4.3 **PRODUCTS – DOCUMENTATION**

Void formers: Submit test certificates to confirm that the formers comply with the following requirements under laboratory conditions, when placed on damp sand and loaded with a mass of wet concrete equal to at least the mass of the beams or slabs they are required to support:

- Deflection during placing and compaction of the concrete is less than the span of the beam or slab divided by 1000.
- Additional deflection between initial set and 7 days does not exceed span/400.
- Collapse and loss of load carrying capacity will occur not more than 48 hours after flooding with water, creating a void at least 60% of the original depth of the void former

### 3.5 **MATERIALS**

Material: Plywood sheeting to AS 6669.

Grade: To meet the design dimensions, loading and surface quality specified to AS 3610.

Joints: Seal the joints consistent with the surface finish class

Tolerances: To AS 3610 Table 3.3.3.



### 3.5.1 **FORM LININGS AND FACINGS**

Compatibility: Compatible with finishes applied to concrete.

### 3.5.2 **LOST FORMWORK**

General: Not to contain timber or chlorides and not to impair the structural performance of the concrete members.

### 3.5.3 **RELEASE AGENTS**

Compatibility: Compatible with finishes applied to the concrete.

### 3.5.4 **VOID FORMERS**

Material: Cardboard or fibreboard, collapsible on absorption of moisture.

## 3.6 **PREPARATION**

### 3.6.1 **CLEANING**

General: Remove free water, dust, debris and stains from the forms and the formed space.

## 3.7 **CONSTRUCTION**

### 3.7.1 **GENERAL**

General: Conform to the Concrete finishes work section.

Removable bolts: Remove the bolts without causing damage to the concrete.

### 3.7.2 **BOLT HOLE FILLING**

Cover: Position formwork tie bolts left in the concrete so that the tie does not project to within 50 mm of the finished surface.

Durability: Provide material with durability and colour matching the concrete.

Recessed filling: Fill or plug the hole to 6 mm below the surface.

### 3.7.3 **CORNERS**

Work above ground: Fillet at re-entrant angles, and chamfer at corners.

- Face of bevel 25 mm.

### 3.7.4 **EMBEDMENTS**

General: Fix embedment's through formwork to prevent movement, or loss of slurry or concrete, during concrete placement.

### 3.7.5 **OPENINGS**

General: In vertical forms, provide form openings or removable panels for inspection and cleaning, at the base of columns, walls and deep beams.

Access: For thin walls and columns, provide access hatches for placing concrete.

### 3.7.6 **RELEASE AGENTS**

Application: Before placing reinforcement, apply a release agent to form linings and facings.



### 3.7.7 SLIP FORMWORK

Provision for inspection: Provide access below the moving formwork, from which surface treatment and inspection may be carried out.

### 3.7.8 PROFILED STEEL SHEETING COMPOSITE FORMWORK

Fixing: If sheeting cannot be fixed to structural steel supports with puddle welds, or with welded shear studs in composite construction, provide details

### 3.7.9 STEEL LININGS

Rust: Clean off any rust and apply rust inhibiting agent prior to reuse.

### 3.7.10 VISUALLY IMPORTANT SURFACES

General: For concrete of surface finish classes 1, 2 or 3, set out the formwork to give a regular arrangement of panels, joints, bolt holes, and similar visible elements in the formed surface.

### 3.7.11 VOID FORMERS

Use: Cast designated suspended ground floor slabs and beams on void formers.

Protection: If likely to be affected by (rain) water keep void formers dry until use, place them on a firm level surface and place reinforcement and concrete with minimum delay.

## 3.8 COMPLETION

### 3.8.1 FORMWORK REMOVAL

Extent: Remove formwork, other than profiled steel sheeting composite formwork, including formwork in concealed locations, but excepting lost formwork.

Timing: Do not disturb forms until concrete is hardened enough to withstand formwork movements and removal without damage.

Stripping:

Foundation sides: 1 day (24 Hrs)

Beam sides, walls: 2 days (48 Hrs)

Columns: 5 days

Beams soffits and slabs: 21 days

Multi-storey work: Provide for stripping without disturbing props supporting succeeding floors.

- Post-tensioned concrete: Remove formwork supporting post-tensioned concrete members only when sufficient prestress has been added to support the loads.

### 3.8.2 LOADING BEFORE STRIPPING

General: Do not erect masonry walls or other brittle elements on beams and slabs while they are still supported by formwork.

## 3.9 REINFORCEMENT

### 3.9.1 DOWELS

Fixing: If a dowel has an unpainted half, embed this in the concrete placed first.

Tolerances:

- Alignment: 2 mm in 300 mm.

- Location:  $\pm$  half the diameter of the dowel.

Grade: 300



### 3.9.2 SUPPORTS

General: Provide proprietary concrete, metal or plastic supports to reinforcement in the form of chairs, spacers, stools, hangers and ties, as follows:

- Adequate to withstand construction and traffic loads.
- Contractor to allow for 50mm thick (17.5 MPa) site mixed concrete as a blinding layer for placement of plastic chair supports where the ground is wet or soft.
- With a protective coating if they are ferrous metal extending to the surface of the concrete, or are used with galvanized or zinc-coated reinforcement.

Minimum spacing:

- Bars:  $\square$  60 diameters.
- Mesh:  $\square$  800 mm.

Supports over membranes: Prevent damage to waterproofing membranes or vapour barriers. If appropriate place a metal or plastic plate under each support.

### 3.9.3 PROJECTING REINFORCEMENT

General: If 'starter' or other bars project beyond reinforcement mats or cages, through formwork or from cast concrete, provide a plastic protective cap to each bar until it is incorporated into subsequent work.

### 3.9.4 TYING

General: Secure the reinforcement against displacement by tying at intersections with either wire ties, or clips. Bend the ends of wire ties away from nearby faces of forms so that the ties do not project into the concrete cover.

Beams: Tie stirrups to bars in each corner of each stirrup. Fix other longitudinal bars to stirrups at 1 m maximum intervals.

Bundled bars: Tie bundled bars together so that the bars are in closest possible contact. Provide tie wire at least 2.5 mm diameter at centres  $\square$  24 times the diameter of the smallest bar in the bundle.

Columns: Secure longitudinal column reinforcement to all ties at every intersection.

Mats: For bar reinforcement in the form of a mat, secure each bar at alternate intersections

Tolerances: To NZS 3109.

### 3.9.5 CLEANING

General: Remove all debris from the formed space.

### 3.9.6 MATERIALS

Only deformed bars are to be used except where 6mm bars are approved by the Principals representative.

3.9.7 Provide all supports, hangers, spacers and ties to approval where not shown.

3.9.8 Plain and deformed bars shall comply with AS/NZS 4671 and be of mild steel and shall have a guaranteed minimum yield point of 300 megapascal, or higher where specified.

3.9.9 Welded wire fabric shall conform to AS/NZS 4671.

3.9.10 Alternative steel for reinforcement may be approved provided that by composition, manufacture, certified tests of strength, elongation, fatigue resistance and weld ability of the alternative has equivalent properties to that specified above.

### 3.9.11 ORIGIN & SPECIFICATION

Before delivery provide certificate stating origin manufacture's name, steel specification: Also a test certificate to prove steel conforms to specifications stated. All steel delivered to site shall be carefully marked for identifications with relevant certificates.



### 3.9.12 **PROTECTION**

Store steel clear of ground and undercover.

3.9.13 Provide walkways to approval if required.

3.9.14 Brace adequately all reinforcement projecting more than 3m from concrete, cut out defects around bars caused by movement as directed before resuming concreting.

### 3.9.15 **FABRICATION**

Fit ties and stirrups tightly around main reinforcement.

3.9.16 Bend deformed bars around rollers, not fixed pins.

3.9.17 Bend deformed bars only once.

### 3.9.18 **TOLERANCE & PROTECTIVE COVER**

Tolerances SHALL BE in accordance with NZS 3109.

3.9.19 The concrete cover is to the surface of stirrups / ties reinforcement.

### 3.9.20 **LAPS**

Excepting as SHOWN no lapping of reinforcement is permitted without written approval.

3.9.21 Where lengths of laps are not shown, ask for approval.

### **WELDING**

Welding of reinforcement shall comply with "Standard Arc Welding (Minor Works) unless otherwise specified.

3.9.22 Welding reinforcement is not permitted without written approval.

3.9.23 Identify rods or bars to be welded with tags or branding.

3.9.24 Before concreting, reinforcement must be inspected by supervising officers. Arrange with Principals representative suitable time for inspection before approval work done without his approval will be rejected. Twenty-four hours notice is required.

