

S P E C I F I C A T I O N S

Auckland Transport Rail Stations Common Elements

Date: November 29th 2012

Prepared for



Prepared by



SPECIFICATIONS

1. ARCHITECTURAL

2. STRUCTURAL

3. CIVIL

4. ELECTRICAL

Preliminary and General specification project specific, not included in this document.

ARCHITECTURAL SPECIFICATIONS

ARCHITECTURAL SPECIFICATIONS

(29 NOV 2012)

LIST OF CONTENTS

1271	GUARANTEES AND WARRANTIES
1291	WARRANTY AGREEMENT
2111	DEMOLITION
3441	STEEL METALWORK
3541	STAINLESS STEEL METALWORK
4231	FIBRE CEMENT SHEET CLADDING
4251	ALUMINIUM COMPOSITE CLADDING
4311	PROFILED METAL ROOFING
4611	GENERAL GLAZING
<u>5518</u>	<u>GENERAL HARDWARE AND FITTINGS</u>
6711	PAINT FINISHES AND PROTECTIVE COATINGS
7413	RAINWATER SYSTEMS
8311	LANDSCAPING

SCHEDULE OF FINISHES

Note: refer to those sections underlined for amendments since previous Issue.

1271 GUARANTEES AND WARRANTIES

1.1 PROVIDE WARRANTIES

Provide warranties in favour of the principal and executed by the contractor in respect of, but not limited to, materials, components, service, application, installation and finishing called for in that specified section of work.

The terms and conditions of the warranty in no case negate the minimum remedies available under common law as if no warranty had been offered.

Failure to provide the warranties does not reduce liability under the terms of the warranties called for in that specified section of work.

1.2 TRADE GUARANTEES AND WARRANTIES

Where specific trade guarantees and warranties are offered covering materials and/or execution of proprietary products or complete installations, provide all such guarantees/warranties to the engineer.

Refer to the individual work sections for detailed requirements on this project.

1.3 FORM OF WARRANTY

Conform with the form of warranty agreement included in this specification.

The wording of the warranty to conform with the form of warranty agreement attached.

1.4 COMMENCE

Commence all warranties from the date of practical completion. Maintain their effectiveness for the times stated.

1.5 DELIVER

Deliver executed warranties to the engineer prior to the issue of the defects liability certificate.

1.6 SCHEDULE OF WARRANTIES

The following is a summary of the guarantees and guarantee periods called for in the specification work sections:

4311	PROFILED METAL ROOFING	5 YEARS
4251	ALUMINUM COMPOSITE CLADDING	5 YEARS
4611	GENERAL GLAZING	5 YEARS
6711	PAINT FINISHES AND PROTECTIVE COATINGS	5 YEARS
7413	RAINWATER SYSTEMS	5 YEARS

1291 WARRANTY AGREEMENT

Contract:

(the contract works)

Contractor:

~

(the contractor)

Principal:

AUCKLAND TRANSPORT

(the principal)

Warrantor:

~

(name of contractor or subcontractor)

Warranted works:

~

(the warranted works)

Warranty period: years from the date of practical completion of the contract.

The principal has entered into a contract for construction of certain contract works with the contractor and the contractor has agreed to arrange for the provision of a warranty in respect of the works or part thereof ("the warranted works").

The warrantor has agreed to provide a warranty in respect of the warranted works for the warranty period on the terms set out in this warranty.

1. IT IS HEREBY AGREED

The warrantor warrants to the principal that all work performed and all materials and/or fittings supplied by the warrantor in respect of the warranted works shall be in accordance with the standard and quality specified in the contract and the relevant drawings and specifications, and if not stipulated the work shall be of good trade practice and materials and fittings of merchantable quality.

This warranty shall be in addition to and shall not derogate from any manufacturer's warranty or any warranty implied by law, attaching to any materials or fittings forming part of the warranted works.

1.1 WARRANTOR'S OBLIGATIONS

The warrantor agrees that if the warrantor is advised by the principal in writing of any defect in materials or workmanship within the warranty period in respect of the warranted works for which the warrantor is liable under the terms of the contract, the warrantor will promptly take steps to remedy that defect.

