

Structural Specification

Avatiu Punanganui Market Bridge Replacement

at Cook Islands

Prepared for Infrastructure Cook Islands



By Beca International Consultants Ltd (Beca)

2 May 2019

Revision History

Revision N°	Prepared By	Description	Date
0	Anton Kivell	Issue for Tender	2 May 2019

DOCUMENT ACCEPTANCE

Action	Name	Signed	Date
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C02S - DEMOLITIONS

C02S SECTION INDEX

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C0200S - DEMOLITIONS - GENERAL

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C0200S.1 PRELIMINARY

Refer to the Conditions of Contract and Preliminary and General, which shall apply to this section of the Contract Works.

C0200S.2 EXTENT OF WORK

The work covered by this section includes the supply of all labour, Materials and Plant for all as described in the Drawings and/or Specification.

C0200S.3 REFERENCED DOCUMENTS

This Specification shall be read in conjunction with the following Standards, which are deemed to form a part of this Specification. In the event of this Specification being at variance with any provision of the Standards, the requirements of this Specification take precedence over the provision of the Standards. Reference to any Standard shall include any amendments thereto and any Standard in substitution therefor. All Materials and workmanship shall comply with these Standards unless expressly noted otherwise.

NZS 6803	Acoustics – Construction Noise
AS 2601:2001	Demolition of Structures.
Cook Islands Building Code,2018	B2, Demolition.

C0200S.4 HAZARDOUS MATERIALS AND EXISTING SITE CONDITIONS

Inspect prior to tendering to identify the extent of any asbestos or any other hazardous materials or circumstances which may be present in the existing construction, including pits or underground tanks. No allowance will be made for any insufficient description in this document.

Any hazardous materials or circumstances are to be immediately identified to the Engineer. Take all steps and all precautions as required by the appropriate regulations when dealing with hazards.

Record and photograph the condition of surrounding buildings and surfaces for later comparison. Ensure that all proposed work practices will not adversely affect their condition.

C0200S.5 NOTIFIABLE WORK

Notify the appropriate Occupational Safety and Health office at Infrastructure Cook Islands, 24 hours before starting the work.

C0200S.6 COOPERATION WITH THE PRINCIPAL

See Preliminary and General.

Plan and execute the works so that disruption to the operations of the Principal is minimised, and interference with the Principal's standard operating procedures and activities on and adjacent to the site is kept to an absolute minimum, and all reasonable requests by the Principal to that end are met.

C0200S.7 COMPLETION

On completion leave the Site clean and ready for an immediate start by following trades.

C0201S - DEMOLITIONS

C0201S.1 OBTAIN PERMITS

Obtain the necessary work permits, establish the inspections required for this work and pay all required charges and fees.

C0201S.2 DEMOLITION PLAN (METHOD STATEMENT)

Prepare a written demolition plan including sketches and covering:

- The extent of the work
- The plant to be used
- Isolation of services, plant and equipment
- Drainage considerations
- The proposed demolition method for each roof, wall and floor
- Hazard identification, assessment and control (staged as necessary)
- Precautions for safety of employees on site
- Precautions for persons in the vicinity
- Emergency procedures
- Proposed dust controls
- Proposed noise controls
- Proposed vibration control
- Precautions for safety of the public.

Submit copies of the demolition plan for comment before proceeding. Also submit the plan to the Occupational Safety and Health Service when required under the Approved Code of Practice for Demolition.

C0201S.3 WORKMANSHIP

The work shall be done only by persons skilled in such work, under the supervision of a suitably experienced person, and in strict accordance with all requirements of the law and the Territorial Authority.

Stop off and seal all existing services to the requirements of the relevant Authorities. Disconnect all overhead services to the requirements of the relevant Authorities. Alternatively, where so required by the Authority concerned, arrange and pay for the stopping-off, disconnection etc., to be carried out by that Authority.

Should the Contractor be thereby able to offer a lower price, he may arrange for the removal of some or all of the existing structures from the Site, which items shall become his property on leaving the Site.

C0201S.4 DEMOLISHED MATERIALS

The following are required for re-use:

- Earth Fill Material behind the new bridge abutment

These shall be dismantled, removed and stored protected from damage and the weather.

Demolished materials not listed above shall be removed from Site, becoming the property of the Contractor on leaving the Site.

C0201S.5 PUBLIC PROTECTION

Work areas shall be delineated by warning tape secured to stanchions securing from access by fencing. The stanchions can be free standing on the ground (i.e. waratahs or similar cast into paint tins). These shall be maintained in good state of service.

Remove on completion of the work.

Signs warning of "Danger, Demolition in Progress", and the Contractor's name and 24-hour contact phone number shall be displayed (or as required by the Demolition Consent conditions).

C0201S.6 HAZARDOUS MATERIALS AND EXISTING SITE CONDITION

Review all available plans of the building, including those of the territorial authority and the network utility operators, all descriptions and past uses, and become totally familiar with the past and present condition and use of the building and its services. No warranty is expressed or implied that any information provided by the Principal in this regard represents completely or accurately the present state of the structure. The Contractor shall be responsible for any inference he may draw from the information made available to him.

Inspect prior to tendering to identify the extent of any asbestos or any other hazardous materials or circumstances that may be present in the existing construction, including pits or underground tanks. No compensation will be made for insufficient description in this document.

Any hazardous materials or circumstances are to be immediately notified to the Engineer. Take all steps and precautions as required by the appropriate regulations when dealing with any hazards.

Record and photograph the condition of surrounding buildings and surfaces for later comparison. Ensure that all proposed work practices will not adversely affect their condition.

C0201S.7 DEMOLITION

Temporary support shall be employed wherever necessary to ensure the stability of partially demolished structures, or structures to be loaded. Loading of existing floors, slabs etc by machinery, plant or debris shall be assessed and approved in writing by a suitably qualified person, copied to the Engineer.

Demolition materials shall not be used as backfill.

Test for flammable gases or hazardous vapours in any potentially dangerous locations or situations, e.g. pits or tanks.

Keep flames and heat away from insulating or flammable materials.

Wherever practical and safe to do so, sawcut partially or completely through items to be demolished before breaking them down.

Ensure that the ground, fences and buildings on adjacent properties are not disturbed or lose their support.

C0201S.8 NOISE/DUST CONTROL

All compressors and percussion tools shall be fitted with effective silencers of a type recommended by their manufacturer and shall be maintained in first class conditions at all times.

Demolition debris shall be confined within the work areas at all times.

The Contractor shall programme his works such that the level of noise and dust at all times shall comply with the Local Authorities regulations and requirements.

The Contractor shall undertake whatever work is necessary to avoid wind-blown dust, other debris and noise being a public nuisance or danger/disruption, to the satisfaction of the Engineer. Such works will include keeping the Site clear of debris which could be moved by wind, and by the spraying of water to settle dust. Such dust and wind-blown debris control shall be maintained 24 hours per day if necessary throughout the duration of the contract.

Blasting, burning or burying of any materials whatsoever is not permitted on the site.

C0201S.9 DRAINAGE AND DISCHARGE FROM THE SITE

The Contractor shall be responsible for drainage on and around the demolition site, and discharges from the site. This shall be to the requirements of the Principal and Local Authorities, including complying with all statutory and regulatory requirements.

Generally, debris and silt shall not be allowed to enter any sump or piped drain.

C0201S.10 ANTIQUITIES OR ITEMS OF VALUE

Report immediately the finding of any fossils, antiquities, or other objects of value, all of which are to remain undisturbed until approval is given for their removal.

C0201S.11 CLEARED SITE

The scope of work includes removal of the structures and any contained hardfill to ground level. This shall include all piles, elevated concrete floor slabs, perimeter foundation walls, or retaining walls holding back terraced ground or paths.

Wires, pipes, or reinforcement shall be cut minimum 200 mm below final finished surface level. Any projecting structural steel or timber shall be cut flush and left in a safe, non-injuring condition. Use grinders as necessary.

C0201S.12 MAKING GOOD

The demolition site shall be cleared free of loose rubble, demolition materials and dust.

Wherever the demolitions will result in leaving a surface which will not be covered by or otherwise be the subject of work by a following trade, the tender shall allow for infilling and grading to match the existing adjacent surfaces in levels, falls and nature of finish.

The demolition site shall be infilled, if necessary, and graded to an even surface marrying to the existing surface in levels and falls, but not the type of surface finish. Use crushed quarry strippings, 19 mm maximum size to fill and blind the demolition area.

Note, that it may be necessary to make good some areas not otherwise affected by the Contract Works in order to achieve such a match.

Complete making good, and seal up and repair adjacent structures damaged or open as a result of the demolition works.

C05 – PILING

C05 SECTION INDEX

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C0506	Steel Sheet Piling

C0500 – PILING – GENERAL

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C0500.1 PRELIMINARY

Refer to the Conditions of Contract and Preliminary and General, which shall apply to this section of the Contract Works.

C0500.2 EXTENT OF WORK

The work covered by this Section includes the supply of all labour, Materials, Plant and Equipment for the construction of piles for the Avatiu Punanganui Market Bridge Replacement project, SP3 Sheet piles, as described in the Drawings and/or Specification.

C0500.3 NATURE OF GROUND

Limited subsoil investigations have been carried out, with the soil profile being inferred from the bore logs of the Avatiu Port investigations, which are contained in the Tender documents. However, no warranty is expressed or implied that such information, given in good faith by the

Engineer, will present a complete or accurate picture of the whole of the Site. The Contractor shall be responsible for any inference he may draw from information made available to him.

It is deemed that the Contractor has inspected the Site and considered the nature of the ground through which piles are to be constructed.

The Contractor shall allow for penetrating through whatever material is encountered to the expected founding level. The tendered rates shall apply to all material excavated or through which a pile is driven, as the case may be, irrespective of whether this is done by hand or by machine.

The fact that a tender has been submitted shall be deemed as evidence that the Contractor accepts the full and sole responsibility for the method of working, including the maintenance of excavation stability, the construction of defect-free piles, and positioning the completed piles within the required tolerances to the approximate founding depth specified on the Drawings. The Contractor shall perform this work to the approval of the Engineer at no extra Cost to the Principal, no matter what may be encountered, including tidal, weather, and ground conditions.

C0500.4 SUBSURFACE CONDITIONS

Investigations indicate that the ground conditions consist of fill over the upper 3.0m which is made up of closely packed silts, clays and basalts gravels. Below this is stream alluvium with coral gravel and basalt.

C0500.5 STANDARD SPECIFICATIONS

This Specification shall be read in conjunction with the following Standards, which are deemed to form part of this Specification. In the event of this Specification being at variance with any provision of these Standards, the requirements of this Specification take precedence over the provision of the Standard. Reference to any Standard shall include any amendments thereto and any Standard in substitution therefor. All Materials and workmanship shall comply with these Standards unless expressly noted otherwise.

AS 2159:1995	Piling; Design and Installation
AS/NZS 1554:2004	Welding of steel structures
AS/NZS 2312:2002	Guide to the protection of iron and steel against exterior atmospheric corrosion
NZS 3404:1997	Steel structures standard
BS 8004:1986	Code of practice for foundations
NZS 4711:1984	Qualification tests for metal arc welders
NZS 4402:1986	Methods of soil testing for engineering purposes

All documents referenced above shall be the latest revision, complete with current amendments, as at the time of issue of this document for tender. Note that reference is also made to Appendix B, AS 2159:1995 for guidelines for safe working practice, with regard to pile inspections carried out by the Engineer.

C0500.6 PILE DESIGN

The pile design, consisting of SP3 Steel Sheet Piles as shown on the Drawings, are the minimum requirements for the piles in the completed structure. The Contractor shall be responsible for the design and detailing of the piles for all handling and driving forces, as appropriate.

C0500.7 PILE DESIGN LOADS

Piles shall be capable of supporting the specified working loads (SWL) specified on the Drawings. Driven piles shall be driven to achieve the ultimate driving resistances specified on the Drawings.

The submission of a tender will be deemed as evidence that the Contractor accepts full responsibility for constructing the piles in accordance with the design detailed on the Drawings, at the anticipated founding levels shown on the Drawings.

C0500.8 HANDLING AND STORAGE OF PILES

All operations such as handling, transporting, lifting and pitching of piles shall be carried out in such a manner as to prevent damage to the piles and/or their coatings.

Piles and pile casings shall be stacked on suitable supports on firm ground, in a manner which will eliminate excessive handling stresses or other damage.

Refer also to section C0500.6.