3.9.25 Remove all formwork preventing proper inspection.

3.9.26 Prior approval of cleaning, fabrication and securing reinforcement being satisfactory at time of concreting.

## 3.10 **COMPLETION**

### 3.10.1 **UNENCASED REINFORCEMENT**

General: If 'starter bars' and other items project from cast concrete for future additions and are exposed to the weather, provide details of protection.



### 3.11 **RESPONSIBILITIES**

#### 3.11.1 **GENERAL**

General: Provide finishes to formed and unformed concrete surfaces as follows:

- Appropriate to the importance (visual or physical) of the concrete elements.
- Compatible with the following trades and finishes.

### 3.12 **CROSS REFERENCES**

#### 3.12.1 **GENERAL**

Requirement: Conform to the following:

- General requirements.
- Concrete formwork.
- Concrete in situ.

### 3.13 **STANDARDS**

#### 3.13.1 **GENERAL**

Formed surfaces: To AS 3610.

### 3.14 **INTERPRETATIONS**

#### **DEFINITIONS**

General: For the purposes of this worksection, the following definition applies:

- Green concrete: Concrete which has set but not appreciably hardened.

### 3.15 **TOLERANCES**

#### 3.15.1 **SURFACE QUALITY**

Formed surfaces: Confirm conformance with the surface finish requirements of AS 3610 for the surface class nominated in the **Formed surface finishes schedule**.

#### 3.15.2 **FLATNESS**

Unformed surfaces: Confirm conformance with the **Flatness tolerance classes table** for the class of finish nominated using a straight edge placed anywhere on the surface in any direction.

**Flatness tolerance class table**

### 3.16 **SURFACE TREATMENT**

#### 3.16.1 **GENERAL**

Range: Do not proceed with the related work until the acceptable range of surface treatments has been determined.



### 3.17 **PRODUCTS**

#### 3.17.1 **MATERIALS**

##### **Surface hardeners, sealants and protectors**

Supply: Allow to apply PENTRA-GUARD (HP) hardener and sealer or approved equivalent.

### 3.18 **EXECUTION**

#### 3.18.1 **SURFACE MODIFIERS**

##### **General**

Application: Apply to clean surfaces in accordance with the manufacturer's requirements.

### 3.19 **FORMED SURFACES**

#### 3.19.1 **GENERAL**

General: Provide formed concrete finishes in conformance with the **Formed surface finishes schedule**.

Damage: Do not damage concrete works through premature removal of formwork.

#### 3.19.2 **CURING**

General: If forms are stripped when concrete is at an age less than the minimum curing period, commence curing exposed faces as soon as the stripping is completed. Apply Canzae Sinak VC5 Vapour Proof System or approved equivalent.

#### 3.19.3 **EVALUATION OF FORMED SURFACES**

General: If evaluation of formed surface tolerance or colour is required, complete the evaluation before surface treatment.

#### 3.19.4 **FINISHING METHODS**

General: If soffits of concrete elements or faces of concrete columns are to have a finish other than off the form, provide details of proposed procedures.

##### Blasted finishes:

- Abrasive: Blast the cured surface using hard, sharp graded abrasive particles until the coarse aggregate is in uniform relief.
- Light abrasive: Blast the cured surface using hard, sharp graded abrasive particles to provide a uniform matt finish without exposing the coarse aggregate.

Bush hammered finish: Remove the minimum matrix using bush hammering to expose the coarse aggregate, recessing the matrix no deeper than half the aggregate size, to give a uniform texture.

Exposed aggregate finish: Remove the vertical face forms while the concrete is green. Wet the surface and scrub using stiff fibre or wire brushes, using clean water freely, until the surface film of mortar is mechanically removed, and the aggregate uniformly exposed. Do not use acid etching. Rinse the surface with clean water.

##### Floated finishes:

- Sand floated finish: Remove the vertical face forms while the concrete is green. Wet the surface and rub using a wood float. Rub fine sand into the surface until a uniform colour and texture are produced.



- Grout floated finish: Remove the forms while the concrete is green. Dampen the surface and spread slurry, using hessian pads or sponge rubber floats. Remove surplus slurry and work until a uniform colour and texture are produced.

Smooth rubbed finish: Remove the vertical face forms while the concrete is green. Wet the surface and rub using a carborundum or similar abrasive brick until a uniform colour and texture are produced.

### 3.19.5 SURFACE REPAIRS

Surface repair method: If surface repairs are required, submit proposals.

## 3.20 UNFORMED SURFACES

### 3.20.1 GENERAL

General: Strike off, screed and level slab surfaces to finished levels, to the tolerance class noted in the **unformed surface finishes schedule**.

### 3.20.2 SURFACE FINISHES

General: Provide surface finishes in conformance with the **Unformed surface finishes schedule**.

### 3.20.3 SURFACE REPAIRS

Surface repair method: If surface repairs are required, submit proposals.

### 3.20.4 FINISHING METHODS – PRIMARY FINISH

Machine float finish:

- After levelling, consolidate the surface using a machine float.
- Cut and fill and refloat immediately to a uniform, smooth, granular texture.
- Hand float in locations inaccessible to the machine float.

Steel trowel finish: After machine floating finish as follows:

- Use power or handsteel trowels to produce a smooth surface relatively free from defects.
- When the surface has hardened sufficiently, retrowel to produce the final consolidated finish free of trowel marks and uniform in texture and appearance.

Burnished finish: Continue steel trowelling until the concrete surface attains a polished or glossy appearance, uniform in texture, appearance and free of trowel marks and defects.

Wood float finish: After machine floating use wood or plastic hand floats to produce the final consolidated finish free of float marks and uniform in texture and appearance.

Broom finish: After machine floating and steel trowelling draw a broom or hessian belt across the surface to produce a coarse even-textured transverse-scored surface.

Scored or scratch finish: After screeding, give the surface a coarse scored texture using a stiff brush or rake drawn across the surface before final set.

Sponge finish: After machine floating and steel trowelling, produce an even textured sand finish by wiping the surface using a damp sponge.

## 3.21 SCHEDULES

### 3.21.1 FORMED SURFACE FINISHES SCHEDULE

Surface finish class to AS 3610.1 Class 1 Finish



### 3.21.2 UNFORMED SURFACE FINISHES SCHEDULE

Steel trowel finish

## 3.22 CONCRETE

### 3.22.1 RESPONSIBILITIES

#### **General**

Provide concrete in situ that:

- Conforms to design details.
- Satisfies quality and inspection requirements.
- Conforms to the **Selections**.

### 3.22.2 CROSS REFERENCES

#### **General Requirements**

Requirement: Conform to the following:

- General requirements.
- Concrete formwork.
- Concrete reinforcement.
- Concrete finishes.

### 3.22.3 STANDARDS

#### **General**

Materials and construction: To NZS 3104

Specification and supply of concrete: NZS 3104, NZS 3109

### 3.22.4 INTERPRETATIONS

#### **Definitions**

General: For the purposes of this worksection the definitions given below apply.

- Assessment:

. Production: An assessment procedure for concrete specified by strength grade, carried out by the supplier on concrete produced by a specific supplying plant and based on the statistical assessment of standard compressive strength tests on concrete.

. Project: An assessment procedure for concrete specified by strength grade, specified at the customer's option, which provides additional test data for the statistical assessment of concrete supplied to a specific project.

Concrete class:

. Normal: Concrete which is specified primarily by a standard compressive strength grade and otherwise in accordance with NZS 3104.

. Special: Concrete which is specified to have certain properties or characteristics different from, or additional to, those of normal-class concrete and otherwise in accordance with NZS 3104.

- Batch: A quantity of concrete containing a fixed quantity of ingredients and produced in a discrete operation.

- Early age strength: A mean compressive strength at 7 days exceeding the values shown in NZS 3104.

- Joint:

. Construction: A joint provided to suit construction sequence with reinforcement continuous across the joint.

. Expansion: An unreinforced joint with the joint surfaces separated by a compressible filler.

- Ambient temperature: The air temperature at the time of mixing and placing of concrete.

- Average ambient temperature: Average value of the daily maximum and minimum ambient temperatures over the relevant period at a site.

Sample: A portion of the material used in the works, or to take such a sample.

- Specimen: A portion of a sample which is submitted for testing.

- Weather:

. Cold: Ambient shade temperature < 10°C.

. Hot: Ambient shade temperature > 30°C.