1.2 REMEDIAL WORK

Any remedial work which the warrantor is liable to undertake under this warranty shall be carried out:

- (a) to the standard required by the contract;
- (b) in a prompt and timely manner;
- (c) without unnecessary inconvenience to any occupants as is reasonably practicable;
- (d) at the warrantor's cost; and
- (e) subject to reasonable access being provided to the warrantor for the purpose of carrying out the remedial work.

1.3 REPAIR AND/OR COMPENSATION

In the event the cost of replacement of work and/or materials is out of all proportion to the consequences of the defect, or where the defect may not be reasonably capable of rectification without substantial expense which is out of all proportion to the cost of the original works, the warrantor may

- (a) where the defect is reasonably rectified by repair rather than by replacement, propose that warrantor's obligation under this warranty shall be only to repair or otherwise make good the defect; or
- (b) propose reasonable monetary compensation in lieu of remedying the defect;
- (c) or propose a combination of both repair and compensation.

The principal must consider the warrantor's reasonable proposal and the parties must endeavour in good faith to reach agreement. Where agreement cannot be reached the dispute shall be resolved in accordance with rule 8.0.

1.4 FAILURE BY WARRANTOR TO PERFORM REMEDIAL WORK

If the warrantor fails to promptly, adequately and satisfactorily carry out the remedial work necessary the principal may arrange for the remedial work to be carried out by other persons. In such event the warrantor is in no way released from obligations under this warranty, which continues in full force and effect, except in respect of the defect remedied by the principal or by another person contracted by the principal. The reasonable cost of the remedial work carried out by such other persons (including all incidental costs to the principal) is to be paid to the principal by the warrantor on demand.

The principal shall advise the warrantor in writing before arranging for the remedial work to be carried out by other persons.

1.5 EXCLUSIONS

The principal agrees that the warrantor is not liable for any defect or damage caused by:

- (a) wilful act or negligence of the principal or any person other than the warrantor, its agents, employees or subcontractors;
- (b) fire, explosion, earthquake, war, subsidence, slips, faulty materials or workmanship other than the work or materials being warranted;
- (c) any force of nature which the warrantor could not reasonably foresee;
- (d) any neglect or delay by the principal in giving notice to the warrantor of a defect in the warranted works within a reasonable time of a defect becoming apparent;
- (e) design faults, errors or discrepancies, unless the warrantor undertook the design of the part of the warranted works the subject of the defect.
- (f) unintended use of the warranted works by the principal or any occupant thereof or failure by the principal or any occupant thereof to maintain the warranted works in accordance with the manufacturer's stated or recommended instructions or requirements.

1.6 ASSIGNMENT

The principal may assign the benefit of this warranty to any person.

1.7 DISPUTES

Any dispute between the principal and the warrantor arising out of this warranty is to be referred to arbitration before a sole arbitrator that the principal and the warrantor agree to appoint. If within 15 working days of notice of dispute, the principal and the warrantor cannot agree on a single arbitrator, either party may request the president of the Arbitrators & Mediators Institute of New Zealand to appoint an arbitrator.

1.8 NOTICES

Notices given to the warrantor are deemed to have been effectively served on the warrantor if given in accordance with the contract.

EXECUTED AS A DEED

Signed by the warrantor:

.....

on this:day of 20.....

(And where required) signed in the presence of:

Witness signature:

.....

...

Name *(print)*:

.....

...

Address *(print)*:

.....

...

Occupation *(print)*:

.....

...

Signed by the principal:

.....

...

on this:day 20.....

(And where required) signed in the presence of:

Witness signature:

.....

...

Name *(print)*:

.....

...

Address *(print)*:

.....

...

Occupation *(print)*:

.....

...

NOTE – Where the warrantor is not the contractor the warranty agreement must be executed by the warrantor and the principal in the manner required for execution of a deed.

Any of these parties which are a company must execute the warranty by having it signed, under the name of the company, by two or more directors. If there is only one director, it is sufficient if the warranty agreement is signed under the name of the company by that director, but the signature must be witnessed by another person.