C0500.9 METHOD STATEMENT

Each tenderer shall provide a method statement for each piling operation to be undertaken in executing the Works. The method statement shall describe all proposed Equipment, and detail the construction sequence. The method statement shall be submitted with the tender and shall contain the following information (as a minimum):

- Programme of the works, detailing the timing and sequence of individual portions of the works.
- Full details of the installation plant to be used, including manufacturer's information and proof of servicing/recent upkeep.
- For driven piles, an assessment of the actual input energy to the piles, and a definition of driving refusal for each type of plant proposed shall also be included.
- Proposed phasing of excavation/filling operations such that the design stresses in the piles (and any supporting frames) are not exceeded.
- A contingency plan to be adopted in the event of encountering obstructions, to minimise disruption and delay.
- Anticipated noise levels (measured in dB) and vibration levels (measured in mm/sec) arising from pile driving operations (if applicable).

The Engineer's review of the Contractor's method statement shall not relieve the Contractor of his obligations to meet the requirements of this Specification.

C0500.10 NOT IN THIS CONTRACT**C0500.11 SETTING OUT AND AS-BUILT LOCATIONS**

The position of all piles shall be accurately set out by the Contractor. The pile positions and verticality shall be checked by the Contractor immediately prior to installation.

After construction, actual pile locations and verticality shall be certified by a surveyor employed by the Contractor for this purpose. The Contractor shall submit an as-built pile plan to the Engineer, ten days prior to incorporating any piles in the pile cap construction. A partial as-built pile plan can be submitted for each sequence of piling operations, as required. An overall as-built pile plan, showing the as-built locations of all piles, shall be submitted to the Engineer within ten days of completing the last pile.

B4.3.4 and C0100.5.10 shall not apply to the above.

C0500.12 SUPERVISION

The Contractor shall nominate a suitably experienced, professionally qualified engineer, as the “Piling Supervisor”. The Contractor shall submit a curriculum vitae for the proposed Piling Supervisor with his tender.

The Piling Supervisor shall be responsible for ensuring that all piling operations comply with the requirements of this Specification, and all referenced publications. The Piling Supervisor shall also ensure that all monitoring and pile records are maintained up to date, and are available for inspection by the Engineer.

C0500.13 INSPECTION

The Engineer requires to have the opportunity of observing all phases of the piling operations and of inspecting particular items such as (but not limited to) set and rebound, the bottom of piles, jointing of casings, concreting, fabrication of reinforcing cages, etc. The Contractor shall therefore keep the Engineer informed daily as to the work anticipated to be carried out on the next working day.

The Contractor shall provide the safety equipment and make provisions for these inspections, in accordance with the requirements of Appendix B of AS 2159 “Guide to Safe Working Practices”. The specification contained in Appendix B of AS 2159 is considered to be the minimum level of safe practise required by the Engineer. Adherence to these requirements in no way relieves the Contractor of his obligations in terms of the Health and Safety in Employment Act 1996.

C0500.14 NOT IN THIS CONTRACT**C0500.15 PROTECTION OF EXISTING STRUCTURES**

The Contractor shall take all care to ensure that no damage is caused by any of the piling works to any existing structure, property or services, and shall undertake to make good, at his expense, any damage caused through vibration, excavation or undermining. If the Contractor suspects that

the piling operation, at any stage, may cause any damage to existing structures, property or services, he shall notify the Engineer immediately.

C0500.16 PROTECTION OF ADJACENT PROPERTY

The Contractor shall take all necessary [reasonable] precautions to avoid damage to adjoining public and private property, including boats, ships and other vessels, and shall undertake to make good, at his expense, any damage caused through vibration, excavation or undermining.

C0500.17 COMPLETION

On completion, the Contractor shall leave the Site and the Contract Works clean and ready for immediate use by following contractors.

C0506 - STEEL SHEET PILING

C0506.1 SCOPE

This section covers the fabrication and installation of top driven steel sheet piles.

C0506.2 MATERIALS

Steel sheet piles shall be SPIII (SP3, 400mm wide, 125mm deep, 13.0mm thick, hat shape), in new condition, and shall be of the sections, numbers and lengths specified on the drawings, complete with all necessary corners, junctions and special piles as detailed.

All corners, junctions and special piles specified on the Drawings shall be fabricated at the sheet pile manufacturer's premises under workshop conditions. Tolerances for pile manufacture shall comply with the requirements of the British Steel Piling Handbook.

All piles and production facilities shall be made available for inspection at any time. All sheet piles shall be carefully examined at the time of delivery to the Site, and damaged piles shall be repaired or replaced. The Contractor shall ensure that all interlocks are clean and free from distortion.

C0506.3 PILE LENGTHS

Piles shall be driven into a minimum depth of the RL specified on the Drawings, and achieve the ultimate geotechnical capacity specified on the drawings.

The anticipated lengths of piles are shown on the Drawings. The actual length of pile will be determined on site, and will be the length required to achieve the ultimate driving resistances specified on the Drawings.

For tendering purposes, Tenderers shall assume that the piles will be the lengths specified on the Drawings.

C0506.4 PILE DIMENSIONS

Requirements for steel sheet piles are shown on the Drawings.

C0506.5 SITE SPLICES OF PILE SECTIONS

Sheet piles shall be supplied in as long a length as is practicable. Where required, sheet piles shall be spliced by butt welding, in accordance with C0506.7.

C0506.6 WELDING OF SHEET PILES

All welds shall be weld category SP in accordance with NZS3404.

All welding procedures shall be qualified to AS/NZS1554. The Contractor shall submit full details of the proposed welding procedures and electrodes, with drawings and schedules as required.

Any defective welds shall be cut out and replaced. The standard for interpretation of non-destructive testing shall be the latest edition of AS/NZS1554. The extent of non-destructive examination (NDE) is as follows:

- (a) 100% visual scanning, which shall determine that no welds called for in the Drawings or Specification are omitted. Visual scanning shall also detect gross weld defects.
- (b) 100% visual examination, which shall determine whether the required weld quality (in accordance with Table 6.2 of AS/NZS1554) has been achieved.

Only welders qualified to AS/NZS1554 and who have a proven record over the previous six months, or who have attained a similar standard, shall be employed on the Works. Proof of welders proficiency and qualification shall be made available to the Engineer on request.

Where sheet piles are to be spliced by butt welding, the interlocks shall not be welded unless a seal weld is required.

C0506.7 MARKING, HANDLING AND STORAGE OF PILES

Each pile shall be clearly marked with white paint prior to installation, with its number, overall length, and at 250 mm intervals, the cumulative length measured from the pile tip.

If sheet piles of different grades are stored on Site, each pile shall be clearly marked showing its grade, with piles of different grades stored separately.

All operations such as loading, transporting, offloading, handling, stacking and pitching of piles shall be carried out in such a manner as to prevent damage to piles or their coatings.

Any damage that does occur shall be drawn to the attention of the Engineer. The Contractor shall submit its proposal for remedial works, for approval by the Engineer, prior to commencing remedial works. The Contractor shall not carry out remedial work on any pile without the written approval of the Engineer. All remedial work to damaged piles shall be carried out prior to incorporation of the pile in the permanent works, and no extra cost to the Principal shall arise from any such extra work.

Should the Contractor fail to meet the above requirements, the Engineer reserves the right to order such extra work as may be required to overcome the resultant structural problems, and no extra cost to the Principal shall arise from any such extra work.

C0506.8 SPECIFIED SET AND RESISTANCE

Target sets, rebounds and hammer operating parameters will be reviewed by the Engineer following completion of the pre-production pile load test programme.

The sets and rebound shall be measured and recorded for each pile at the completion of driving. When a set or resistance is being measured, the following requirements shall be met:

- (a) The pile shall be in good condition, without damage or distortion.
- (b) The hammer blow shall be in line with the axis of the pile, and the impact surfaces shall be flat and perpendicular to the hammer axis.
- (c) The hammer shall be in good condition, delivering the required energy per blow as specified in section C0506.9, and operating correctly.
- (d) The rebound shall be measured and recorded.

The set shall be recorded either as the penetration in millimetres per ten blows, or the number of blows required to produce a penetration of 25 millimetres.

C0506.9 PILE DRIVING

The Contractor shall carry the sole responsibility for providing all necessary equipment for the pitching, positioning and driving of piles to the depths specified on the Drawings. The selection of driving equipment shall be made having due regard for the ground conditions and pile type.

The Contractor shall provide the Engineer with information on the efficiency and energy of the driving equipment. Where a drop hammer is used, the mass of the hammer shall be at least 70% that of the pile. No drop shall exceed 1500 mm for a top driven pile. For other types of hammer, the energy delivered to the pile shall be at least equivalent to that of a drop hammer of the required mass and maximum drop. The Contractor shall submit with his tender, details of the proposed pile driving equipment, including hammer weight, and an example set of Hiley calculations that show that the required driving resistance as defined by Hiley can be achieved.

Care shall be taken when using drop hammers on floating craft to avoid instability of the craft and to prevent damage to the pile.

The piles shall be guided and held in position by temporary gates, with each pile fully interlocked with its neighbour without exception. Piles shall not bypass one another in place of interlocking. At all stages during driving, the free length of the sheet pile shall be adequately supported and restrained. Reference should be made to sections C0500.15 and C0500.16.

The Contractor shall ensure that sheet piles are driven without significant damage or declutching. The Engineer shall be notified immediately if piles are damaged or declutched during driving.

Pile driving hammers shall be correctly positioned on the sheet pile so that the hammer is aligned as near to the sheet pile axis as is practically possible. Freely suspended pile hammers shall be equipped with correctly adjusted leg guides and inserts. Where a hammer is mounted in a rigid leader, the leader shall be stable. The anvil block or driving plate shall be of a sufficient size to cover as much as possible of the cross section of the pile.

The driving of each pile shall be continuous until either the depth and/or resistance or set, as required by the design, has been achieved. In the event of an unavoidable interruption to driving, a pile may be re-driven provided it can be driven to the specified depth, resistance or set without damage.

A follower shall not be used unless the set, where applicable, has been revised to take into account the reduction in the effectiveness of the hammer blow.

Where sheet piles are driven in panels, the end piles of each panel shall be driven in advance of the general run of piling. After allowing for initial penetration, no pile in the panel shall be driven to an excessive lead in comparison to the toe level of the panel in general, and where hard driving is encountered, this lead shall not exceed one metre.

The Engineer shall be given 24 hours' notice of the commencement of pile driving. The Contractor shall give the Engineer adequate notice and provide all necessary facilities to enable the Engineer to check driving resistances, sets, and rebounds. The Contractor shall monitor and record the driving resistance at 500 mm intervals (i.e. record the number of blows required for each 500 mm of pile penetration).

The Contractor shall inform the Engineer without delay if an unexpected change in driving characteristics is encountered.

C0506.10 RISEN PILES

The sequence and method of piling shall limit uplift and lateral movement so that the final position of each pile is within the specified tolerances. At all times, the deflections of each pile from its axis as formed shall not be such as to cause damage or impair durability of the piles or any structures or services.

The maximum permitted uplift of any pile due to pile driving operations is 3 mm. All piles that are uplifted more than the maximum permitted amount shall be re-driven.

The Contractor shall make checks of uplift for nominated piles once a week for the duration of the piling operation, and report the results to the Engineer. The Engineer shall review the requirements for continuing pile survey periodically.

C0506.11 REDRIVING OF PILES

The Contractor may be required to re-drive piles selected by the Engineer after pile installation. Such piles shall be mobilised by a minimum of 50 blows, prior to checking the set and rebound. Re-driven piles shall be driven to refusal, by which is meant the last 10 blows shall cause a penetration of 10 mm or less. Piles shall be accurately marked in 25 mm intervals to observe penetration. Piles selected for re-driving shall not be cut off until re-driving is completed and approved by the Engineer.

The Contractor shall provide an updated legible set card for each pile at the completion of re-driving.

C0506.12 PREBORING AND JETTING

Piles shall not be pre-bored without the written approval of the Engineer. Pre-boring of piles may be allowed by the Engineer as long as the piles remain in intimate contact with surrounding soil and the completed piles comply with the requirements of the Specification. If boring is oversize, any gap between tube and ground shall be filled with compacted sand to the Engineer's approval. No pile shall be pre-bored within one metre of final founding level.

Piles shall not be jetted without the written approval of the Engineer. Prior to jetting any pile, the Contractor shall submit to the Engineer details of the equipment to be used and the proposed method to be adopted.