### 3.23 **INSPECTION**

#### **Notice**

Inspection: Give notice so that inspection may be made of the following:

- Base or subgrade before covering.
- Membrane or film underlay installed on the base or subgrade.
- Completed formwork, and reinforcement, cores, fixings and embedded items fixed in place.
- Surfaces or elements to be concealed in the final work before covering.
- Commencement of concrete placing

### 3.24 **TESTS**

#### 3.24.1 **GENERAL**

Sampling and testing of specimens: Submit test certificates, and also retain results on site.

#### 3.24.2 **CONSTRUCTION TESTS**

Frequency: Conform to NZS 3104. For each property test at least two specimens from each sample.

#### 3.24.3 **CONCRETE TESTING METHODS**

Testing methods: Conform to NZS 3112.

Sampling, identification and testing: Sample the concrete on site, at the point of discharge from the agitator to NZS 3112.

Drying shrinkage: Test 3 specimens of each type of concrete every 3 months or every 3000 m<sup>3</sup> placed concrete. Base assessments on the average of the 3 specimens test results. Conduct 2 sets of tests on trial mixes.

Slump: Test at least one sample from each batch before placing concrete from that batch in the work.

Strength grade/Characteristic compressive strength: Spread the site sampling evenly throughout the pour.

- Sampling frequency: To the **Project assessment strength grade sampling table**.
- Specimen size: Nominally 200 x 100 mm diameter but, if aggregate size exceeds 20 mm, nominally 300 x 150 mm diameter.

#### 3.24.4 **CONTROL TESTS**

General: Determine strength using site cured specimens.

#### 3.24.5 **EMBEDDED PRESSURE PIPES**

General: If leak tests have not been successfully completed, do not embed pipes.

#### 3.24.6 **LIQUID RETAINING STRUCTURES**

Testing for liquid tightness (to AS 3735): Required.

#### 3.24.7 **PROJECT ASSESSMENT**

Standard: To NZS 3104

#### 3.24.8 **TEST AUTHORITY**

General: Concrete supplier or other registered laboratory as approved by the clients representatives



### 3.24.9 TEST RECORDS

Records and reports: To AS/NZS 3112

### 3.24.10 PROJECT ASSESSMENT STRENGTH GRADE SAMPLING TABLE

Concrete Pour	Volume of Pour	Number of Cylinders/Cores Required	Testing of Samples
All structural pours i.e. foundations, floors, walls, beams and columns	Up to 5m <sup>3</sup>	6 cylinders per concrete pour	2 cylinders at 7 days 2 cylinders at 28 days 2 cylinders standby.
	5m <sup>3</sup> and above	12 cylinders per concrete pour	3 cylinders at 7 days 3 cylinders at 14 days 3 cylinders at 28 days 3 cylinders standby.

### 3.25 SUBMISSIONS

#### 3.25.1 PRODUCT CONFORMITY

General: Submit current assessments of conformity as follows:

- Certificate of conformity by a JAS-ANZ accredited third party.
- Declaration of conformity by an AS/NZS ISO 9001 quality management system certified supplier.
- Report by a NATA accredited laboratory describing tests and giving results which demonstrate that the product conforms.

#### 3.25.2 CONSTRUCTION PROPOSALS

Concrete: Submit proposals for mixing, placing, finishing and curing concrete including the following:

- Addition of water at the site.
- Changes to the plastic concrete mix.
- Curing and protection methods.
- Curing period for low-pressure steam curing, if proposed.
- Cutting or displacing reinforcement or cutting hardened concrete.
- Handling, placing, compaction and finishing methods and equipment, including pumping.
- Sequence and times for concrete placement, and construction joint locations and relocations.
- Site storage, mixing and transport methods and equipment, if applicable.
- Temperature control methods.

Cutting or coring: If cutting or coring of hardened concrete is proposed, provide details.

Loading: If proposed construction systems, loads and procedures, including propping and re-shoring, differ from submitted design documentation, submit details.

Sequence of concrete placement: If sequential placement of slab segments is proposed, provide details.

Sawn joints: Submit proposed methods, timing and sequence of sawing joints.

Multi-storey work: If any of the following occurs, submit details:

- Formwork procedures or construction loadings differ from the information included in the project documentation.
- Project documentation does not include formwork shoring or stripping procedures or allowable loadings from stacked materials.

Props: Props above a floor do not coincide with the props below.



### 3.25.3 PRODUCT PROPOSALS

Concrete mixes: Submit details, for each grade and type of concrete including any proposed use of special-purpose cement types.

Curing compounds: Allow to use Canzae Sinak VC5 Vapour proof system or approved equivalent immediately after placing fresh concrete.

### 3.25.4 PRE-MIXED SUPPLY

Delivery docket: For each batch, submit a docket listing the information required by NZS 3109, and the following information:

- For special class prescription concrete, details of mix, additives, and type of cement binder.
- Method of placement and climate conditions during pour.
- Name of concrete delivery supervisor.
- Project assessment carried out each day.
- The amount of water, if any, added at the site.

The concrete element or part of the works for which the concrete was ordered, and where it was placed.

- The total amount of water added at the plant and the maximum amount permitted to be added at the site.

### 3.25.5 CONSTRUCTION DOCUMENTATION

Cores, fixings and embedded items: If the locations of these items are not shown or are shown diagrammatically, submit shop drawings showing the proposed locations, clearances and cover. Indicate proposed repositioning of reinforcement.

## 3.26 MATERIALS

### 3.26.1 AGGREGATES

Standard: To AS/NZS 3111, AS/NZS 3121  
Maximum aggregate size 20mm

### 3.26.2 CEMENT

Cement shall be Portland Cement or rapid hardening Portland Cement.  
Standard: To NZS 3122.  
Age: Less than 6 months old.  
Storage: Store cement bags under cover and above ground.

### 3.26.3 COLOURED CONCRETE

Standard: To AS 3610.

### 3.26.4 POLYMERIC FILM UNDERLAY

Vapour barriers and damp-proofing membranes: To AS 2870 clause 5.3.3.

### 3.26.5 CHEMICAL ADMIXTURES

Contents: Free of chlorides, fluorides and nitrates.

### 3.26.6 CURING COMPOUNDS

Standard: To NZS 3109.



### 3.27 **EXECUTION**

#### 3.27.1 **POLYMERIC FILM UNDERLAY**

##### 3.27.1.1 **Location**

General: Under slabs on ground including integral ground beams and footings, provide a vapour barrier or, in areas prone to rising damp or salt attack, a damp-proofing membrane. As a minimum all vapour barriers under ground floor slabs to be 150 $\mu$  (Microns).

##### 3.27.1.2 **Installation**

General: To AS 2870 clause 5.3.3.

##### 3.27.1.3 **Base Preparation**

General: According to base type as follows:

- Graded prepared subgrade: Blind with sufficient sand to create a smooth surface free from hard projections. Wet the sand just before laying the underlay.
- Concrete working base: Remove projections above the plane surface and loose material.

#### 3.27.2 **CONCRETE**

##### 3.27.2.1 **General**

General: Provide concrete in conformance with the drawings.

##### 3.27.2.2 **Elapsed Delivery Time**

General: Ensure that the elapsed time between the wetting of the mix and the discharge of the mix at the site is in conformance with the **Elapsed delivery time table**. Do not discharge at ambient temperature below 10°C or above 30°C unless approved measures are taken by heating or cooling so that the delivered concrete is within the range 5°C to 35°C.

##### 3.27.2.3 **Elapsed Delivery Time Table**

Concrete Temperature at Time of Discharge (°C)	Maximum Elapsed Time (Hours)
24 – 27	1.5
27 – 30	1.0
30 – 32	0.75

##### 3.27.2.4 **Pre-Mixed Supply**

Addition of water: If water is to be added, comply with NZS 3104

Transport: Mode must prevent segregation, loss of material and contamination of the environment, and must not adversely affect placing or compaction.

##### 3.27.2.5 **Site Mixed Supply**

Emergencies: If mixing by hand is carried out, provide details.

Plant: Mix concrete in plant located on the construction site.



### 3.27.3 CORES, FIXINGS AND EMBEDDED ITEMS

#### 3.27.3.1 Adjoining Elements

General: For adjoining elements to be fixed to or supported on the concrete, provide for the required fixings. If required, provide for temporary support of adjoining elements during construction of the concrete.

#### 3.27.3.2 Protection

General: Grease threads. Protect embedded items against damage.

Compatibility: Ensure inserts, fixings and embedded items are compatible with each other, with the reinforcement and with the concrete mix to be used and surface finish requirements.