The witness must not only sign but must also add his or her occupation and address. Alternatively, companies may execute under power of attorney. Any party which is a body corporate (other than a company) must execute by affixing its seal, which must be attested in the manner provided for in the rules of, or applicable to, the body corporate.

In the case of a party who is an individual, the party must sign and the signature must be witnessed by another person. The witness must not only sign but must also add his or her occupation and address.

2111 DEMOLITION

This section deals with the demolition of existing buildings and structures in whole or in part, to the extent necessary to carry out the contract works.

1. GENERAL

Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

NZS 6803 Acoustics - Construction noise

OSH publications: Approved code of practice for demolition
Guidelines for the management and removal of asbestos

Health and Safety in Employment Act 1992
Health and Safety in Employment Regulations 1995

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.

Requirements

1.2 QUALIFICATIONS

Carry out demolition:

- only under the supervision of a suitably experienced person, using only operators and drivers trained for this work
- using only experienced certified construction blasters for explosives demolition
- calling upon engineering expertise in those areas of demolition required by the OSH publication: Approved code of practice for demolition.

1.3 NOTIFIABLE WORK

Notify the appropriate OSH office of work that is notifiable under the Health and Safety in Employment Regulations 1995, 24 hours before starting the work.

1.4 NOISE

Refer to NZS 6803 tables 2 and 3 for the upper limits of construction work noise in residential and industrial areas over the various time periods, particularly 0730 to 1800 hours and plan the work using silenced and noise insulated plant to comply with those requirements. Do not exceed these limits, or any more stringent limits imposed by the local authority.

1.5 HEALTH AND SAFETY IN EMPLOYMENT ACT

Comply with the Health and Safety in Employment Act in general and the OSH publication: Approved code of practice for demolition, section 1.2.

In addition indemnify and keep indemnified the principal from and against all costs, damages, fines, penalties, loss, expense or other liability incurred or suffered, arising directly or indirectly from any breach of the Act.

- 1.6 ASBESTOS
Comply with the Health and Safety in Employment Act in general and the OSH publication: Guidelines for the management and removal of asbestos, section 2. Safe removal of asbestos.

Performance

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

- 1.8 DEMOLITION PLAN (METHOD STATEMENT)
Prepare a written demolition plan including sketches as described in the OSH publication: Approved code of practice for demolition, clause 4.8 and covering:
- the extent of the work
 - the plant being used
 - the proposed method for each roof, wall and floor
 - hazard identification
 - hazard assessment and control
 - 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.

- 1.9 SUBMIT COPIES
Submit copies of the demolition plan for written approval before proceeding. Also submit the plan to the OSH when required under the OSH publication: Approved code of practice for demolition.

2. PRODUCTS

Materials

- 2.1 ELEMENTS FOR SALVAGE
Carefully dismantle, remove and store on site where directed. Protect from damage and weather.
The following schedule of elements remain the property of the principal:

Component	Location
TBA	

2.2 ELEMENTS FOR RE-USE
Carefully dismantle, remove and store on site where directed. Protect from damage and weather until required.

Component	Location
TBA	

2.3 REMAINING ELEMENTS
Store all elements not scheduled for salvage or re-use on site until convenient for removal.

2.4 DEMOLITION RUBBLE FOR RE-USE
Do not contaminate with other materials and stockpile separately on site where directed and until required.

Material location	Building location	Hardfill location
TBA		

2.5 MATERIAL AND ELEMENTS FOR DISPOSAL
Remove demolished material and elements continually from the site through the period of the demolition.

3. EXECUTION

Conditions

3.1 EXISTING SERVICES
Notify the network utility operators and arrange for them to locate the position of all services adjacent to and entering the site. Disconnect and seal off services before work commences. Protect services adjacent to the site.

3.2 USE THE CHECK LIST
Use the checklist offered in the OSH publication Approved code of practice for demolition, chapter 10 and the demolition plan, to ensure that all major points in this contract are covered.

3.3 SITE INSPECTION
Visit and check the site, the building or structural work being demolished and any contents for likely hazards.

3.4 EXAMINE STRUCTURE
Examine roofs, walls, cantilevered structures and basements as required by the Approved code of practice for demolition and follow their requirements.