C0506.13 CUTTING OFF AND PREPARING OF PILE HEADS

No cutting or welding of piles shall be carried out without prior written approval of the Engineer. All such cutting shall be carried out using oxyacetylene, oxypropane or other approved method. The remaining pile shall be of clean and even appearance, with grinding tools used to remove splatter.

Cutting must be carried out to prevent damage or distortion to adjacent piles.

The finished level of the cut pile shall be within 20 mm of the theoretical level.

Cut-offs shall become the property of the Contractor and shall be removed from the Site.

C0506.14 TOLERANCES

The Contractor shall make all necessary provisions to the driving procedure, casing installation, initial spotting and inclination of piles in order to achieve installation of piles to the specified tolerances. Refer also to sections C0500.15 and C0500.16.

Tops of piles shall not vary more than 50 mm horizontally and 20 mm vertically from their true position as given in the Drawings.

The maximum permitted deviation of finished vertical piles from a vertical line, at any level, is 1 in 75.

The maximum permitted deviation of any part of the finished pile from the specified rake is 1 in 25 for piles

If records or measurements show that piles have been installed outside the specified tolerances, the Contractor shall provide the Engineer with details of measures to be adopted to enable the piles to comply with the specification. Forcible correction of laterally displaced piles shall not be made, unless the Contractor can demonstrate that the strength, integrity and durability performance of the pile will not be adversely affected.

Should the Contractor fail to meet the above requirements, the Engineer reserves the right to order such extra work as may be required to overcome the resultant structural problems, and no extra cost to the Principal shall arise from any such extra work. Any additional engineering design work required because of piles placed outside the specified tolerances (for example, the strengthening of the wharf deck or design of additional piles) shall be carried out by the Engineer and paid for by the Contractor.

The Contractor shall not carry out remedial work on any pile, without the written approval of the Engineer.

C0506.15 CORROSION PROTECTION

No specific corrosion protection system is required for the piles.

C0506.16 PILE CONSTRUCTION RECORD CARD

The Contractor shall complete a Pile Construction Record Card for every pile constructed on the Site. A copy of the proposed Pile Construction Record Card shall be submitted to the Engineer on week prior to commencing pile construction. The Pile Construction Record Card shall contain the following information as a minimum:

- Contract and structure name.
- Pile number, location, type, diameter, steel grade, preformed length, driving shoe details, and locations of splices.
- Date and time of driving, re-driving or pre-boring, including stoppages and delays, from start to finish.
- Type, weight, drop (if applicable) and mechanical condition of the hammer, and equivalent information for other equipment.
- The height of the working platform on which the piling machine operates.
- The number of blows required for each 500 mm of penetration of the pile and the typical drop height/stroke.

- Final drop height, etc, and the set and rebound, recorded either as the penetration in millimetres per ten blows, or the number of blows required to produce a penetration of 25 millimetres, including a legible copy of the set card and the calculated ultimate driving resistance.
- Any information regarding obstructions, delays and other interruptions to the sequence of work.
- Expected and actual (as assessed on site) seabed and sandstone levels.
- The expected and actual constructed founding levels.
- Where changes in length have occurred due to lengthening or shortening, all relevant information including off-cut length or extension length, reason for change and on what authority the change was made, shall all be included.
- Weather conditions .
- The design and actual constructed elevation of the top of the pile, including compliance with tolerances.
- The Contractor's signature verifying that all work has been completed satisfactorily.

Pile construction records shall be submitted to the Engineer within 24 hours of the completion of concrete placement of each pile.

C06 - CONCRETE WORK

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C0606	Precast Concrete Units
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C0600 - CONCRETE WORK - GENERAL

C0600.0 INDEX

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C0600.1 PRELIMINARY

Refer to the CONDITIONS OF CONTRACT and also PRELIMINARY AND GENERAL, which shall apply to this section of the Contract Works.

C0600.2 EXTENT OF WORK

The work covered by this section includes the supply of all labour, Materials and plant for the mixing and placing of all concrete, together with all other associated trade work, complete as shown, all as described in the Drawings and/or Specification, or as necessary.

The Contractor shall do all preparation necessary to receive or adjoin other work, and shall generally be responsible for the installation of embedments in concrete, and for forming all penetrations, chases, nibs, etc., necessary for the work of other trades.

C0600.3 STANDARD SPECIFICATIONS

All materials and workmanship shall comply with NZS 3109:1997 and the Standards to which it refers except as modified by the requirements of this specification.

.1 The following Standards, including those referenced in NZS 3109, shall apply:-

In the event that there is a conflict between any Standard and this Specification then the requirements of this Specification shall take precedence.

AS/NZS 4672:2007	Steel prestressing materials
AS/NZS 1554:2004	Structural steel welding Pt 2; Arc stud welding (steel studs to steel) Pt 3; welding of reinforcing steel
ASTM C309-2003	Liquid membrane-forming compounds for concrete curing
BS 5212:Part 1:1990	Cold applied joint sealants for concrete pavements
BS 5896:1980	High tensile steel wire and strand for the prestressing of concrete
BS 4486:1980	Hot rolled and processed high tensile alloy steel bars for prestressing of concrete
BSEN 10002-1:1990	Tensile testing metallic materials – at ambient temperatures
NZS 3101:2006	Concrete structures standard
AS/NZS 1170:2002	Structural design actions
NZS 3104:2003	Concrete production
NZS 3106:1986	Code of practice for concrete structures for the storage of liquids.
NZS 3111:1986	Methods of test - water and aggregate
NZS 3112:Part 1:1986	Testing Concrete - Tests relating to Fresh Concrete
NZS 3112:Part 2:1986	Testing Concrete - Tests relating to the determination of strength of concrete
NZS 3112:Part 3:1986	Testing Concrete - Tests on hardened Concrete other than for strength
NZS 3112 Part 4:1986	Testing Concrete - Tests relating to grout
NZS 3113:1979	Chemical admixtures for concrete
NZS 3114:1987	Concrete surface finishes
AS/NZS 3121:1986	Water and aggregate for concrete
NZS 3122:1995	Portland Cement
NZS 4203:1992	Code of Practice for general structural design and design loadings for buildings.
AS/NZS 4671:2001	Steel reinforcing materials
NZS 4702:1982	Metal-arc welding of Grade 275 reinforcing bar
CIBC	The Cook Island Building Code

.2 Alkali - Silica Reaction

The following requirements are necessary to reduce the risk of adverse alkali-aggregate reaction in the concrete to an acceptable level for this contract. They are additional to all requirements of NZS 3121 and NZS 3122. The additional requirements refer to Cement & Concrete Association of New Zealand Report N° TR3, Alkali-Silica Reaction: Minimising the Risk of Damage to Concrete: Guidance Notes and Recommended Practice (Second Edition) 2003 (the Model Specification).

Only those clauses of the Model Specification referred to, or are consequent to those clauses referred to below, apply to this Contract.

The Contractor, upon request by the Engineer and prior to placing any concrete, shall submit his proposals for complying with these requirements.

The total mass of reactive alkali in the concrete mix shall not exceed 2.5 kg/m³ as determined by the methods set out in the Model Specification sections 6 and 7.

The Contractor shall furnish to the Engineer certificates for cement, water, aggregates, pigments, mineral and chemical admixtures in respect of reactive alkali contents as set out, in part, in Model Specification sections 6 and 7.

Both the fine and coarse aggregates shall be non-reactive, as classified in accordance with Model Specification Clauses 6.2.1.

The Contractor shall furnish to the Engineer evidence of the composition of the aggregates to be supplied, in accordance with Model Specification section 6.

The Contractor shall give the Engineer immediate notice of any change in the composition of the materials used in the concrete mix design which may increase either the average reactive alkali content or the potential reactivity of the aggregate. A revised mix design for any concrete which would be affected by increased reactive alkali content or aggregate reactivity shall be submitted to the Engineer for review and shall conform to the requirements of this Specification.

.3 Concrete Mix Design Requirements

Table C.600.1 outlines the concrete mix design requirements.

Table C0600.1 – Concrete Mix Design Reference Table

Mix Ref.	Description	Specified Concrete Strength	Max Aggregate Size	Slump	Method of Placement	Minimum Cement Content	Maximum Water Content
A	Site concrete	10MPa	19mm	NBC	Gravity	-	-
B	Mass concrete fill	20MPa	35mm	NBC	NBC	-	-
C	General purpose	30MPa	19mm	NBC	NBC	-	170kg/m ³
D-1	Medium structural	40MPa	19mm	NBC	NBC	350kg/m ³	170kg/m ³
D-2a	Medium structural	40MPa	19mm	120 \pm 25mm	Pump	350kg/m ³	170kg/m ³
E	Precast Deck 'U' Beams	40MPa	13mm	120 \pm 25mm	Pump	350kg/m ³	170kg/m ³

* NBC – Nominated by constructor

C0600.4 INSPECTION TESTING

- .1 Test samples shall be taken on site in accordance with the requirements of NZS 3109 Section 9, and as required in accordance with C0600.8. Test certificates from an approved laboratory shall be forwarded automatically to the Engineer.

The frequency of testing shall be 3 N^o standard cylinders per concrete pour.

The above testing shall be additional to the manufacturer's plant testing programme.

The Contractor shall submit work plans for the work to be undertaken in compliance with the Quality Assurance requirements of the Contract Conditions including off site precasting.

Work plans and inspection/test schedules shall include but not be limited to the following:

- Concrete strength testing (submit details with tender)
- Inspection prior to placement of concrete (Concrete Placement Card Records)
- Reinforcement compliance records (e.g. Certificates of origins, or certification by an IANZ accredited laboratory, reverse bend tests etc)

- Procedures to control the removal of support props
- Procedure for Contractor Review of Concrete Shop Drawings
- Details of Concrete Supply to meet the requirements of C0600.3.2
- Proposals giving details of the proposed concrete testing shall be submitted with the tender
- Concrete mix designs proposed
- Daily Concrete Batch Records (including water contents and moisture content of aggregates)
- Tolerance checks of critical items (e.g. Checking precast half beam starter position in fabricator's yard)
- Monitoring of off-site precast manufacture.

Inspection and test schedules and information noted above shall be submitted to the Engineer prior to commencement of work.

Other than those specifically noted, other Quality Records shall be made available to the Engineer and shall be submitted if requested.

- (a) No concrete shall be placed until the Engineer has had the opportunity to observe that the Drawings and Specification have been complied with. To this end, the Contractor shall give the Engineer at least one Working Day's notice prior to pouring concrete. Such notice and observation in no way relieves the Contractor of any of his responsibilities under the Contract.
- (b) The Contractor shall appoint a "Concrete Works Inspector" to be responsible for quality control of all concrete works. This shall include inspection of all aspects of concrete work prior to all concrete pours, inspection of concrete placement and record keeping.

The "Concrete Works Inspector" shall be of no lesser standing than foreman a Registered Engineer.

- (c) The Contractor shall submit to the Engineer for approval the format of a proposed Concrete Placement Card to be completed and signed by the Concrete Works Inspector. The minimum information required for such a card is given in the Sample Concrete Placement Card in C0600.11.

The Concrete Works Inspector shall complete his inspections and sign the approved Concrete Placement Card prior to the commencement of the pour and following completion of the pour. The signing of the Concrete Placement Card shall confirm that all work related to the pour in question has been satisfactorily completed and the Drawings and Specification have been complied with.

- (d) The Contractor shall keep the Concrete Placement Cards on Site and shall make these available for inspection by the Engineer.

The Contractor shall submit a copy of completed cards to the Engineer at the first available site meeting.

- (e) Should the Contractor not give the Engineer the required notice as in .2 above or fail to carry out the placement of concrete in accordance with .3 to .5 above then the concrete in question may be liable for rejection by the Engineer.

Concrete which is so rejected shall be removed and reinstated at no cost to the Principal.

- (f) The Contractor shall on request demonstrate to the Engineer that all reinforcement complies with the Specification by producing manufacturer's certificates and certificates of origin.

Equivalent certification by an IANZ accredited laboratory is an acceptable alternative.

On request, reverse bend tests in accordance with AS/NZS 4671 shall be carried out.

C0600.5 NOT IN THIS CONTRACT

C0600.5 NOT IN THIS CONTRACT

C0600.6 SHOP DRAWINGS

The Contractor shall produce Shop Drawings of the following items:

- Precast beams

The Contractor shall be responsible for the accuracy of all such drawings and details. These drawings shall be produced so as to enable competent tradesmen to fabricate the structures to the dimensions, shapes and standards given in the Drawings and the Specification.