Corrosion: If in external or exposed locations, galvanize anchor bolts and embedded fixings or propose alternate materials such as stainless steel.

#### 3.27.3.3 Structural Integrity

General: Fix cores and embedded items to prevent movement during concrete placing. In locating cores, fixings and embedded items, reposition but do not cut reinforcement, and maintain cover to reinforcement.

Isolation: Isolate embedded items so that water cannot track to concrete providing minimum cover to reinforcement.

#### 3.27.3.4 Tolerances

General: Maximum deviation from correct positions:

- Anchor bolt groups for structural steel: To AS/NZS 2465.
- Cores and embedded items generally: 10 mm.
- Other fixing bolts: 3 mm.

### 3.27.4 CONCRETE WORKING BASE

#### 3.27.4.1 Finish

Membrane support: Wood float finish or equivalent.

#### 3.27.4.2 Installation

General: Lay over the base or subgrade and screed to the required level.

#### 3.27.4.3 Surface tolerance

Deviation: 5 mm from the correct plane; 5 mm from a 3 m straight edge.

### 3.27.5 PLACING AND COMPACTION

#### 3.27.5.1 Placing

Horizontal transport: Use suitable conveyors, clean chutes, troughs or pipes.

General: Use placing methods which avoid segregation and loss of concrete, and which minimise plastic settlement. Maintain a generally vertical and plastic concrete edge during placement.

Layers: Place concrete in layers  $\square$  300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set. Compact into previous layer.



### 3.27.6 PLACING AND COMPACTION

#### 3.27.6.1 **Placing**

Horizontal transport: Use suitable conveyors, clean chutes, troughs or pipes.

General: Use placing methods which avoid segregation and loss of concrete, and which minimise plastic settlement. Maintain a generally vertical and plastic concrete edge during placement.

Layers: Place concrete in layers  $\square$  300 mm thick, such that each succeeding layer is compacted before previous layer has taken initial set. Compact into previous layer.

#### 3.27.6.2 **Compaction**

Methods: Use immersion and screed vibrators accompanied by hand methods as appropriate to remove entrapped air and to fully compact the mix.

Vibrators: Do not allow vibrators to come into contact with set concrete, reinforcement or items including pipes and conduits embedded in concrete. Do not use vibrators to move concrete along the forms. Avoid over-vibration that may cause segregation.

#### 3.27.6.3 **Placing Records**

General: Keep on site and make available for inspection a log book recording each placement of concrete, including the following:

- Date.
- Specified grade and source of concrete.
- Slump measurements.
- The portion of work.
- Volume placed.

#### 3.27.6.4 **Rain**

General: During placement and prior to setting, protect the surface from damage, to achieve the desired finish.

#### 3.27.6.5 **Vertical Elements**

General: In vertical elements, limit the free fall of concrete to 1500 mm per 100 mm element thickness, up to a maximum free fall of 3000 mm, using enclosed vertical chutes or access hatches in forms.

Handling: Prevent premature stiffening of the fresh mix and reduce water absorption and evaporation losses. Mix, transport, place and compact the concrete in conformance with the **Elapsed delivery**

#### 3.27.6.6 **Time Table**

Placing concrete: Maintain the temperature of the freshly mixed concrete in conformance with the **Hot weather placing table**.

Formwork and reinforcement: Before and during placing, maintain temperature at  $\square$  35°C.

Temperature control: Select one or more of the following methods of maintaining the specified temperature of the placed concrete at < 35°C:

- Cool the concrete using liquid nitrogen injection before placing.
- Cover the container in which the concrete is transported to the forms.
- Spray the coarse aggregate using cold water prior to mixing.



- Use chilled mixing water.

#### 3.27.6.7 Hot Weather Placing Table

Concrete Element	Temperature Limit
Normal concrete in footings, beams, columns, walls and slabs	35 <sup>0</sup> C
Concrete in mass Concrete section $\geq$ 1m in each dimension or concrete of strength 40 MPa or greater, in section exceeding 600mm in thickness	27 <sup>0</sup> C

#### 3.27.7 CURING

##### 3.27.7.1 General

Allow to use Canzae Sinak VC5 Vapour proof system or approved equivalent immediately after placing fresh concrete.

#### 3.27.8 CONSTRUCTION JOINTS

##### 3.27.8.1 Location

General: Do not relocate or eliminate construction joints, or make construction joints not shown on the drawings. If emergency construction joints are made necessary by unforeseen interruptions to the concrete pour, submit a report on the action taken.

##### 3.27.8.2 Finish at Construction Joints

General: Butt join the surfaces of adjoining pours. In visually important surfaces make the joint straight and true, and free from blemishes impermissible for its surface finish class.

##### 3.27.8.3 Joint Preparation

General: Roughen and clean the hardened concrete joint surface. Remove loose or soft material, free water, foreign matter and laitance. Dampen the surface just before placing the fresh concrete and coat with a neat cement slurry.

#### 3.27.9 EXPANSION JOINTS

##### 3.27.9.1 Joint Filling

Joint filling: Fill with jointing materials as documented. Finish visible jointing material neatly flush with adjoining surfaces.

Preparation: Before filling, dry and clean the joint surfaces, and prime.

Water tightness: Apply the jointing material so that joints subject to ingress of water are made watertight.

##### 3.27.9.2 Jointing Materials

Type: Provide jointing materials compatible when used together, and non-staining to concrete in visible locations.

Bond breaking: Provide back-up materials for sealants, including backing rods, which do not adhere to the sealant. They may be faced with a non-adhering material.

Foamed materials (in compressible fillers): Closed-cell or impregnated types which do not absorb water.



### 3.27.10 COMPLETION

#### 3.27.10.1 Loading

Loading: Give notice before loading the concrete structure.

Protection: Protect the concrete from damage due to construction load overstresses, physical and thermal shocks, and excessive vibrations, particularly during the curing period.

Surface protection: Protect finished concrete surfaces and applied finishes from damage.

### 3.28 CONCRETE STRENGTH

3.28.1 Unless otherwise stated the characteristic strength of the concrete shall be as follows:

All-concrete shall be ready mix unless otherwise approved.

Element	Slump	Concrete Type	Maximum Aggregate Size	Minimum Concrete Strength F'c (Mpa)
Footing	80	A	20	25Mpa
Slabs on ground	80	A	20	25 Mpa
Columns	80	A	20	25 Mpa
Beams	80	A	20	25 Mpa
Suspended Slab	80	A	20	25 Mpa



## **SECTION 4 MASONRY**

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### **4.1 PRELIMINARY**

#### **4.1.1 GENERAL**

Refer to the general conditions of contract and the Preliminary and General clauses which will also apply to this section of the work.

#### **4.1.2 STANDARDS**

The following standards shall form part of this specification except as specified herein:

NZS 4455

NZS 4230:2004

NZS 3112

AS/NZS 4456:2003

Methods of test for concrete

Masonry units, segmental pavers and flags- Methods of test

### **4.2 MATERIALS**

#### **4.2.1 MASONRY UNITS**

Unless noted otherwise, all masonry blocks are to be type B as specified in NZS 4230 and shall comply with NZS 4455.

Supply sound units with exposed surfaces free from chips or other imperfections, of uniform colour and texture.

4.2.2 In addition to the principal units referred to other types may be used where approved, including a restricted number of units incorporating knock-in portions provided that portions are removed before the unit is brought to the wall. Remove these knock-in portions from the job.

4.2.3 For all cells filled construction, use open end bond beam units throughout, unless otherwise specified.

4.2.4 For intermittently filled construction and vertical reinforcement placed prior to laying of units, use open units at vertical reinforcement and standard units elsewhere. Where vertical reinforcement is placed after laying, open end units do not have to be used.

### **4.3 WORKMANSHIP**

Concrete blocks shall be laid by experienced tradesmen in accordance with the best trade practice and approved by the Principals representative. Material and / or workmanship that do not reach an acceptable standard, that is, units are out of line, or incorrectly laid etc. will be dismantled and rebuilt at the contractor's expense. Mortar joints must be constantly even in thickness and perpend must be in line vertically. Care shall be taken to ensure that control joints as required maintain a vertical line.

### **4.4 SCOPE**

Generally construct all walls complete with reinforcing bond-beams, lintels, grout filling, openings etc. As shown on the drawings and specified herein.