3.5 WELLS AND UNDERGROUND STORAGE TANKS
Test for flammable vapours or any other hazardous gases and follow established procedures to manage any hazards.

- 3.6 SPECIAL BUILDINGS
Refer to the OSH publication: Approved code of practice for demolition, clause 4.7 and follow the advice given in respect of caution and the obtaining of advice.
- 3.7 DO NOT DISTURB SUPPORT
Do not disturb support to foundations of buildings on adjoining property, or the ground of adjoining property.
- 3.8 PROTECTION
Erect approved temporary screens and shelter to protect from weather, dust and dirt penetration those parts of the existing building, other buildings and the remainder of the site being retained in their present condition.
- 3.9 SAFETY DURING DEMOLITION
Refer to the OSH publication: Approved code of practice for demolition and carry out the requirements laid down in chapter 5 in respect of:
- instability
 - supervision
 - plant, tools and equipment
 - personal protective equipment
 - protection of the public
 - unauthorised access to site.
- 3.10 DEMOLITION PROCEDURES
Refer to the OSH publication: Approved code of practice for demolition and carry out the requirements laid down in clause 5.10 including:
- scaffolding
 - health
 - disposal of debris and waste material
 - fire protection.
- 3.11 BUILDINGS
Refer to the OSH publication: Approved code of practice for demolition, chapter 5 and carry out the requirements in respect of:
- buildings
 - prestressed concrete structures
 - storage tanks
- 3.12 HAND TOOL AND PERSONAL PROTECTIVE EQUIPMENT
Refer to the OSH publication: Approved code of practice for demolition, appendix A and appendix B and carry out the requirements laid down for:
- hand tools
 - power tools
 - personal protective equipment
 - cutting and welding.

Application

- 3.13 CARRY OUT DEMOLITION
Carry out all demolition to the requirements of the OSH publication: Approved code of practice for demolition.
- 3.14 CARRY OUT ASBESTOS REMOVAL
Carry out asbestos removal to the requirements of the OSH publication: Guidelines for the management and removal of asbestos.
- 3.15 PLAN THE WORK
Refer to the OSH publication: Approved code of practice for demolition, chapter 6 and carry out the selected methods in the demolition plan for this work, to the requirements under the following methods of demolition:
- by hand
 - with the ball
 - by pusher arm
 - by deliberate collapse
 - by wire rope pulling
 - by explosion or implosion
 - using power grapples and shears
 - by other methods.
- 3.16 MECHANICAL PLANT
Refer to the OSH publication: Approved code of practice for demolition, chapter 7 and carry out the requirements in respect of:
- general plant safety
 - front-end loaders, backhoes, excavators and bulldozers
 - trucks
 - use of plant indoors.
- 3.17 CONTAMINATED SITES
If the site is chemically contaminated carry out the procedures, management and control as laid down in the OSH publication: Approved code of practice for demolition, chapter 8.
- 3.18 DIG OUT
Dig out foundations, footings, basement, floor slabs, paths, drains, cesspits and manholes that are part of or service the demolished building. Leave the voids that result. Do not backfill.

Completion

- 3.19 MAKE GOOD
Make good damage to adjoining buildings or property caused by demolition work.

- 3.20 REINSTATE
Reinstate where any damage is caused by this demolition to those parts of the existing building, other buildings and the remainder of the site being retained.
- 3.21 LEAVE
Leave work to the standard required by following procedures.
- 3.22 DISPOSAL OF ASBESTOS
Store, label and dispose of asbestos to the requirements of section 5 of the OSH publication: Guidelines for the management and removal of asbestos.
- 3.23 TAKE AWAY
Take away from the site all plant, tools and equipment, temporary access works, and demolished materials and elements, to leave the site completely clean and tidy.

3441 STEEL METALWORK

This section deals with the fabrication and installation of fabricated steel items, and includes galvanised finishes where specified.