The Contractor shall be solely responsible for the production, and co-ordinating, of all Shop Drawings for compliance with the requirements of the Drawings and Specification.

In this regard the Contractor shall ensure that:

- shop drawings are co-ordinated with the requirements of all other trades and other trade's shop details.
- all necessary site measurement and checking has been undertaken.
- the shop drawings are co-ordinated with all Contract requirements.

The Contractor shall advise the Engineer of any errors, omissions or conflicts found in the Drawings during the Shop Drawing preparation. The Engineer will then advise the manner in which the error, omission or conflict shall be resolved.

The Shop Drawings shall be checked by the Contractor and submitted to the Engineer at least 5 Working Days prior to fabrication commencing.

The Shop Drawings shall be signed by the Contractor as having been checked by a person approved by the Contractor's Site Engineer or Project Manager and shall be accompanied by a signed copy of the Shop Drawing Check Form. Refer C0600.12.

A general review may be undertaken by the Engineer.

The Shop Drawings shall be checked by the Contractor and two copies shall be submitted to the Engineer at least three weeks prior to the programmed commencement of fabrication.

The Engineer will review the Shop Drawings and return them to the Contractor with comments within 5 Working Days. Any comment or lack of comment resulting from such review shall not relieve the Contractor of any of his contractual obligations.

C0600.6 NOT IN THIS CONTRACT**C0600.7 NOT IN THIS CONTRACT****C0600.7 NOT IN THIS CONTRACT****C0600.8 CONSTRUCTION REQUIRING SUPPORT FROM OTHER PERMANENT WORKS**

Where construction is to be supported from a structure below, the Contractor's attention is drawn to the requirements specified under Clause 5.1.8 of NZS 3109 as amended in C0601.

In regard to the above, ten Working Days prior to commencement of construction requiring support, the Contractor shall supply to the Engineer the following information:

- Details of schedule for removal of props or loading of support elements including age of various levels of construction at critical stages.
- Calculations by a Registered Engineer demonstrating that the requirements of Clause C0601.5.5 of C0601 are satisfied.
- Details of any concrete strength-testing additional to Section C0600.4 to demonstrate that adequate strength is obtained to allow removal of props.
- Where proprietary precast concrete floor systems or composite steel decking slabs are to be placed, the above information shall be provided by the Contractor in conjunction with the proprietary floor manufacturer information as appropriate.
- Confirmation of the age and strength of precast units to be erected.

C0600.8 NOT IN THIS CONTRACT**C0600.9 TRIAL MIX TESTS**

At least 4 weeks prior to the placing of any concrete in the works, the Contractor shall prepare trial mixes of concrete in the presence of the Engineer. The trial mixes shall be mixed for the same time and handled and transported by the same plant the Contractor proposes for the Works. Each mix shall comprise not less than cubic metres of concrete and contain all materials in the same proportions per cubic metre which he proposes for use in the works.

Test specimens will be prepared and tested by the Engineer from each trial mix in accordance with NZS 3112, Part 2.

To determine the workability of the concrete the Contractor shall place and compact the concrete in trial moulds with dimensions typical of the Works and containing typical reinforcing steel. The sides of the mould shall be so constructed that they can be stripped without shock or disturbance of the concrete placed therein. The sides of the moulds shall be stripped immediately after the concrete has set. The workability shall be judged by the surface appearance and compaction obtained.

The mean strength of samples cured and tested in accordance with NZS 3112, Part 2 shall be 7 MPa greater than the grade, strength specified, otherwise the Contractor shall adjust the mix design and repeat the trial.

C0600.9 NOT IN THIS CONTRACT**C0600.10 COMPLETION**

On completion, leave the works clean and ready for immediate use by following trades. Clear away all debris and Temporary Works arising from this trade.

C0600.11 SAMPLE CONCRETE PLACEMENT CARD (REFER C0600.4)

.1	Project: Contractor: Date of Inspection/Pour Location of Pour Volume of Pour	_____		

.2	Formwork <ul style="list-style-type: none"> • Adequately braced and supported • Grout tight • Correct dimensions • Cleaned and oiled • Formed surfaces straight • Major penetrations located • Embedded items located • Nibs, rebates etc • Correct for specified surface finish • Adequate seating P.C. Units 		Initials	Comments
			_____	_____
.3	Reinforcement <ul style="list-style-type: none"> • Grade and size, R or D • Correct amount, stirrups, ties etc • Placement, tolerance, clearance • Stability and cover (chairs, spacers etc) • Clean steel • Lap location and lengths, bends • Starters correctly located 		_____	_____
			_____	_____
.4	Construction joints <ul style="list-style-type: none"> • Location • Roughened • Clean • Water bar placed if specified 		_____	_____
			_____	_____
.5	Slabs on Grade <ul style="list-style-type: none"> • Dowels correctly positioned • DPC or GPC • Shear Keys • Reinforcement cut at joints • Mesh supported • Finishing apparatus 		_____	_____
			_____	_____
.6	Testing <ul style="list-style-type: none"> • Compression Strength • Slump/Flow 		_____	MPa
			_____	mm
.7	Other <ul style="list-style-type: none"> • Hard topping • Additives • Access for pouring, pumping concrete • 2 vibrators in working order 		_____	_____
			_____	_____
.8	Special Requirements <ul style="list-style-type: none"> • Local Authority informed prior to pour • Engineer informed prior to pour 		_____	_____
			_____	_____
Pre-Pour Check: Concrete Inspector's Name/Signature/Date Time of Commencement of Pour		_____		
Completion: Pour satisfactorily complete Name/Signature/Date		_____		
Sawcutting of slabs _____		_____		
Curing being carried out _____		_____		
(Note on reverse any problems experienced during the pour)				

C0600.12 SHOP DRAWING CHECK FORM

I (name) of (firm's name) being the Contractor's designated person responsible for the preparation of the shop drawings required by specification clause C0600.6 certify that the drawings listed below have been prepared, reviewed, co-ordinated and checked prior to submission to the Engineer in accordance with the requirements of C0600.6.

SAMPLE CHECK LIST

		CHECKED
1.0	Shop Drawings prepared to an acceptable presentation standard.	.....
2.0	Shop Drawing revisions noted and clouded.	.....
3.0	Dimensions <ul style="list-style-type: none"> • relevant dimensions indicated • site measurement noted and checked • dimensions co-ordinated and checked with the requirements of the Contract documents and other trades.	.....
4.0	Drawing numbers and revisions from which Shop Drawings have been prepared noted on the Shop Drawing.	.....
5.0	All relevant contract information including specification requirements indicated on Shop Drawings.	.....
6.0	Shop Drawings checked and co-ordinated with the requirements of all Drawings and Specifications (e.g. Architectural, Civil, Structural, Building Services, etc).	.....
7.0	Shop Drawing checked and co-ordinated with the requirements of other trades Shop Drawings.	.....
8.0	Drawings checked for corrections prior to re-submission, where required by Engineer to be re-submitted.	.....
9.0	Shop Drawings approved by the Contractor for fabrication, signed and dated.	.....

SIGNED:.....

POSITION:.....

DATE:.....

Drawing Numbers to which certification applies are listed on the following page.

DRAWING N^o	REVISION N^o	TITLE	DATE ISSUE TO ENGINEER
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Note: A completed copy of this form shall accompany all shop drawing submissions to the Engineer.

C0601 - VARIATIONS TO NZS 3109

C0601.1 GENERAL REQUIREMENTS

Section 1, Clause 1.2.1 - recommended practice shall also be adhered to unless expressly noted otherwise hereunder.

C0601.2 DEFINITIONS

Section 2 - "Construction Reviewer" shall mean the Engineer or the Engineer's Representative for this Contract.

C0601.3 REINFORCEMENT

Section 3 Reinforcement - Refer also C0602.

C0601.4 NOT REQUIRED

C0601.5 FORMWORK, EMBEDDED ITEMS AND CONSTRUCTION JOINTS

.1 Clause 5.1.1 - add -

Formwork shall be so constructed that the finished concrete work will be to the shape, lines and levels as shown on the drawings.

The formwork for each section of concrete placement shall be completely constructed before concreting of that section is commenced.

Formwork shall be inspected and levels checked immediately preceding the placing of reinforcement and any bulging, warping or lack of fit shall be remedied.

Formwork for concrete below water level and for concrete subject to wave and tidal actions shall be watertight and designed to resist flotation forces when fixed in position. The sides of the forms shall be of sufficient height to prevent the ingress of water and overtopping from tide and wave action.

The Contractor's proposals for the pattern of joints for surfaces which will be visible on completion of the work must be agreed with the Engineer before fabrication begins.

20 x 20 mm fillets and chamfers shall be used on all corners, unless expressly noted otherwise on the Drawings. All external angles in exposed members shall be protected against damage after stripping. Slightly bevel all insertions to ensure easy removal without damage to the concrete.

.2 Clause 5.1.2 - add -

The Contractor shall accept responsibility for the design, construction and use of the whole of the formwork and falsework. Refer Preliminary and General.

Formwork and falsework shall have adequate strength and rigidity to withstand the pressures from placement and vibration of concrete.

Should any formwork or falsework move while the concrete is being placed or within the periods specified for the retention of formwork, the concrete shall be rejected. The whole of the concrete shall be removed between such limits as the Engineer may determine, construction joints shall be formed and the section of work shall be reconstructed after the formwork has been strengthened and adjusted.

Concrete work which is mis-shapen or in any other way defective due to the inadequacy of the formwork shall be rejected, removed and replaced, or the defect shall be remedied by a method proposed by the Contractor and approved by the Engineer, at the Contractor's cost.

.3 Clause 5.1.4 - add -

Give camber to beams and cantilevers as noted on the Drawings.

.4 Clause 5.1.6 - add -

Before the reinforcement is placed, the interior surfaces of forms shall be treated with a release agent to prevent adhesion of mortar. Release agents shall be of a non-staining type applied in a thin film.

Any reinforcement in contact with the release agent shall be thoroughly cleaned to remove all traces of the release agent or may be subject to rejection.

.5 Clause 5.1.8 - add -

In providing support to construction from a previously constructed structure the Contractor shall plan the removal of propping as shown on the Drawings such that stresses and deflections are not excessive as follows;

(a) Construction Loads

The construction loads imposed on a structure of age 28 days or more shall be such that the strength requirements do not exceed those induced by the design loading, unless it is demonstrated by calculation that the strength requirements are within the capacity of the supporting structure.

Where the structure is less than 28 days old, the allowable loads shall be appropriately reduced.

The Contractor is warned that leaving props in place may in some cases lead to an unacceptable accumulation of stresses in lower construction.

(b) Deflections

Where construction loads on a structure are such that strength requirements are greater than those due to the design loading, or where a structure is to be loaded at an age less than 28 days, the Contractor shall demonstrate that calculated final deflections (following removal of construction loads and application of design loads) are either less than the calculated deflections which would be caused by the application of the design loading, or within acceptable limits as defined by the Engineer. Such calculations shall take into account, where appropriate, non-recoverable deflections due to creep of young concrete.

.6 Clause 5.2 - add -

The finishes for formed surfaces are shown on the Drawings.

.7 Clause 5.3. - add -

Not Required

.8 Clause 5.5 - add -

All penetrations, nibs, chases, embedments, etc., shall be positioned as required. The Contractor shall check the requirements of other trades and shall be wholly responsible for the accuracy of locating all such items. Any penetration not detailed in the Drawings shall be confirmed by the Contractor before work starts in that area.

.9 Clause 5.6.1 - add -

Not Required

.10 Clause 5.6.2.3. - add -

Should edges at construction joints be damaged, the Engineer reserves the right to nominate the method of repair.

.11 Clause 5.6.2.3. - add -

Not Required

C0601.6 SUPPLY OF CONCRETE

Clause 6.1.2 - the specified strengths are shown in Table C0600.1 and on the Drawings.

The Contractor shall on request within three working days supply the Engineer with the concrete mix design.

C0601.7 CONCRETE PLACING, FINISHING AND CURING

Comply with C0600.4.2.

.1 Clause 7.2 - add -

Concrete shall not be placed when the outdoor shade temperature exceeds 30°C.

In windy conditions or conditions that may lead to evaporation of the mix water from the surface of freshly placed concrete, the Contractor shall take adequate steps to prevent such evaporation from occurring.

These measures may include the provision of windbreaks or the application of a fine mist spray during concreting operations or any other measure approved by the Engineer.