#### 4.5 **MORTAR**

Mortar shall be mixed in the proportion of 1 cement: 0.25 lime: 3 sand provided that the lime may be replaced by an approved Plasticiser and waterproofing agent in the proportions recommended by the manufacturer. Mortar shall have minimum compressive strength of 12.5 MPa after 28 days. Mortar must be trowelled to the blockwork to give a full continuous mortar bed on each face, tamped to give 10mm even mortar joints both horizontally and vertically. Mortar must also be trowelled into the end of each block prior to laying and NOT laid and the perpend pointed after. Where indicated as fairface blockwork joints shall be finished concave. Where blockwork is plastered joints shall be left raked suitable for plaster finish.

#### 4.6 **GROUT FILLING**

All blockwork shall be filled with 30 Mpa for service core and 17.5 MPa elsewhere. Clean out all debris, remove projecting mortar before filling. Co-operate with the contractor in the filling of blockcells and bond beams. Filling shall occur as the walls are built. Not more than 4 courses being built up before filling commences.

#### 4.7 **REINFORCEMENT**

##### 4.7.1 **GENERAL**

Take delivery of reinforcing steel from the steelworker as specified under Concretor and build in as work proceeds. Main reinforcing to blockwork shall with deformed mild steel with plain steel for ties.

##### 4.7.2 **TIES**

Use mechanical ties where bonding is not possible such as wall tee junctions. Mechanical ties shall be 34 x 10 mild steel flats 675 long bend ends and spaced every fourth course vertically.

4.7.3 Provide as shown in the drawings.

4.7.4 Where the reinforcement is not specified the following should be adhered to:

(a)	200	blockwork	:	
		vertical	:	12 diameter every 400 crs.
		horizontal	:	16 diameter every 3 <sup>rd</sup> course in a bond beam.
(b)	150	blockwork	:	
		vertical	:	12 diameter every 600mm crs.
		horizontal	:	16 diameter every 3 <sup>rd</sup> course in a bond beam.
(c)	100	blockwork	:	
		Vertical	:	12 diameter every 400 crs.
		horizontal	:	16 diameter every 3 <sup>rd</sup> course

At top of 100 Blockwork provide 100 x 200 bond beam reinforced with 2 - 12 diameter and 6mm ties at 150 crs.

#### 4.8 **JOINTS**

Where indicated on the drawings all masonry are to be constructed with a preformed joint filler consisting of selected impregnated fibres, such as Expandite Joint Filler. The filler is to be the same thickness as the joint width and is to extend through the full thickness of the masonry except where specified otherwise. Ordinary insulation board dipped in creosote will not be accepted.



#### 4.9 **BUILDING-IN**

##### 4.9.1 **FRAMES**

Built in timber door and window frames where fairface blockwork is specified and if requested to do so by the main Contractor. Frames will be set out complete with fixing by the Carpenter. Protect frames from damage during construction.

##### 4.9.2 **BOLTS, PLATES, ETC.**

Built in all bolts, straps, soap holders, etc. provided by the Carpenter.

##### 4.9.3 **PIPES ETC.**

Build in pipes, conduits, electrical switch boxes, switchboards etc. provided by others.

#### 4.10 **CLEANING DOWN**

On completion, clean down walls and remove all mortar projections and irregularities. Make good damaged corners, arises, on surface of fairface blockwork. Patch and make good around pipes etc. penetrating blockwork. Leave walls to be plastered suitable for the application of plaster.

#### 4.11 **DEFECTS**

Before decorating finishes are applied to a face blockwork all surfaces shall be properly cleaned down ; the work will then be inspected and the Principals representative will direct what attention is required if any defects exist. Generally minor defects may be carefully patched but faulty blocks or badly damaged blocks will be condemned and must be cut out and replaced. Where blockwork is to receive paint or other decorative treatment, minor defects may be patched provide that such patching will be completely cancelled by the paint etc. Allow to make good where pipes etc. penetrate the blockwalls.

#### 4.12 **FAIRFACE BLOCKWALL** (where applicable)

All fairface blockwall shall be laid in accordance with the relevant clauses of NZS 4210.

- 4.13 Blockwalls shall be perfectly true and plumb. Joints shall be even thickness and shall not vary beyond the tolerance of plus or minus 2mm but shall average out at 10mm over walls. Any blockwork which shows more than 6mm under part of a 800mm long straight edge placed anywhere across the blockwork surface or more than 3mm under a 600mm straight edge placed anywhere across the blockwork surface will be condemned, broken down and rebuilt to be within the above mentioned tolerances at the Contractor's expense.

Point up with mortar on all faces as the laying proceeds and build in all fixings required and provided by other trades.

#### 4.14 **CUTTING OF BLOCKWORK**

Note that where blocks are required to be cut they shall only be cut with a "Vibrapac" or other suitable masonry saw. Holes and openings in face blockwork shall be neatly cut to the required shape and size.

#### **CONCEALED PIPEWORK**

It is most important that the Blocklayer study the positions of pipework, waste pipes and vents which are required to be concealed in the Concrete Blockwork. No allowance will be made for any pipes not treated as specified and will be required to be concealed as the Contractor's expense.



## **SECTION 5    STRUCTURAL STEELWORKER**

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### **5.1    PRELIMINARY**

#### **5.1.1    GENERAL**

Refer to the General Conditions of Contract and the Preliminary & General clauses which will also apply to this section of the work.

The engineer requires a minimum of 48 hrs prior notice for site inspection requests.

#### **WELD INSPECTION AND QUALITY CONTROL**

##### **FABRICATION OF STEEL IN CHINA**

Structural Engineer or other nominated member of consultant team to identify a random section of steel to be removed from a member under fabrication at the fabrication yard. This section (approx. 300mm wide) will be taken to a SGS laboratory in Australia and tested for the following:

- 1) Chemical composition analysis:    (C, Si, Mn, P, S)
- 2) Tensile Test:    Ultimate Tensile Strength, Yield Strength, Elongation.
- 3) Charpy Impact Test

Welds to be inspected at the fabrication yard by SGS and reports sent to consultants to inspect during fabrication process.

##### **SITE WELDING**

Site welding shall be carried out by SGS and reports provided to consultants.

#### **5.1.2    STANDARDS**

The following standards shall form part of this specification.

NZS 3404	Steel structures standard Part 1: Steel structure standard Part 2: Commentary to steel structure standard
NZS 4711	Qualifications test for metal-arc welders
NZS 4781	Code of Practice for safety in welding and cutting
AS/NZS 1111	ISO metric hexagon commercial bolts and screws
AS/NZS 1112	ISO metric hexagon nuts, including thin nuts, slotted nuts and castle nuts
AS/NZS 1252	High strength steel bolts with associates nuts and washers for Engineer
AS/NZS 1554	Structural steel welding 1554.1: Welding of steel structures
AS/NZS 4855	Welding Consumables (electrodes)
AS/NZS 4680	Hot dip galvanised coatings on ferrous articles
AS/NZS 9002	Quality systems – Model for quality assurance in production, installation and servicing
AS/NZS 4600	Cold-formed steel structures
AS/NZS 3679	Hot rolled bars and sections
AS/NZS 3678	Hot rolled plates
AS/NZS 1163	Cold formed structural steel hollow sections



AS/NZS 2312	Guide to the protection of structural steel
AS 1627	Metal finishing – Preparation and pre-treatment of surfaces 1627.2: power tool cleaning 1627.4: Abrasive blast cleaning
AS 1897	Electroplated coatings on threaded components (metric coarse series)
AS 1397	Steel sheet and strip
AS 1418	Cranes, hoists and winches
AS 1273	Washers
AS 1627	Metal Finishing
AS 3828	Safe erection of structural steel for buildings
AS4100	Steel structures
NZBCF5/AS1	Sprayed metal coatings Part 1: Protection of iron and steel by aluminium and zinc against atmospheric corrosion
ASS/SNZ HB62	Safe erection of building steelwork

## 5.2 **GENERAL**

### 5.2.1 **RESPONSIBILITIES**

#### **General**

General: Provide structural steel work that is integrated into the building construction.

### 5.2.2 **CROSS REFERENCES**

#### **General**

Requirement: Conform to the following:

- General requirements
- Steel – hot dip galvanised coatings
- Steel – protective paint coatings

### 5.2.3 **STANDARDS**

#### **General**

Materials, construction, fabrication and erection: To NZS 3404.

Cold-formed steel: AS/NZS 4600

### 5.2.4 **ADJOINING ELEMENTS**

#### **General**

Fixing: provide for the fixing of the adjoining building elements that are to be connected to or supported on the structural steel

### 5.2.5 **INSPECTION**

#### **Notice – on site**

Inspection: Give notice so that inspection may be made of the following:

- Anchor bolts in position before casting in.
- Steelwork and column bases erected on site, before grouting, encasing, site painting or cladding.
- Tensioning of bolts in categories 8.8/TB and 8.8/TF.
- Reinforcement and formwork in place prior to any encasement.
- After any grouting, encasement, fire protection or site painting is completed.