1. GENERAL Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

BS 4	Structural steel sections, Part 1: Hot-rolled sections
AS/NZS 1554	Structural steel welding
AS 1594	Hot-rolled steel flat products
BS 2630	Resistance projection welding of uncoated low carbon steel sheet and strip using embossed projections
AS/NZS 4680	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
AS/NZS 4792	Hot-dip galvanised (zinc) coatings on ferrous hollow sections, applied by a continuous or special process
NZS/BS 4848	Hot-rolled structural steel sections
BS 6265	Resistance seam welding of uncoated and coated low carbon steel

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.

Requirements

1.2 QUALIFICATIONS

Metalworkers to be qualified as welders and experienced in working with steel and the techniques specified.

1.3 SHOP DRAWINGS AND INSTALLATION DETAILS

Provide shop drawings for review by the engineer before commencing manufacture. Allow 10 working days for review.

Shop drawings to show, but not be limited to:

- Design calculations
- Complete details of construction, connections and all support systems
- Dimensions of all typical elements and of any special sizes and shapes
- Provision for the exclusion and/or drainage of moisture
- Jointing details and method of fixing between individual elements and between this installation and adjacent work
- Provision for adjustment of fixings to ensure true alignment of windows
- Sealant types and full size sections of all sealants and backing rods

- Provision for seismic movement and movement under wind loads
- Co-ordination requirements with other work

1.4 REVISED SHOP DRAWINGS

Provide a copy of shop drawings revised to include required modifications, before proceeding with any fabrication or erection.

1.5 SAMPLES AND PROTOTYPES

Prepare samples, and construct prototypes for review as to appearance, form and conformance with the drawings and specifications. Submit all information required to assist the review process, including technical data, manufacturer's literature, independent appraisals and producer statements.

Timing for the provision and review of samples, sample panels and prototypes to be included in the contract programme. Allow a minimum of 10 working days for each review. Proceed only after instructions to proceed have been issued in writing by the engineer. In situ work may be incorporated in the finished work if so confirmed, otherwise allow to remove completely and replace.

2. **PRODUCTS** **Materials**

2.1 STEEL SECTIONS

Hot-rolled steel sections to BS 4, part 1 and NZS/BS 4848, part 4.
Hot-rolled hollow steel sections to NZS/BS 4848, part 2.
Hot-rolled sheet and/or steel flat/strip to AS 1594.

Components

2.2 SCREWS

Self-tapping metal with similar composition and mechanical properties to the parent metal and with the type of head, length, gauge and thread to suit the work and its location.

2.3 BOLTS

Similar composition and mechanical properties to the parent metal, selecting type and size to suit the work and its location.

2.4 RIVETS

Solid domed with similar composition and mechanical properties to the parent metal. Flat head mild steel to be galvanised.

Finishes

2.5 FINISHES

Refer Section 6711 PAINT FINISHES AND PROTECTIVE COATINGS.

3. EXECUTION Conditions

3.1 DELIVERY

Do not deliver any elements to the site which cannot be unloaded immediately into suitable storage conditions.

Avoid distortion of elements during transit, storage and handling. Prevent pre-finished surfaces rubbing together, and any contact with mud, plaster or cement. Keep protective coverings dry.

3.2 PREPARATION

Ensure location and substrate is ready to receive the elements and will allow work of the required standard.

Assembly

3.3 PROTECTION

During fabrication protect all surfaces which will be visible in completed work.

3.4 FORMING

Formed work to be free from warping, buckling and fractures. Form bends with a brake press or by cold rolling.

Unless specified otherwise, mitre junctions of identical sections.

Form holes without distortion of surrounding metal.

3.5 CLEANING

Remove all burrs and sharp arrises which would be visible after fixing, or a hazard to the user.

3.6 JOINTS

Draw riveted joints tightly together, with rivets closed to completely fill holes.

Ensure mechanical joints are tight with no visible gaps.

Bed in mastic all mechanical joints of elements which will be located externally, including all mating surfaces, cleats and other fixings.

Use countersunk fixings where they will be visible after the component has been fixed and where raised heads would interfere with any moving part.

Assembly - Welding

3.7 PREPARATION

Remove grease, dirt, moisture and oxide from edges being welded.

Remove scale and residue from arc and power cutting by machining or hand grinding.