Such a mist shall be of adequate density to negate loss of water due to evaporation but shall be limited so that no extra water is added to the concrete mix.

Concrete shall not be exposed to rain or sea spray during mixing, transport or placing or until it has set. During rain and when rain is impending, approved protective measures shall be taken.

Any concrete so exposed shall be removed from the works if required by the Engineer.

.2 Clause 7.3 - add -

The forms and reinforcement shall be free of seawater and salt spray before the placing of any concrete.

.3 Clause 7.4 - add -

Concrete shall be deposited as near as practicable to its final position. It shall not be dropped from a height in excess of 2 metres except with the prior permission of the Engineer, nor shall it be dumped away from its final position and worked along the forms.

Care shall be taken that no shock or vibration reaches concrete after setting until it is at least 3 days old, and that any starters projecting from green concrete are not shaken or disturbed.

Concrete which has partially hardened or has been contaminated by foreign materials shall not be deposited in the works.

Retempered concrete shall not be used in the works.

Except at permitted construction joints, concrete in each section of the work shall be placed in a continuous operation such that new concrete is constantly being placed against unset concrete to produce a monolithic mass.

All barrow runs, chute runs, pipelines, walkways and any other means of conveying concrete shall be adequately supported by independent means directly from the formwork and in no case shall the means of conveying the concrete be supported from or allowed to displace the reinforcement.

Concrete in which the reinforcement has been displaced shall be declared defective and shall be demolished.

The Contractor shall organise the delivery of concrete in such quantities as can be effectively handled by the labour and equipment available. The Engineer may at his discretion order the Contractor to provide additional equipment or men to assist in placing concrete and/or alter the method of placing.

.4 Clause 7.5

Concrete Placing underwater. Refer Section C0610 Tremie Concrete.

.5 Clause 7.7

The finishes required for unformed surfaces are shown on the Drawings.

For all concrete surfaces (except floors) which will be visible on completion of the works, the minimum cement content shall be 350 kg/m³ mixed concrete, regardless of lesser quantities being allowed by NZS. The Contractor shall allow for supplying a greater cement content than this should it be necessary to achieve the finish specified.

Note that restrictions to maximum cement content under Clause C0600.3.2 apply.

.6 Clause 7.8.4

Seven days shall be the absolute minimum curing period.

For the slab surface, the following shall apply:

(a) General

All concrete shall be cured for at least 14 days to ensure the durability, strength, and watertightness of the structure. Failure to comply with this Clause may lead to concrete being rejected by the Engineer, in which case it shall be taken out, replaced and correctly cured, at no extra cost.

(b) First 7 Days After Pouring

All concrete and its enclosing forms and all surfaces at joints, shall be kept continuously wet and shall be thoroughly protected from direct rays of the sun, and from drying winds.

To this end, as soon as the concrete has set sufficiently, covers of continuously wetted materials shall be placed as required, or a system of fine water sprays shall be set up and operated continuously against the work, or another suitable method adopted. The method adopted for any part of the works shall be agreed with the Engineer in advance.

(c) 8-14 Days After Pouring

All concrete surfaces shall be protected from direct rays of the sun and from exposure to severe drying winds. The surface shall be kept damp by occasional hosing, the frequency of this depending on the prevailing weather conditions.

At no time during this period shall any surface be allowed to completely dry out.

C0601.8 NOT IN THIS CONTRACT

C0601.9 CONCRETE ACCEPTANCE TESTS DURING CONSTRUCTION

Refer C0600.4.

C0601.10 REPAIR OF CONCRETE

Refer C0611.

C0602 - REINFORCING STEEL

C0602.1 FABRICATION AND PLACING OF REINFORCING STEEL

.1 Grade

Deformed Grade 300E bars are denoted by the symbol D in the Drawings.

Plain round Grade 300E bars are denoted by the symbol R in the Drawings. These may be used for stirrups, ties and dowels.

Deformed Grade 500E steel bars shall be used only in those positions marked DH in the Drawings. Should plain round Grade 500E bars be required, they will be marked RH. Grade 500E bars shall be manufactured using the microalloy process, unless specifically approved otherwise by the Engineer.

With the Engineer's approval, bars may be used in lieu of mesh provided that the total steel strength provided (A_{sfy}) is not thereby diminished and centres of bars do not exceed 250 mm.

.2 Requirements additional to NZS 3109

Clause 3.4 - add -

On delivery to the site, steel reinforcement shall be stored on supports clear of the ground and shall be protected from any wind-blown sea spray

Clause 3.2.1 - add -

The contractor shall prepare reinforcement schedules from the contract drawings and shall be responsible for ensuring the supply and placing of the reinforcement as shown or implied on the contract drawings and in accordance with this specification.

Clause 3.5.1 - add -

The reinforcement shall be secured against displacement by supports, and by tying at intersections with annealed iron wire not smaller than 1.25 mm diameter, or by approved clips.

The ends of wire ties shall be bent away from the nearby faces of forms and shall not project into the concrete cover.

Starter bars shall be secured to prevent damage including the provision of restraint against swaying in the wind.

Under no circumstances shall reinforcement be displaced from the positions shown on the drawings for the purpose of accommodating electrical conduits or service pipes of any description without the written permission of and to the details approved by the Engineer.

Clause 3.5.1 - add -

Supports shall be used to maintain the correct position of the reinforcing steel during placement and compaction of concrete, the minimum number of rigid supports being:

Slab steel - two supports per m^2

Beam steel – one line of support per metre length

Wall steel - one support per two m^2

Column steel - one line of support per metre length

Plastic spacers are preferred. Concrete blocks used to fix the steel from the forms shall be at least as strong as the adjacent poured concrete and firmly wired to the reinforcement using wires cast into the blocks. Concrete blocks may only be used where the concrete surface will not be exposed.

If top steel in slabs is supported from the bottom steel then a plastic spacer shall be placed beneath the bottom steel immediately under the top steel support.

Clause 3.7.1 - add -

Splices in adjacent bars shall be staggered by at least 600 mm.

Except where shown, no lapping of rods will be permitted without the express approval of the engineer. Rods with kinks or bends not shown on the Drawings shall not be used.

Clause 3.7.2 - add -

Welding of reinforcement, including tack welding, is forbidden without the express approval of the Engineer. If permitted, welding shall comply with AS/NZS 1554, Pt 3. Grade 500E reinforcement shall not be welded without the submission of a specific welding procedure and, together with the welders, shall all be to the approval of the Engineer.

C0602.2 PROVISION FOR EARTHING

At the position indicated on the drawings securely tie 2-12 mm diameter (minimum) plain round bars, one on each side of a reinforcing bar, to project outside the concrete by 200 mm to allow for later attachment by brazing on of a 25 x 4 mm copper earth strap.

C0602.3 STARTER GROUTING

Refer C0605.6.

C0605 - GROUTING OF BOLTS, SOLEPLATES ETC

C0605.1 SELECTION OF GROUT

- .1 When a specific type of grout is required it is designated on the Drawings. Where no grout is designated, the selection shall be as specified below.
- .2 Alternative proprietary systems of grout may be approved by the Engineer upon application by the Contractor, with submission of both descriptive literature and supportive test data which demonstrate fitness for the proposed purpose.
- .3 **Acceptable Types of Grout**

The following are examples of acceptable grouts for various applications.

APPLICATION	NAME	NOTES
Anchor bolts set in holes or pockets in concrete.	Sikadur 31	Rapid strength gain usually desirable
Equipment, soleplates, general i.e. pumps, agitators, motors etc.	Minimum Shrinkage Plain Grout or "Embeco 636" or "Masterflow 713".	
Equipment soleplate - plate - heavy duty subject to vibration and/or thermal effects i.e. Machines, compressors, fans, generators, mills etc.	"Embeco 636"	
Block-outs, agitator and pump inserts, etc.	"Masterflow 713"	Non-shrink required - surface to be mech. roughened.

C0605.2 MATERIALS

- .1 Proprietary grout shall be provided in a pre-mixed form. 10 mm aggregate may be added where permitted by the manufacturer and where the thickness of voids to be grouted permits.
- .2 Portland cement shall conform to NZS 3122.
- .3 Water and aggregate shall conform to NZS 3121.

C0605.3 PROPORTIONING

This shall be as specified by the manufacturer in his written instructions.

C0605.4 WORKMANSHIP

- .1 The Contractor shall apply to the Engineer for approval of his Materials and preparation methods before placing any grout.
- .2 The strictest control shall be exercised in proportioning and application.

- .3 Premixed proprietary grouts shall be prepared and applied in strict accordance with the manufacturer's written instructions.
- .4 Grout under soleplates shall be wet cured for a minimum of 7 days and at a temperature above 10°C. Curing compounds shall not be used. Other grouts shall be cured in accordance with the manufacturer's written specifications.

C0605.5 PREPARATION FOR APPLICATION

- .1 For cementitious grout, concrete surfaces shall be roughened, cleaned and thoroughly wetted and shall be kept moist for a minimum of 24 hours prior to grouting.

For epoxy grout, concrete surfaces shall be roughened, cleaned and shall be thoroughly dry prior to grouting.

- .2 Mix temperatures shall be maintained as recommended in the manufacturer's written instructions.

C0605.6 STARTER GROUTING AND TESTING

- .1 All installation and grouting shall be carried out by personnel experienced in this type of work and familiar with the materials to be used. Materials including proprietary anchor bolt systems, shall be stored, mixed and placed in strict accordance with the manufacturer's written instructions and recommendations.
- .2 The epoxy resin grout shall be chemically resistant and suitable to give an ultimate anchor pull out resistance of at least twice the specified test load. This shall be demonstrated by documented test results.

The following proprietary products are acceptable:

Anchor Bolts Hilti HVA (H.D. Galv.) and HVA-R (stainless steel) adhesive anchors.

Chemset (H.D. Galv.) Chemical Anchors.

Araldite K80 epoxy resin grout or equivalent.

- .3 Holes shall be prepared as per C0605.5.1.
- .4 Unless noted otherwise on the Drawings the following materials shall be used:
 - Anchor bolts. Threaded rod, nuts and washers complying with the requirements of AS 1111 for grade 4.6 bolts, to be hot dip galvanised.
 - If called up as stainless steel the material shall be type 316 stainless steel or equivalent.
 - Starters. Grade 500E deformed bar in accordance with AS/NZS 4671.

Test loads shall be 75% of the calculated yield load. For horizontal anchors the method of installation shall be such that bonding resin does not run out of the hole.

- .5 Unless stated otherwise on the Drawings, the Engineer shall select 5% of the anchors (minimum 1 of each type) for testing. Test the anchors by applying an axial tensile load (using a suitable hydraulic jack) and measuring the load. The grouted item shall be deemed satisfactory if the test load can be sustained for a period of 5 minutes without a drop-off in load capacity.

If any anchor fails its test it shall be reinstated at the Contractor's cost and retested. A minimum of two additional anchors (selected by the Engineer) shall also be tested.

C0606 - PRECAST CONCRETE UNITS

C0606.1 GENERAL

.1 General

Sections C0600, C0601, and C0602 shall apply unless noted otherwise.

.2 Concreting and Curing

Each unit shall be cast in one continuous operation, and shall be properly cured as soon as possible after casting. Steam curing may be used to accelerate the curing of the units. Units shall be cured in accordance with NZS3101 by water curing or wrapping in polythene.

Units shall be crack free.

.3 Inspection and Testing

The Contractor shall provide a Concrete Placement Card for each unit constructed in accordance with C0600.4.

.4 Handling, Transportation and Erection

Units shall be handled, transported and erected so that no damage is caused to them at any stage. Every care shall be taken against damage or soiling in transit. Any damaged unit will be rejected by the Engineer. Units shall be lifted only by using the lifting eyes. The Contractor shall be responsible for the design, provision and subsequent removal and making-good of such lifting eyes as may be required.

The Contractor shall be responsible for erection. Units shall be erected in accordance with details presented under C0600.8. Should the Contractor wish to modify the connection details to facilitate erection, he shall notify the Engineer in sufficient time to allow his modifications to be properly considered by the Engineer prior to the casting of the units.

The Contractor shall note that the reinforcement shown on the drawings has been designed only for the completed structural configuration. It is the Contractor's responsibility to check the design of the units under all manufacture, transport, installation and construction load cases and to provide any additional reinforcement which may be necessary to ensure satisfactory performance.

.5 Tolerances

Refer C0601.5.7.

Further tolerances required are provided on Drawing 6204430-SB-0350 .