### 5.2.6 **SUBMISSIONS**

#### 5.2.6.1 **Origin of Steel**



Requirement: If it is proposed to use steel not of Australia or New Zealand origin, submit documentation which demonstrates that the steel complies and is suitable for fabrication to Australia or New Zealand standards.

#### 5.2.6.2 Bolts

Compliance: Submit a manufacturer's compliance/test certificate from an accredited testing organisation confirming compliance with AS/NZS 1252.

Independent certification: if bolts manufactured from outside Australia, provide an Australian NATA accredited laboratory independent compliance certificate based on appropriate testing and verification.

#### 5.2.6.3 Shop Drawings

General: Submit shop drawings showing the following information:

- Identification
- Steel type and grade
- Dimensions of items
- Required camber, where applicable
- Connection details
- Orientation of members
- Surface preparation methods and coating system if shop applied.
- Breather holes for hollow sections (with seal plates) being hot-dip galvanized.
- Location of and preparation for site welds.
- Required fixings for adjoining building elements.

Substitution: if alternative sections or connections are proposed, provide details.

Purlins and girts: If it is proposed to support other than cladding on or from purlins and girts, provide details.

Splices: If variations to document splice locations or if additional splices are proposed, submit details.

#### 5.2.6.4 Materials and Components

Concrete or masonry anchors: if masonry anchors other than as shown on the drawings are required or proposed for the support or fixing of structural steel, submit evidence of the anchor capacity to carry the load.

#### 5.2.6.5 Execution

Anchor bolts: If anchor bolts do not meet specified location tolerances, submit proposals that will allow steel erection to proceed.

Splicing: if splicing of structural members is intended, submit proposals.

Distortions: Submit proposals for preventing or minimising distortion or galvanised components, welded components or welded and galvanised components; and proposal for restoration to design shape.

### 5.3 PRODUCTS

#### 5.3.1 STEEL TYPE AND GRADE

##### 5.3.1.1 Material

Conformance: Steel members and sections shall conform to the **Steel grade (minimum) table. Hot Rolled Steel**

Member Type	Steel Grade
UB, UC, PFC and TFC, EA & UA Flat bars and plates	Fy = 300MPa
RHS, SHS	Fy = 350MPa



## Cold Formed Steel

- 1.0mm BMT: G550, Z450
- 1.2mm BMT: G500, Z450
- 1.5, 1.9, 2.4 and 3.0mm BMT: G450, Z450

Z indicates minimum zinc coating mass in g/m<sup>2</sup>

G indicates minimum yield strength in MPa.

### 5.3.1.2 Type of Steel Grade

Universal beams and columns, parallel flange channels, large angles to AS/NZS 3679.1 300

Flat, small angles, taper flange beams and columns to AS/NZS 3679.1 300

Welded sections to AS/NZS 3679.1 300

Hot rolled plates, floor plates and slabs to 3678 300

Hollow sections to AS/NZS 1163:

- Circular section less than 165 mm nominal outside diameter

- Sections other than the above

C250/C350

C350/C450

Cold formed purlins and girts to AS 1397 G450 Z350

## 5.3.2 BOLTS

### Bolts, nuts and washers

Finish: Hot-dip galvanised, corrosion-free, and in serviceable condition.

## 5.4 EXECUTION

### 5.4.1 FABRICATION AND EXECATION

#### 5.4.1.1 General

Care: Shop detail and fabricate members so that they can be properly erected.

Substitution: If any substitution of members is proposed, provide details.

#### 5.4.1.2 Beam Camber

General: If beam members have a natural camber within the straightness tolerance, fabricate and erect them with the camber up.

#### 5.4.1.3 Straightening

Care: If correcting distorted members, conform to the submitted procedures and avoid damage

#### 5.4.1.4 Work Exposed to View

Welds: Grind smooth but do not reduce the weld below its nominal size.

Shearing, flame cutting and chipping: perform carefully and accurately.

Comers and edges: Grinds fair those comers and edges, which are sharp, marred, or roughened.

#### 5.4.1.5 Site Work

General: Other than work shown on the shop drawings as site work, do not fabricate, modify or weld structural steel on site.



#### 5.4.1.6 Identification Marks

General: Provide marks or other means of identifying each member compatible with the finish, for the setting out, location, erection and connection of the steelwork in accordance with the marking plans.

Cold-formed members: Clearly mark material thickness

Monorail beams: Identify and mark rated capacity in accordance with AS 1418.18 clause 5.12.6.

#### 5.4.1.7 Tolerances

Measurement: Tolerances are to be checked by measurement after fabrication when corrosion protection has been applied.

Conformance: To NZS 3404

### 5.5 **WELDING**

#### 5.5.1 GENERAL

Standard: To AS/NZS 1554.1

#### 5.5.2 WELD CATEGORY

Weld categories not shown on the drawings: Category SP.

#### 5.5.3 WELD TYPE

Weld type not shown on the drawings: 6mm continuous fillet weld made using E48XX electrodes or equivalent.

### 5.6 **BOLTING**

#### 5.6.1 GENERAL

Standard: To AS 1111.1 and AS/NZS1252

#### 5.6.2 CONNECTIONS

Connection Type: For connections not shown on the drawings, provide 10mm plates, 6mm continuous fillet welds and 2 M16 bolts in 8.8/s bolting category.

#### 5.6.3 ANCHOR BOLTS

General: Provide each anchor bolt with 2 nuts and 2 oversize washers and provide sufficient thread to permit the levelling nut and washer to be set below the baseplate.

Galvanising: Galvanise all components.

Hexagonal bolts: To AS 1111.1

Hexagonal nuts: To AS1112.3

Plain washers: To AS 1237.1

Set out: Set out bolt groups using templates and subjected to survey check.

#### 5.6.4 LOCK UNITS

General: Provide lock nuts for bolts in moving parts or parts subject to vibration and for vertical bolts in tension.



## 5.6.5 TENSIONING OF BOLTING CATEGORIES 8.8/TB AND 8.8/TF

Method: Contractor to allow for use of a torque wrench to ensure that the required torque has been achieved. Contractor to inform Engineer for inspection and verification.

## 5.7 SURFACE PREPARATION AND TREATMENT

### 5.7.1 GENERAL

General: Conform to the steel – protective paint coatings and/or Steel – hot-dip galvanised coatings work sections as appropriate.

General: Coat structural steelwork not encased in concrete.

Standard: To AS 1627.4 and AS/NZS 2312 Section 1.

Steel surfaces: Remove loose mill scale, loose rust, oil, grease, dirt, globules of weld metal, weld slag and other foreign matter. Ensure surfaces are dry. Surface preparation. Class 2.5 blast.

Coating: Coat prepared steelwork as follows:

-Primer: Zinc phosphate primer.

-Thickness: 75µm

-Requirement: Verify and record thickness.

-Time delay: Prime the steel surface as soon as possible after surface preparation and before the surface deteriorates. If the surface is contaminated or rust bloomed, repeat surface preparation before priming.

-Conditions: Do not prime in adverse conditions.

-Concrete encasing: Where members are part concrete encased extend the priming 25mm into the surface to be encased.

-Clearances: Keep priming clear of members and components to be site welded, and surfaces against which concrete are to be poured (including concrete encasing except as noted above). On completion of site welding, of concrete pouring and of 8.8/TF bolting, prime to give complete coverage of exposed surfaces.

-Inaccessible surfaces: Where surfaces will be in contact or near contact after fabrication or erection, apply the finish and allow it to dry before assembly.

Marking: On the contact surfaces or friction type joints, confine the use of marking ink to the minimum necessary for marking hole positions.

Shop work: Apply the primer coat or protective system to the structural steel before delivery to the site.

Transport and handling: Do not damage the paintwork.

Site work: After erection, repair damage to the shop coating and apply coating omitted at site connections

## 5.8 FIRE PROTECTION COATING

### General

General: Apply fire protection to structural steelwork in conformance with the structural fire protection systems worksection.

## 5.9 ERECTION

### 5.9.1 GENERAL

Standard: To AS 3828.

Execution: Ensure that every part of the structure has sufficient design capacity and is stable under construction loads produced by the construction procedure or as a result of construction loads, which are applied.