The onus is on the Contractor to study the Drawings, and to advise the Engineer before construction begins if he considers he will not be able to meet the tolerances inherent in the details shown in the Drawings. In this connection, his attention is drawn to the fact that the total tolerance indicated by a detail may have to be achieved by the co-operation of several trades (e.g. Precaster for fixings in precast work, Metalworker for brackets and the like, and Concretor for cast-in-situ fixings).

.6 Connections/Site Jointing**.7 Insitu Concrete Joints**

Refer C0601.6 for details of requirements for concrete supply. The Contractor shall take all reasonable steps to ensure the colour and surface finish achieved on the cast-in-situ joints matches that of the units. The Contractor shall submit his proposed method of achieving this to the Engineer not less than 4 weeks before pouring of the joints commences.

The Contractor shall nominate a limited number of responsible personnel who shall be involved in the mixing and pouring of the insitu joints. The Contractor shall demonstrate their familiarity with the procedures required to ensure the quality requirements shown on the Drawings and contained in this specification are achieved.

The Contractor shall demonstrate the proposed method of joint construction by fabricating a full-size joint test strip for the approval of the Engineer .

.8 Grouted Connections

Details of grouted Mechanical reinforcement splice connections between cruciform units and grouted duct connections to the foundations are given on the Drawings.

The Contractor shall nominate responsible personnel who shall be trained in the correct procedures for the mixing and injecting of the grout in these connections.

The Engineer shall be given at least one Working Day's notice of the grouting of the first column mechanical reinforcement splice. When grouting the splice, the Contractor shall demonstrate to the satisfaction of the Engineer and a representative of the grout supplier the competence of the nominated personnel. Should the Engineer not be satisfied, no further grouting of such splices shall take place until improved procedures have been devised by the Contractor and satisfactorily demonstrated.

.9 Surface Finish

- (a) The exterior faces shall be F4.
- (b) The interior faces shall be F3.
- (c) Construction joints shall be type B in accordance with NZS 3109.

C0611 - REPAIR OF CONCRETE

C0611.1 GENERAL

- .1 The Contractor shall advise the Engineer of the presence of any defective concrete. No repairs shall be undertaken without the expressed acceptance of the Engineer.
- .2 The Contractor shall provide a method statement prior to commencing any repairs to concrete. The method statement shall include appropriate details of the extent of repair work proposed, the extent and type of preparation, type of repair materials and method of application, protection and curing methods, standard of finish which will be achieved and other relevant details. The Contractor shall allow the Engineer reasonable time to review, comment, accept or reject the proposed repair method before commencing work. Such rejection may require the defective concrete to be removed and replaced. At the Engineer's discretion the Contractor may be required to supply certification for the proposed remedial work by a Registered Engineer.
- .3 Completed repair works shall comply with the requirements of the Specification or as otherwise accepted by the Engineer, which shall include a finish consistent with the surrounding areas. Special attention may be required to achieve acceptable long-term surface finish match (e.g. colour, texture, etc) to visible areas.
- .4 The Contractor shall not be entitled to additional payment for repair of defective concrete work.

C07 - STRUCTURAL STEELWORK

C07 SECTION INDEX

C0700	Structural Steelwork - General
C0701	Structural Steelwork - Fabrication
C0702	Structural Steelwork - Erection
C0703	Structural Steelwork - Corrosion Protection

C0700 - STRUCTURAL STEELWORK - GENERAL

C0700.0 INDEX

C0700.1	Preliminary
C0700.2	Extent of Work
C0700.3	Standard Specifications
C0700.4	Shop Drawings
C0700.5	Specific Requirements
C0700.6	Test Certificates
C0700.7	Guarantee
C0700.8	High Strength Bolting Certificate
C0700.9	Quality Assurance
C0700.10	Health & Safety
C0700.11	Completion Certificate
C0700.12	Completion

C0700.1 PRELIMINARY

This specification should be read in conjunction with the contract documents, refer to the preliminary and general clauses applicable to the works under this contract. In the event of conflict, the Contractor shall seek clarification from the Principal's Representative.

C0700.2 EXTENT OF WORK

This specification is particular to scope of work under this Contract including the detailed design, fabrication, delivery to site, erection, surface preparation and protection of all structural steelwork, including fixings, attachments, weldplates and embedded items into concrete and blockwork.

C0700.3 STANDARD SPECIFICATIONS

This Specification shall be read in conjunction with the following standards, the requirements of which form a part of this Specification. In the event of conflict between referenced documents, the requirements of this Specification take precedence. Standards listed below refer to their latest issue complete with amendments and commentaries, current at the time of preparing the Contract Documents. All materials and workmanship shall comply with these Standards unless expressly noted otherwise. Note that the standards listed below also cross-reference to various other standards, and these are also deemed to be required.

NZS 3404:1997	Steel Structures Standard
NZS 3404.1:2009	Steel Structures Standard - Materials, fabrication, and construction
NZS 4781:1973	Code of practice for safety in welding and cutting.
AS/NZS 2980:2007	Qualification of welders for fusion welding of steels.
AS/NZS 4791:2006	Hot-dip galvanized (zinc) coatings on ferrous open sections, applied by an in-line process
AS/NZS 4792:2006	Hot-dip galvanized (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialized process
AS/NZS ISO 9001:2008	Quality management systems - Requirements.
AS/NZS ISO14171:2013	Welding consumables – Solid wire electrodes, tubular cored electrodes and electrode/flux combinations for submerged arc welding of non-alloy and fine-grained steel – Classification.
AS/NZS ISO 14174:2013	Welding consumables – Fluxes for submerged arc welding and electroslag welding – Classification.
AS 1101.3:2005	Graphical symbols for general engineering - Welding and non-destructive examination
AS 1214:1983	Hot dipped galvanised coatings on threaded fasteners (ISO metric coarse thread series).
AS 1397:2011	Continuous hot-dip metallic coated steel sheet and strip – Coatings of zinc and zinc alloyed with aluminium and magnesium.
AS 1674.1:1997	Safety in welding and allied processes - Fire precautions.
BS 8202.1:1995	Coatings for fire protection of building elements Part 1: code of practice for the selection and installation of sprayed mineral coatings.
BS 8202.2:1992	Coatings for fire protection of building elements Part 2: code of practice for the use of intumescent coating systems to metallic substrates for providing fire resistance.
SAA/-SNZ HB62:1995	Code of practice for safe erection of building steel work
WTIA TN05	Flame cutting of steels, WTIA (Welding Technology Institute of Australia) - Technical Note No. 5.
WTIA TN07	Health and safety in welding, WTIA (Welding Technology Institute of Australia) - Technical Note No.7.
SCNZ	Report 14:2007 Steel Connect Structural Steel Connections Guide
DBH	The NZ Building Code
CIBC	The Cook Island Building Code

C0700.4 SHOP DRAWINGS

Shop drawings of all structural steel components shall be prepared by the Contractor at his expense, from the information presented in the structural and architectural drawings and any other relevant contract documents. The shop drawings will show full construction details. Where discrepancies are identified, it shall be the duty of the Contractor to notify the Engineer of these

discrepancies as soon as they become evident. Failure to do so shall not mitigate failure to perform to programme.

The Contractor shall be responsible for the production, co-ordination and accuracy of all such drawings and details. These drawings shall be produced so as to enable competent tradesmen to fabricate the structures to the dimensions, shapes and standards as shown on the contract drawings and specification.

In this regard the Contractor shall ensure that:

- Shop drawings are co-ordinated with the requirements of all other trades and other trade's shop details.
- All necessary site measurement and checking has been undertaken.

All fabrication errors (whether or not occasioned by errors in the shop drawings) shall be corrected at no extra cost to the Principal.

Shop drawings shall be prepared to conform to the methods set out in "AISC Detailing for Steel Construction", except weld symbols which shall comply with AS 1101.3. The drawings shall provide complete details of each assembly in the steelwork, together with all information relevant to their fabrication, surface treatment and erection. Each component and connection shall show the relevant work points.

Aspects to be covered by the shop drawings shall include, but are not limited to the following:

1. Dimensions of overall assemblies and individual components (verified by site measurement).
2. Full component drawings, showing all end preparations required for following work.
3. Weld preparation, preheating requirements, and fully detailed welding descriptions.
4. Component assembly details, both for shop assembly and site assembly.
5. Finishes, including surface preparation and recoating time.
6. Pre-camber and propping requirements.
7. Material grades of sections, plates, bolts and welding consumables.

All members shall be clearly marked with an approved mark and orientation. The shop drawings shall include a set of approved marking plans. If marks are not self-locating, the first sheet of such marking plans shall show a comprehensive index of the location of each beam, brace, truss, column etc.

The contract programme shall make due allowance in the steelwork procurement period for the preparation, checking, review (as noted below unless agreed otherwise) and subsequent correction and re-review of shop drawings. Prior to preparing shop drawings the Contractor shall provide and agree a drawing delivery schedule and drawing format and numbering system with the Engineer.

Before commencing fabrication, copies of the shop drawings shall be forwarded to the Engineer in accordance with the agreed schedule. The Engineer shall return one set of drawings to the Contractor generally within two weeks of receipt, annotated with any comments they may have, for incorporation by the Contractor who shall resubmit sets of the amended shop drawings within a further one week to the Engineer.

Shop drawing review indicates only that the design intent has been correctly interpreted without the need for further modification, other than the corrections indicated by the reviewer. Review of shop drawings does not relieve the Contractor of responsibility for the correctness of the shop

drawings, site dimensions, the overall design and performance, or for ensuring the work is carried out in compliance with the Contract documents. Neither can the review be construed as authorising departures from the Contract documents.

Failure to present these drawings on time, or any requirement by the Engineer for amendment or resubmission of a drawing, shall in no way relieve the Contractor of any of his obligations with respect to the programme, dates or any other obligations under the terms of the contract documents.

The shop drawings shall be signed by the Contractor as having been checked by a person approved by the Contractor’s Site Engineer or Project Manager and shall be accompanied by a signed copy of the Shop Drawing Check Form.

SAMPLE CHECK LIST

		CHECKED
1.0	Shop Drawings prepared to an acceptable presentation standard.	.....
2.0	Shop drawing revisions noted and clouded.	.....
3.0	Dimensions - Relevant dimensions indicated - Site measurement noted and checked - Dimensions coordinated and checked with the requirements of the contract documents and other trades.	.....
4.0	Drawing numbers and revisions from which shop drawings have been prepared, noted on the Shop Drawing.	.....
5.0	All relevant contract information including specification requirements indicated on shop drawings.	.....
6.0	Shop drawings checked and coordinated with the requirements of all design drawings and specifications (e.g. architectural, civil, structural, building services, etc).	.....
7.0	Shop drawing checked and coordinated with the requirements of other trades shop drawings.	.....
8.0	Shop drawings approved by the Contractor for fabrication, signed and dated.	.....

SIGNED:

POSITION:

DATE:

I(name) of (firm’s name) being the Contractor’s designated person responsible for the preparation of the shop drawings required by specification clause C0700.4, certify that the drawings listed below have been prepared, reviewed, coordinated and checked prior to submission to the Engineer in accordance with the requirements of C0700.4.

Drawing numbers to which certification applies.

DRAWING N°	REVISION N°	TITLE	DATE ISSUED TO ENGINEER

Note: A complete copy of this form shall accompany all shop drawing submissions to the Engineer.

C0700.5 SPECIFIC REQUIREMENTS

The following table outlines specific design requirements;

	Reference	Description
AESS Steelwork	NZS 3404.1 2009 Table 27	
Fracture Critical Members	NZS 3404.1 2009 Appendix A	
Seismic Resisting System, Type		
Seismic Member Categories	NZS 3404 1997 CI 12.2.5	
Fatigue Members	NZS 3404 1997 Section 10	
Weld and bolt failure consequence category	NZS 3404.1 2009 Table 28	
Seismic weld demand category	NZS 3404.1 2009 Table 29	
Importance Level	AS/NZS 1170.0 Table 3.2	

C0700.6 TEST CERTIFICATES

Certification shall be provided to the Engineer for steels, fasteners and welding consumables in accordance with NZS 3404.1 prior to the submission of shop drawings. All test certificates shall be in the English language and shall relate to samples taken from the supplied material.

A copy of test certificates for all materials shall be provided to the Engineer on request. These shall show all information necessary to confirm compliance with the quality specified. High strength steel shall be marked accordingly by the supplier before delivery. Materials shall be identifiable at all stages of fabrication and traceable to the relevant material certificates.

Should the Contractor wish to use steel sourced from manufacturers outside of Australia, New Zealand, Japan, Canada, USA or UK, written approval should be first sought from the Principal's representative and the following additional requirements satisfied:

- The Contractor shall supply results from additional steel tests carried out by independent accredited laboratories in New Zealand, approved by the Principal's Representative. One set of tests shall be carried out from samples taken from each steel plate thickness >10mm and for each steel supply source. The tests shall include:
 - Mechanical tests – for strength and elongation
 - Chemical Analysis – to identify all chemical elements within the steel composition
- The tests shall demonstrate that the proposed material complies with the minimum standards required. In the event that the material falls short of minimum standards, it shall be rejected.

The following additional requirements apply to the supply of all high strength bolt assemblies to AS/NZS1252:

- Manufacturer's Test Certificate.

An accredited testing organisation in the country of the bolt manufacture shall prepare a manufacturer's compliance test certificate for issue to the supplier with each batch of the finished product. The certificate shall contain information in accordance with the requirements of ASI TechNote 1-06.

The supplier shall ensure the production process is quality traceable and that supplied batches share the same statistical characteristics of the samples tested. The Subcontractor shall provide a copy of the certification to the Contractor and the Principal's Representative.

- Compliance Certificate – Independent testing and verification in Australia and New Zealand

The bolt supplier shall appoint an independent local accredited testing laboratory and shall supply them with the manufacturer's compliance documentation, noted above, from the bolt manufacturer/supplier together with all details of the batch of bolts. The local accredited laboratory shall independently test and verify that the samples and documentation supplied complies with the relevant local standard. This testing shall be completed prior to the release of the bolts to site. The bolt supplier shall accept full liability for any loss or damage caused by the supply of bolts found non-compliant with the requirements of AS/NZS 1252. The bolt supplier and local laboratory shall jointly issue documentation certifying that the product is verified and in compliance with the relevant local standard.

All costs of testing and providing the above certificates shall be borne by the Contractor. A copy of the above certificates shall be supplied to the Principal's Representative prior to erection

commencing on site. High strength bolts will be marked by the supplier as meeting the above requirements prior to delivery.

C0700.6 NOT IN THIS CONTRACT

C0700.7 GUARANTEE

Refer (11.5.1) and C0100.15.

The Contractor shall provide a guarantee to cover the materials and workmanship of the protective treatment defined in C0703 (appropriate for the environment in which the structure is to be built).

C0700.7 NOT IN THIS CONTRACT

C0700.8 NOT IN THIS CONTRACT

C0700.9 QUALITY ASSURANCE

The Contractor's quality plan (refer to Section C0100 Preliminary and General) shall include quality assurance plans complying with AS/NZS ISO 9001 for both fabrication and erection of structural steelwork as necessary to assure that all work is performed in accordance with the drawings, the specification and the requirements of the contract documents.

The quality assurance plans must take account of all specific requirements of the drawings and specification, and include verification of compliance with the following, where relevant:

- Material grades and certification.
- Size and designation of each member and connection component.
- Fabrication requirements including any specific material and non-destructive examination requirements for:
 - Seismic frames and seismic member categories.
 - Members requiring fabrication conforming to fatigue provisions.
 - Weld failure consequence category.
 - Seismic weld demand category.
 - Fracture control plan for railway bridges.
 - The location of any Fracture Critical Members in bridges.
 - Any steel elements subject to architecturally exposed structural steel (AESS) requirements.
- Tolerances including any specific fabrication or erection tolerances more stringent than otherwise required by Sections 3 and 4 of NZS 3404.1.
- Weld preparation, welding processes, sizes, types, and categories of welds.

- Welding quality management system requirements, including the AS/NZS 1170.0 importance level of the structure.
- Sizes, property class, and tightening categories of bolts.
- Locations and details of planned joints, connections, and splices.
- Pre-camber of members.
- Corrosion protection requirements including:
 - Coating type, quality and maintenance regime.
 - Preparation and inspection.
 - Surfaces not to be coated, for example areas with shear studs to be welded on later, or faying surfaces of friction grip joints.
- Fire protection requirements
- Permanent marking requirements for end of life traceability and reuse.
- Transport, handling and storage including measures to prevent distortion and damage to steelwork and coatings.
- Erection procedures and equipment including any constraints on construction sequence or methodology.
- Required extent of propping of the deck and any supporting beams.
- The required method of screeding of concrete surfaces (to level or to thickness).
- Designated items requiring precision setting out of anchor bolts.
- Orientation and alignment of all members.

A quality control check list for each significant component of the works shall be completed and signed by a suitably qualified representative of the Contractor responsible for quality control, as fabrication and erection of each component is completed.

C0700.10 HEALTH & SAFETY

All work must be undertaken in accordance with the requirements of the Health and Safety in Employment Act and the Contractor's Safety Management Plan (refer to Section C0100). The requirements of Statutory Authorities, Government Departments and relevant Acts and Laws shall be adhered to at all times. The Contractor shall comply fully both on and off site with the provisions of the New Zealand Building Code in all matters relating to construction safety, in particular with approved documents F1 (Hazardous Agents on Site), F2 (Hazardous Building Materials), F4 (Safety from Falling), and F5 (Construction and Demolition Hazards).

Where the elimination or isolation of on-site hazards is not possible, appropriate and effective equipment, clothing and work practices shall be used to minimise these hazards.

Health and safety practices for welding should be in accordance with WTIA Technical Note 7.

Erection practices shall comply with AS 3828. During erection the structure shall be made safe against erection loading, including loading due to erection equipment or its operation, and wind. Temporary propping, bracing and restraint shall be provided as required to ensure that the structure is stable and safe at all times. Design of such temporary support structure shall be the responsibility of the Contractor. Temporary bracing and restraint shall be left in place until the erection is sufficiently advanced to allow safe removal.

C0700.11 COMPLETION CERTIFICATE

On completion of the work, the Contractor shall provide a signed Producer Statement - Construction (PS3) for the steelwork trade, in accordance with the requirements of the local authority.

Appropriate quality assurance records covering the following, where relevant, shall form the basis of the Producer Statement - Construction (PS3):

- Quality control checklists.
- Material Traceability.
- Welding Procedures.
- Welder qualifications.
- Coatings.
- Material Transportation and Safe Handling.
- Erection Procedures.
- As-Built position
- Bolt Certificates.
- Auditing.

These quality assurance records shall be provided, upon request, to the Engineer in support of this Producer Statement.

C0700.12 COMPLETION

On completion leave the Site clean and ready for an immediate start by following trades.

C0701 - STRUCTURAL STEELWORK - FABRICATION

C0701.1 MATERIALS

.1 Structural Steel

Structural steel fabrication shall comply with NZS 3404. Grade shall be as tabulated below, unless noted otherwise on the drawings or in the specification:

Materials

Item Description	Material	Section/Profile
Hot rolled sections	AS/NZS 3679:Gr 300 or BHP-300 Plus	AS/NZS 3679.1 and .2
Hot rolled plate, flat, packing and filler plates	AS/NZS 3679.2:Gr 250	
Welded beams and columns	BHP NZ Steel Grade 300 MOD	
RHS, SHS	AS 1163:Gr C350	
CHS	AS 1163, ASTM A106:Gr B API Spec 5L	Spec for line pipe
Bolts, nuts, washers	AS 1111 and AS 1112 AS/NZS 1252 or 2451	ISOmetric bolts and nuts 8.8/TB UNO
Cold formed sections Dimond High Span Steel & Tube HST	Grade 450, HDG Z275 finish	

.2 Bolting Treatment

All bolts, nuts and washers shall be hot-dip galvanised by the manufacturer to comply with AS 1214 unless otherwise detailed in the Drawings. Custom galvanising of high strength bolts is not permitted.

.3 All items shall be of one length without welding unless approved by the Engineer.

C0701.2 WORKMANSHIP

.1 General

All work shall comply with NZS 3404.

.2 Cutting

All members shall be cut to the lengths required. All cutting shall comply with NZS 3404.14.3.3 and HERA 17, Vol 2, clause 5.2 and shall be by mechanical means. Site cutting and hand gas cutting is not permitted, unless approved by the Engineer. Stiffeners shall be ground to fit.

.3 Welding

All welding to be carried out in accordance with NZS 3404, AS/NZS 1554.1 and AS/NZS 1554.5.

Seal weld all exterior and/or exposed members connected by welding and which are in close contact, to prevent the ingress of moisture; except where another sealing method is detailed on the Drawings.

Seal all ends of RHS and CHS using minimum 3 mm plate unless expressly detailed otherwise.

Welding symbols shall comply with AS 1101 – ‘Graphic symbols for general engineering’.

Any weld not detailed otherwise in the Drawings shall be a 5 mm fillet weld all round.

Site welding is not permitted, unless approved by the Engineer or shown on the Drawings. See C0702.1.2.

.4 Weld Quality Control

Comply with NZS 3404, AS/NZS 1554.1 and AS/NZS 1554.5 for welding inspection and quality control and meet the following requirements:

The Contractor shall provide the services of a Welding Inspector who shall complete all inspections, tests (including NDT testing) and reports required by this specification. This shall include any additional inspections, tests and reports necessary due to the presence of any welding or related workmanship defects. See AS/NZS 1554.1 Section 7 for Welding Inspector qualifications. The Welding Inspector shall be an independent party contracted directly to the Contractor

The Welding Inspector appointment shall be approved by the Engineer. The name, company, technical qualifications and curriculum vitae details of the proposed Welding Inspector shall be submitted to the Engineer for acceptance a minimum of 2 weeks prior to commencing fabrication of structural steelwork.

The Principal shall provide the services of an independent Welding Inspector and complete inspections specified. The Contractor shall complete all required tests (including NDT testing) and reports as nominated by the Welding Inspector and as required by this specification. This shall include any additional tests and reports necessary due to the presence of any welding or related workmanship defects.

Details of inspections by the Welding Inspector shall be recorded and shall include but not be limited to the date, type of inspection, weld types and locations and results. The Welding Inspector shall submit a weekly report in writing to the Engineer with a copy to the Contractor, reporting fully on all progress, testing, rework and welding quality matters for that week.

Welding procedure sheets shall be prepared by the Contractor and approved by the Welding Inspector then submitted together with any necessary test certificates to the Engineer. See AS/NZS 1554.1 Section 4 or AS/NZS 1554.5 Section 4 as appropriate.

Welder and welding supervisor qualification shall be as specified in AS/NZS 1554.1. Section 4 or AS/NZS 1554.5 Section 4 as appropriate. Evidence of qualifications shall be submitted for approval to the Engineer 7 days before commencing welding.

Welder identification is required on all welds except welds to minor cleats and brackets.

All welds are to be Category GP (as defined in NZS 3404) unless Category SP is nominated.

Extent of Non-Destructive examination shall be as listed below:

- The welds to be inspected shall be chosen by the Welding Inspector.
- 100 % of all GP and SP category welds shall be visually scanned for gross defects and to ensure that the welds have been made. See AS/NZS 1554.1 Clause 7.3.
- The first 2 welds of each weld type shall be visually examined to table 6.2.2 of AS/NZS 1554.1, for each welder. If problems are found, visually examine all welds for that welder until specified quality is achieved consistently.
- 10 % of GP Category welds shall be visually examined to table 6.2.2 of AS/NZS 1554.1 for each welder. If problems are found increase visual examination to 25% for that welder (examining welds completed before and after suspect weld) until specified quality is achieved consistently. If additional problems are found increase visual examination to 100% until specified quality is achieved consistently. (If doubt exists as to which welder completed a suspect weld increase visual examination to 100% for all welds until specified quality is achieved consistently.) If lack of fusion or cracking is suspected carry out Magnetic Particle or Liquid Penetrant testing as the minimum level of testing to the suspect welds as instructed by the Welding Inspector.
- 100 % of SP Category welds shall be visually examined to table 6.2.2 of AS/NZS 1554.1. If lack of fusion or cracking is suspected carry out Magnetic Particle or Liquid Penetrant testing as the minimum level of testing to the suspect welds as instructed by the Welding Inspector.
- 100 % of SP Category site welds are to be Non-Destructively Tested (NDT) by either Radiography, Ultrasonic, Magnetic Particle or Liquid Penetrant testing.
- A minimum of 10% of all SP Category shop welding shall be Non-Destructively Tested by either Radiography, or Ultrasonic testing for each welder. If problems are found increase testing to 100% for that welder until specified quality is achieved consistently.
- A minimum of 10% of all GP Category site welding (e.g. column and beam splice butt welds) shall be Non-Destructively Tested by either Radiography, Ultrasonic, Magnetic Particle or Liquid Penetrant testing for each welder. If problems are found increase testing to 100% for that welder until specified quality is achieved consistently.
- If not specified, the type of Non-Destructive Testing (NDT) shall be chosen by the Welding Inspector, to suit the circumstances concerning the welds being tested and to meet the specification requirements.