### 5.9.2 TEMPORARY WORK

General: Provide all necessary temporary bracing and propping.

Temporary connections: If required cleats are not shown on shop drawings, submit details.

Temporary members: If temporary members are required, fix so as not to weaken and deface permanent steelwork.

### 5.9.3 HAND FLAME CUTTING

General: If hand flame cutting of bolt holes appears to be necessary, submit a report and proposed alternative options.

### 5.9.4 SITE WELDS

Completion: Weld only when correct alignment and preset or camber have been achieved.

Overhead welding: If overhead welding is required, submit proposals.

### 5.9.5 ANCHOR BOLTS

General: For each group of anchor bolts provide a template with setting out lines clearly marked for positioning the bolts when casting in.

### 5.9.6 GROUTING AT SUPPORTS

Preparation: Before grouting steelwork to be supported by concrete or masonry, set steelwork on packing or wedges.

Permanent packing or wedges: Form with solid steel or grout of similar strength to the permanent grout

Temporary packing or wedges: Remove before completion of grouting.

Timing: Grout at supports before the construction of any supported floors, walls, roofing, wall cladding or precast.

Temperature: Do not grout if the temperature of the base plate or the footing surface exceeds 35<sup>0</sup> C.

Minimum compressive strength ((MPa): 40 – Non shrink grout to be used.

### 5.9.7 HANDLING

Care: Handle members or components without overstressing or deforming them.

Protection: Wrap or otherwise protect members or components to prevent damage to surface finishes during handling and erection.

### 5.9.8 DRIFTING

Limitation: Use drifting only to bring members into position, without enlarging holes or distorting components.

### 5.10 REPAIRS

#### **General**

General: Repair finishes to ensure the full integrity of each phase and each coating.

### 5.11 COMPLETION

#### 5.11.1 TOLERANCES

Compliance: After erection is complete confirm compliance with NZS 3404.



### 5.11.2 TEMPORARY CONNECTIONS

General: Remove temporary cleats on completion and restore the surface.

### 5.12 PAINTING OF STRUCTURAL STEELWORKS

All steelwork to be grit blast to AUST standard 1627.4 Class 2 Round off rough welds, sharp steel edges and weld spatter.

The following paint system or approved alternative shall be used on all structural steel members excluding pre-galvanised members i.e. purlins, nuts, bolts and washers.

Prepare steel surface as follows:

- |                    |   |  |
|--------------------|---|--|
| Degrease washing   | - | Remove all contaminants by detergent washing. Cleaning off all residues. |
| Waterblasting      | - | Clean fresh water @ 3000psi & @ 20 L/min minimum                         |
| Abrasive Blast 2 ½ | - | Abrasive Blast Cleaning – refer to AS 1627.4                             |

#### Exterior

Primer Coat – Resene Armourzinc 120 (DFT 75 microns)

1<sup>st</sup> Coat – Resene Armourcote 510 (DFT 200 microns)

2<sup>nd</sup> Coat – Resene Uracryl 403 (DFT 75 microns)

#### Interior

Primer Coat – Resene Zinplate 10 (DFT 75 microns)

Finishing Coat – Resene Armourcote 510 (DFT 200 microns)

The above paint system is to be applied in strict accordance with manufacturers specification. A 15 year warranty shall be provided on both the paint system and application.

All bolts, nuts and washers to be galvanised.

All bolts to be grade 8.8 bolts.

The paint shall be handled and applied strictly, in accordance with the manufacturers instruction. All portions of the shop coat which have been damaged in transit and erection including site welds shall be scrapped, brushed, washed with clean water, dried and painted with one further coat of the approved primer.



## **SECTION 6 METALWORKER**

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### **6.0 PRELIMINARY**

#### **6.1 GENERAL**

Refer to the applicable Fiji Standard Form Of Building Contract and the Preliminary & General clauses which will also apply to this section of the work.

#### **6.2 STANDARDS**

The following standards and all relevant latest AS/NZS standards shall form part of this specification.

AS/NZS 1554.1 – 7                      Structural Steel Welding

#### **6.3 WORKMANSHIP**

All workmanship in this section shall be carried out by competent tradesman to the highest possible standards.

#### **6.4 MATERIALS**

All mild steel and brass used in this work shall be the best of their respective kinds complying with the standards mentioned above.

#### **6.5 GALVANISING**

All mild steel angles, bolts, straps, rectangular hollow sections etc. used shall be galvanised where specified or shown on drawings. Hot dip galvanising is preferred where at all possible but those components that are fabricated from un-galvanised mild steel may be electro galvanised. Prime all welded joints in galvanised work with zinc epoxy primer applied in accordance with the manufacturers instructions.

#### **6.6 WELDING**

All welding and bracing shall be carried out in accordance with the above mentioned standards so as to give full strength to welded joints.

6.7 Unless otherwise specified use 50 x 50 x 3mm thick galvanised washer.



## SECTION 8 CARPENTRY

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### 8.1 PRELIMINARY

#### 8.1.1 GENERAL

Refer to the General Conditions Of Contract and the Preliminary & General clauses which will also apply to this section of the work.

#### 8.1.2 STANDARDS

The following standards shall form part of this specification.

NZS 3601	NZS 3605	NZS 3618	AS/NZS 1530.3
NZS 3602	AS/NZS 1328	AS/NZS 1148	NZMP 3640
NZS 3603	AS/NZS 2269	NZS 3631	
NZS 3604	NZS 3615		

### 8.2 MATERIALS

#### 8.2.1 GENERAL

All materials shall be the best of their respective kinds. Timber used in this contract shall be the best quality, in accordance with the above mentioned standards. Timber shall be well seasoned, treated with preservative and have the correct respective moisture content, free from shakes, bad knots and any other defects. The timber used shall be as specified unless specifically mentioned in the drawings to the contrary.

All dimensions on the plan are relative to rough sawn sizes unless stated to the contrary. All proprietary linings, fittings, materials etc. shall be of an approved manufacture and design. All nails, bolts etc. used shall be hot dip galvanised unless stated to the contrary.

#### 8.2.2 ORDERING OF MATERIALS

Contractor shall place orders for all timbers within two weeks of contract commencement. Any claims arising from delay in ordering will not be allowed. Notify Principals representative immediately if any timber size or species is unobtainable.

#### 8.2.3 TYPES OF TIMBERS

Unless specified otherwise the following timbers shall be used - exposed timbers shall be of one species only.

Roof framing	Exposed beams, rafters and purlins	Treated Dakua Makadre, treated Kauvula
Sarking		Treated Dakua Makadre, treated Dakua Salusalu, treated Kaudamu, treated Pine
Weatherboards	External	Treated Dakua Makadre, treated Dakua Salusalu, treated Kaudamu
Floor framing bearers, joists		Rosarosa, Yasiyasi Sacau, Yasiyasi, Sacau treated Kauvula
Wall framing		Treated Dakua Makadre, treated Kauvula, treated Kaudamu



Flooring	Exterior	Sacau, Vesi, Yasiyasi Damanu, Rosarosa
Balustrades	Exterior & Interior	Treated Dakua Makadre, treated Dakua Salusalu, treated Kaudamu, treated Kauvula
Frames		Treated Dakua Makadre, \treated Dakua Salusalu, treated Kaudamu, treated Kauvula
Sills		Treated Dakua Makadre, treated Dakua Salusalu, Rosarosa, Sacau, Vesi, Yasiyasi
Stairs	Exterior & Interior	Rosarosa, Sacau, Yasiyasi, Vesi

#### 8.2.4 TREATMENT

All timbers noted above as being treated shall have Tanalith NCA pressure treatment as specified at the end of this section.

#### 8.2.5 MOISTURE CONTENT

The moisture content of the timbers shall be strictly adhered to. The Principals representatives reserve the right to submit any timber to a recognised testing authority for testing and report.

The contractor shall replace at his own expense any timber which has been damaged or shrunk on finished work caused through the use of imperfectly seasoned timbers. Generally the moisture content of framing timbers shall not exceed 18%.

#### 8.2.6 NAILS & FASTENERS

All brads, nails etc. shall be the best quality of appropriate gauge, strength shall be long enough to enter the second timber for at least half their length before being punched. Screws shall be of sufficient length and gauge for their purpose. Screws for door furniture and other iron mongery shall be of material and pattern to match the various fittings. All screws exposed to the outside shall be solid brass. All nails and bolts shall be galvanised.

#### 8.3 WORKMANSHIP

Workmanship shall be of the highest standard in accordance with best trade practice. The whole of the work shall be properly framed and the various sections securely spiked and / or strapped together to withstand hurricane conditions. All finished or partly finished work shall be protected from discolourations. Surface injury or other damage from exposure to weather or other causes. All nail holes in exposed work shall be punched.

#### 8.4 EXTENT OF WORK

This section includes all carpentry work shown on the drawings. It also includes waiting upon all trades, cutting, boring, nogging as they may require for the proper completion of the whole contract.

#### 8.5 PRIMING & SEALING

The external face, ends and butts of all external finishing timbers and all finishing timbers, frames etc. in contact with concrete or blockwork shall be primed before fixing.

All rafters, beams and sarking which are exposed shall have a priming coat applied before erection.



This clause should be read in conjunction with the Painting Section for reference to those timbers requiring different types of priming. It is the Contractor's responsibility to ensure that timber being finished with oil stain or varnish shall receive their correct first coat.

8.6 **FINISH**

Remove all arises, rough and uneven patches, hammer marks, machine marks and other surface defects to the satisfaction of the Principals representatives before any finishing medium is applied.

8.7 **DAMP PROOF COURSE**

Between all faces of framing timbers in contact with concrete or concrete blockwork place a 3 ply bitumenous fabric.

8.8 **ATTENDANCE**

Wait upon all trades, cut or bore timbers as they may require. Provide and fix all blocks, supports and the like. Reduce to a minimum, the cutting of structural members and in no circumstances cut into or check rafters, beams and purlins within the middle third of the length. Attachments to concrete and concrete blocks shall be made by means of screws and plates and plugs, bolts either built in or engaging and expanding sockets of the approved design or as detailed.

8.9 **PROTECTION**

All timber and joinery upon arrival at the site shall be immediately fillet stacked. All joinery, kiln dried timber and all dressed timber shall be protected from the weather and from damage continuously during the contract, before and after installation.

8.10 **TREATMENT**

Treat all non heart and hardwood timbers with Tanalith NCA preservative with the following composition :

Copper Sulphate	Nominal Percent - 29.7
Sodium Chromate	31.7
Arsenic Pentoxide	26.3
Sodium Pyroarsenate	12.3

The degree of treatment shall be as set out in the Schedule Of Treatment for timber in various positions as follows:

- A). Out of ground contact and continuously protected from the weather or painted and adequately ventilated 3.5kg/m (cubic).
- B). Out of ground contact but not continuously protected from the weather or situations such as in Continuous contact with damp masonry in unventilated ground line floor, cellars, wet conditions, exposed verendah floors, garden furniture, fire escapes, barge boards etc. 7kg/m cubed.
- C). Ground contact situations where timber is in contact with the ground or similar situations in normal conditions prevailing in either the wet or dry zones in Fiji. 12 - 18 kg/m cubed as directed.
- D). Marine uses exposed to marine boring organisms 48kg/m cubic.

Additional information on timber treatment can be obtained from the Forestry Department, Suva.



### 8.11 **HARDWARE**

8.11.1 All hinged doors unless otherwise specified will be hung on 3/100m butt hinges.

Door Furniture shall be positioned :

Knob & Furniture	800 off floor
Lever & Furniture	1250 off floor

### 8.12 **PREPARATIONS FOR HANDING OVER**

Before handing over the building to the owner, the contractor shall properly prepare the building for occupation and use. He shall remove all rubbish and gear, check and adjust all hardware, present all keys and in all areas where linings are applied, employ an approved firm of commercial cleaners to wash down all washable surfaces and polish all floor coverings. All glass throughout the building shall be washed and left free of mark, paint spots etc. and all floors where no floor coverings are applied will be swept and hosed down after which all floor channels, traps, floor drains and sumps shall be cleaned out. All foreign materials, nails, silt etc. to be removed from all gutters. Refer to Preliminary & General clauses on completion.

### 8.13 **JOINERY**

Take delivery of all joinery and fix in accordance with good trade practice in accordance with positions as shown on the drawings.

### 8.14 **FINISHES**

All dressing grades shall be machine dressed and in addition all finishing timbers shall be scraped and sand papered by hand to a smooth even surface ready to receive painting and polishing. No machine marks, hammer marks or surface defects shall be visible in finished work. Punch all nails and remove all arises where polished work is specified, the timber shall be carefully matched for uniformity of colour grain and texture to ensure a uniform finish. Internal doors shall be finished with a coat of stain, coat of shellac, 2 coats Matt Polyurethane, rub down with steelwool and polish with Linseed Oil.

### 8.15 **RESAWN TIMBERS**

Timber scheduled on the Schedule OF Finishes shall be timbers which have been resawn with a band saw to remove circular mill saw marks.

### 8.16 **COMPLETION**

On completion of all above ceiling trades and adjustments, leave ceiling and suspension where exposed perfectly clean, aligned straight and level.



## **SECTION 14 GLAZIER**

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### **14.1 PRELIMINARY**

#### **14.1.1 GENERAL**

Refer to the General Conditions of the contract and the Preliminary & general clauses which will also apply to this section of the work.

#### **14.1.1 STANDARDS**

The following and all relevant latest AS/NZS standards shall form part of this specification :

AS 1288	Glass in buildings, selection and installation
NZS 4223.1	Code of practise for glazing in buildings – glass selection and glazing
AS/NZS 4667	Quality requirements for cut-to-size and processed glass.

### **14.2 MATERIALS**

All glass used shall be of good quality manufacture free of all blemishes and sizes suitable for each location. Refer to the window and door schedule for the sizes of respective glazing. Refer schedule of safe glazing sizes for thickness.

#### **14.2.1 OBSCURE GLASS**

Spotswood 6mm or as selected.

#### **14.2.2 MIRRORS**

6mm selected glazing quality polished plate. Supply and fix mirrors to dimensions and where shown on drawings. Fix mirrors as detailed or directed. Arrise all edges. Back with 6mm plywood. Fit rubber washers between the backing and the wall.

### **14.3 WORKMANSHIP**

All work in this section shall be carried out by competent tradesman in a skilful workmanlike manner. Glaze all windows and doors with good quality glass of approved manufacture and of the types and weights indicated on the drawings or herein specified. Check all timber frames, sashes and reprime any not highly primed. Check glass sizes on the job. Allow for expansion as required. Back putty sprig and face putty fully flush and trim of surplus. Putty shall be best quality linseed oil putty coloured to match stain when in stained frames.

Where indicated fixed glazing shall be secured by timber glazing beads. Ensure that all glazing is fully back puttied and that putty also extends between the glass and the frames and glass and the glazing beads.

### **14.4 BREAKAGES**

The glazier shall make good any reasonable amount of breakage from workmanship, accidents etc. Any large breakages shall be adjusted with the trade responsible. Contractor to protect all windows against damage.



## CLEANING

The contractor shall allow to properly clean down all glazing at the completion of the his work.

Glazing sizes to comply with wind loads of AS1170.2 2002

Min. thickness	Max. area in sq.ft	Max. Area in sq.m
2402 - 3mm	1.87	0.1737
3202 - 4mm	2.4	0.2230
3/16" - 5mm	5.3	0.4924
7/32" - 5.5mm	9.1	0.8454
1/4" - 6mm	10.7	0.9940



## **SECTION 16 ALUMINIUM WINDOWS**

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### **16.1 PRELIMINARY**

#### **16.1.1 GENERAL**

Refer to the General Conditions of contract and the Preliminary & General clauses which will also apply to this section of the work.

#### **16.1.2 STANDARDS**

The following and all relevant latest AS/NZS standards shall form part of this specification:

AS	2048
NZS	4203
NZS	3504
NZS	4211
AS	1170
AS/NZS	1866
BS	1474
AS	1734
BS	4872

### **16.2 WORKMANSHIP**

All workmanship in this section shall be carried out by competent tradesmen to the highest possible standards.

### **16.3 FINISH**

All aluminium should be Anodised to NZS3503.

### **16.4 SEISMIC MOVEMENT AND WINDOW LOADING**

#### **16.4.1 SEISMIC MOVEMENT**

Shall comply with NZS 4203 zone factor 0.4. Provide Engineering calculations.

### **16.5 WARRANTEES**

Provide warranty in respect of material and workmanship.

### **16.6 GLAZING**

All glazing used shall be able to withstand wind load for 77.7 m/s ULS Regional wind speed. Wind speed in accordance with AS1170.

### **16.7 SAMPLES**

Submit samples upon request.

### **16.8 SHOP DRAWING**

Provide shop drawings and structural calculations including installation details, four weeks before manufacturing.