.5 Repair of Welds

Weld repair shall be to AS/NZS 1554.1 or AS/NZS 1554.5 as appropriate.

.6 Tolerances

Tolerances for fabricated steelwork shall comply with NZS 3404 Section 14.4 & 15.3.

Architecturally exposed structural steelwork (AESS) needs more stringent controls on cross section tolerances than those specified in NZS 3404. Particular members requiring this are identified as AESS members. The tolerances required for these members are as follows:

.7 Bolting

Bolting procedures shall comply with NZS 3404.14.3.6. Holing shall be to NZS 3404.14.3.5.

When steel thickness exceeds 16 mm, bolt holes shall be drilled or subpunched 3mm undersize and reamed to size. Remove all burrs.

Bolts shall be sized so that at least two threads protrude past the nut when fully tightened.

Bolts with 'threads excluded' shall have the unthreaded parallel shank extend not less than 3 mm beyond the shear plane.

Remove all oil, dirt, loose scale and rust, burrs, fins etc from surfaces of contact.

Notation of bolting categories.

Bolting Category	Bolt Standard	Bolt Property Class	Tension Method	Joint Type
4.6/S	AS/NZS 1111	4.6	snug tight	bearing
8.8/S	AS/NZS 1252	8.8	snug tight	bearing
8.8/TB	AS/NZS 1252	8.8	full tension	bearing
8.8/TF	AS/NZS 1252	8.8	full tension	friction

Unless specifically noted, bolts shall have threads excluded from the shear plane.

C0701.3 ENGINEER'S INSPECTION

The Principal may instruct the Engineer to undertake further separate inspections or employ others to complete further inspections and/or testing. Such additional inspections and/or testing shall not replace or reduce the responsibilities of the Contractor under C0701.2 Workmanship, above.

C0702 - STRUCTURAL STEELWORK - ERECTION

C0702.1 ERECTION

.1 General

Erection shall comply with NZS 3404. The Contractor shall prepare and submit to the Engineer a detailed method-of-work plan for the structural steel erection, no less than 2 weeks before commencing structural steel erection. This plan shall not be at variance with the site safety management system and/or the contract quality plan.

.2 Site Cutting and Welding

Site cutting and welding are not permitted, unless approved by the Engineer or shown on the Drawings. When approved, site cutting and welding shall be of the same standard as C0701.2 and shall not be done under adverse weather conditions unless protected. See AS/NZS 1554 Section 5.4.

.3 Tolerances

Tolerances for steelwork erection shall comply with NZS 3404 Section 15.3.

.4 Handling

Delivery, storage and handling shall comply with NZS 3404.

Padded slings shall be used to handle all corrosion-protected steelwork. The Contractor is responsible for the execution and the safety of all erection operations and procedures.

.5 Erection Bolts

Provision of bolts and seatings for erection is not necessarily made in the Drawings. The shop drawings shall give particulars of erection bolts and seatings.

Erection bolts which could become a potential threat to safety if they work loose, shall be removed at completion of erection.

.6 Grouting

Grouting shall be in accordance with NZS 3404.

Grouting shall be carried out after the holding down bolts and steelwork have been aligned. See NZS 3404.15.5 for details.

Grout shall have a minimum compressive strength of 50 MPa at 28 days determined from the cylinders moulded, cured and tested in accordance with section 5 of NZS 3112 Part 4.

The underside of each column baseplate shall be grouted using a prequalified, proprietary non-shrink, high-strength grouting system which shall be installed in full compliance with the manufacturer's written instructions.

Prequalified grouting systems are:

- (a) Masterflow 500.
- (b) Masterflow 880.
- (c) Fosroc's "Conbextra GP".

- (d) Fosroc's "Conbextra HF".
- (e) Sika grouts.

Anchor or holding-down bolts shall be tightened after the grout has cured.

.7 Attachments for Services etc

No attachments may be made to the structural steelwork for the support of services etc., without the approval of the Engineer. In general, the Engineer will not approve attachments by means of explosive driven fastenings.

C0702.2 BOLTED CONNECTIONS

.1 General

All work shall conform to NZS 3404. See Sections 14 & 15.

Hardened steel washers shall be used beneath the heads of all nuts and hardened steel taper washers shall be used under the bolt-head or nut where the taper exceeds 3 deg.

.2 Tightening

All tension-type bolts shall be tightened by the "part turn" method of tensioning. See NZS 3404. 15.2.5.2.

The inspection and test plan for quality control of tightening bolts shall form part of the method-of-work plan for structural steel erection. See C0702.1. This plan shall be approved by the Construction Reviewer and submitted to the Engineer for approval prior to commencing erection of structural steel. The direct supervision of bolt tensioning shall be by a suitably experienced person/s, employed as foreman or of higher standing.

C0703 - STRUCTURAL STEELWORK - CORROSION PROTECTION

C0703.1 QUALITY ASSURANCE

.1 Applicator's Quality Assurance Procedures

For steelwork in external environments or in aggressive internal environments, applicators shall have in place formal written quality assurance (QA) procedures appropriate to the scope of work under this contract, details of which shall be submitted with the tender.

During the course of the contract, where necessary the Engineer shall be given access to the QA certification records from 7.3.1 for verification purposes.

.2 Inspection and Testing

An approved independent Painting Inspector shall inspect all steelwork in external environments, or in aggressive internal environments, at all stages of surface preparation, and coating application. The Contractor shall employ the Paint Inspector. The Painting Inspector's scope of work shall be as defined in AS/NZS 2312 and this specification. The Paint Inspector shall hold Certified Coatings Inspector certification from the Certification Board for Inspection Personnel (CBIP) or an equivalent qualification acceptable to the CBIP. The Contractor shall submit the name of the proposed Paint Inspector, including full details of his qualifications/certification and past experience, to the Engineer with his Tender. The Engineer reserves the right to approve, or reject, the proposed Paint Inspector.

The Paint Inspector shall, in discussion with the applicator, produce a specification for the extent and frequency of inspection and testing applicable to each area of work and corrosion protection system, in accordance with AS/NZS 2312 Clause 11, and AS 3894. The proposed specification for inspection and testing shall be submitted to the Engineer for review and approval 7 days prior to application of any coating. Upon approval by the Engineer the specification for inspection and testing shall form part of the Contract Documents.

After the coating has dried, it shall be inspected for any defects, misses, etc. Site testing of protective coatings shall be undertaken to AS 3894.

Dry film thickness measurements shall be made. The Contractor shall demonstrate to the Paint Inspector and the Engineer that he has in fact achieved the specified film build-up, failing which he shall at no extra cost apply additional paint until the specified minimum film build-up has in fact been achieved.

C0703.2 PAINT TREATMENT

Prepare steelwork in conditions approved for the application of coatings. All off-site preparation and coating application shall be carried out under cover, in a controlled environment and with adequate lighting.

Before painting, all surfaces shall be cleaned to grade B St 3, B Sa 2, C Sa 2 or C St 3, as specified in SIS 05 59 00, or AS 1627.9.

Oil, grease, and fine surface dust shall be removed immediately before the application of the paint. Surfaces to be surrounded by concrete or within 50 mm of a site weld or at HSFG mating surfaces shall remain unpainted.

No paint shall be applied to any surface which is not clean (as above), or perfectly dry, or under weather conditions which, in the opinion of the Engineer, are likely to be harmful to paint.

Sufficient time shall be allowed for the paint to harden out.

Apply alkyd zinc phosphate primer or equivalent with a minimum dry film build of 50 micron.

Within a week, apply one coat of or equivalent to give a further minimum dry film build of 50 micron.

Apply a shop prime coat of aromatic inhibitive fast drying primer or equivalent, to a minimum dry film build of 75 micron.

Within a Week of the primer coat, apply one coat of alkyd-based micaceous iron oxide or equivalent to give a further minimum dry film build of 50 micron.

Failure to cover within 7 days will mean a further coat of primer shall be applied at no extra cost before any further paint is applied. Both coats of paint shall cover all steel surfaces.

If any deterioration of paint occurs before the application of the next coat, then the Contractor, at no extra cost, shall prepare the surface again and apply one additional coat of paint.

After erection clean all unpainted or damaged places and Site welds as above, reprime and undercoat as above.

All paint shall be from one manufacturer only, and shall be applied strictly in accordance with its written instructions.

Refer C30 Painting for further coats of paint to be applied to steel exposed to view on completion of the work.

C0703.3 NOT IN THIS CONTRACT

C0703.4 NOT IN THIS CONTRACT

C0703.5 HOT DIPPED GALVANISING

.1 Steelwork to be Galvanised

Clean sections thoroughly and apply zinc coating by the hot-dip process to the requirements of AS/NZS 4680 to give a coating weight of not less than 600 grams per square metre.

Items to be galvanised:

- Steel frame of Pedestrian Barrier

.2 Cleaning

All surfaces shall be thoroughly cleaned to any one of the preparation grades Sa 2½ in S1S 05 59 00. Oil and grease shall be removed by wiping with turpentine, not kerosene. Fine surface dust shall be removed immediately before the application of the protective coating.

.3 Application

Galvanising process shall be in accordance with AS/NZS 2312, AS/NZS 4680 and the Manual of the Galvanising Association of NZ. The dry film build up to be achieved shall be as per the Table of the above manual. The Contractor shall demonstrate to the Engineer that he has in fact achieved this thickness.

C0703.6 NOT IN THIS CONTRACT

C0703.7 GUARANTEE

The guarantee requirements and period for each generic corrosion protection system are specified below. The guarantee provided shall be a joint guarantee from both the corrosion protection manufacturer, covering the manufacture and suitability of the corrosion protection system provided, and from the Contractor covering preparation, workmanship and application of the corrosion protection system against any defect for the specified guarantee period.

Refer C0700.7.

C1409M - TIMBER EXTERIOR

C1409.1 GENERAL

.1 Scope

This section deals with lengths of timber fixed to the Pedestrian barrier as either the top rail or infill elements.

Refer to drawing 6204430-SB-0401 for details

.2 Documents

DOCUMENTS REFERRED TO

Documents referred to in this section are:

NZS 3602	Timber and wood based products for use in building
NZS 3604	Light timber frame buildings not requiring specific design

Documents listed above and cited in the clauses that follow are part of this specification. However, this specification takes precedence in the event of it being at variance with the cited document.

C1409.2 PRODUCTS

.1 Materials

EXTERNAL TIMBER

To NZS 3602, treated H4 unless durable heartwood (KWILA or CEDAR) is provided.

.2 Components

SCREWS, STAINLESS STEEL

8G x 75 mm 316 stainless steel.

Use other sizes to suit profile being fixed.

.3 Finishes

SEMI-TRANSPARENT STAIN

Water borne acrylic stain, solvent borne semi-transparent oil stain, or solvent-borne semi-transparent oil-alkyd stain to suit the timber.

C1409.3 EXECUTION

.1 Conditions

STORAGE

Take delivery of timber undamaged and unmarked and store on site under cover and clear of areas where work is in progress, to ensure materials are of the required standard when fixed in place.

SUBSTRATE

Ensure that the substrate will allow work of the required standard. If it does not, do not proceed until the substrate has been rectified.

PRIMING AND SEALING

If not pre-finished before delivery, coat all faces and edges immediately. Then fillet stack trim until fixed. Keep dry and undamaged. Coat to suit the paint system specified in PAINTING. Allow to re-coat if exposed for more than one month before the final coating is applied.

.2 Application**EXECUTION**

To NZS 3604, except as varied in this specification. Execution to include those methods, practices and processes contained in the unit standards for the National Certificate in Carpentry and the National Certificate in Joinery (cabinetry, exterior joinery, stairs).

.3 Completion**LEAVE**

Leave the whole of this work free of blemishes, undamaged and to the standard of finish required for following work.

PROTECTION

Protect the completed work and make good before any surface finish is applied.

REPLACE

Replace all damaged or marked elements.

REMOVE

Remove all debris, unused materials and elements from the site.

C1409.4 NOT IN THIS CONTRACT