- 3.8 ACCURACY
Ensure accurate fit using clamps and jigs where practical. Use tack welds for temporary attachment where jiggling is not practical.
- 3.9 WELDING
Use tack welding only for temporary attachment.
Make joints with parent and weld metal fully fused throughout with no inclusions, holes, porosity or cracks.
Welding to AS/NZS 1554, BS 2630 and BS 6265 as appropriate.
Finish butt welds which will be visible in completed work smooth and flush with adjacent surfaces.
- 3.10 SPATTER AND RESIDUES
Prevent weld spatter falling on surfaces of materials which will be self finished and/or visible in completed work.
Ensure complete removal of flux residues and slag.

Application

- 3.11 INSTALLATION
Locate plugs accurately and use in accordance with the manufacturer's requirements. Fix plumb, level and true to line.
Comply with the specified standards, the reviewed shop drawings and installation details, including brackets, bolts, fixings, grout, bedding compounds and sealants.
- 3.12 LOADING
Elements must not carry any structural load unless designed to do so. Do not use as strutting or support when in place.
- 3.13 SEPARATION
Isolate dissimilar materials (metal and non-metal) in close proximity as necessary by painting the surfaces or fitting separator strips.
Place isolators between metals and treated timber and cement-based materials.

Finishing

- 3.14 PREPARATION FOR COATINGS
Before applying coatings remove all welding slag, weld spatter, anti-splatter compounds, paints, grease, flux, rust, burrs and sharp arrises. Make good all defects which would show after application of coating. Finish surfaces smooth.
- 3.15 GALVANISING
After fabrication completely remove all surface contaminants and hot-dip galvanise to AS/NZS 4680 and AS/NZS 4792.
- 3.16 PAINT FINISHES
Refer Section 6711 PAINT FINISHES AND PROTECTIVE COATINGS.

Completion

3.17

COMPLETION

Ensure all elements are free of marks or blemishes, with all moving parts working fully and freely.

Replace damaged, cracked or marked elements.

Leave work to the standard required by following procedures.

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

3541 STAINLESS STEEL METALWORK

This section deals with the fabrication and installation of stainless steel items of a general nature.

1. GENERAL

Related work

1.1 RELATED SECTIONS

Refer to Section 3441 STEEL METALWORK for non-stainless steel metalwork items.

Documents

1.2 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 1554-6 Structural Steel Welding – Welding Stainless Steels for Structural Purposes

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.

Requirements

1.3 QUALIFICATIONS

Metalworkers to be experienced in working with stainless steel and the techniques specified.

1.4 SHOP DRAWINGS AND INSTALLATION DETAILS

Provide shop drawings for review by the engineer before commencing manufacture. Allow 1 week for review.

Shop drawings to show, but not be limited to:

- Design calculations
- Complete details of construction, connections and all support systems
- Dimensions of all typical elements and of any special sizes and shapes
- Provision for the exclusion and/or drainage of moisture
- Jointing details and method of fixing between individual elements and between this installation and adjacent work
- Provision for adjustment of fixings to ensure true alignment of windows
- Sealant types and full size sections of all sealants and backing rods
- Provision for seismic movement and movement under wind loads
- Co-ordination requirements with other work

1.5 REVISED SHOP DRAWINGS
Provide a copy of shop drawings revised to include required modifications, before proceeding with any fabrication or erection.

1.6 SAMPLES AND PROTOTYPES
Prepare samples, and construct prototypes for review as to appearance, form and conformance with the drawings and specifications. Submit all information required to assist the review process, including technical data, manufacturer's literature, independent appraisals and producer statements.

Timing for the provision and review of samples, sample panels and prototypes to be included in the contract programme. Allow a minimum of 10 working days for each review. Proceed only after instructions to proceed have been issued in writing by the engineer. In situ work may be incorporated in the finished work if so confirmed, otherwise allow to remove completely and replace.

2. PRODUCTS

Materials

2.1 STAINLESS STEEL SECTIONS
Plates/rods/flat bars/equal angles/tubes/square tubes/
chromium/nickel steel alloy.
Grade: 316L
Finish: refer Schedule of Finishes
Dimensions: refer drawings

Components

2.2 SCREW AND BOLT FIXINGS
Grade 316 stainless steel with the type of head, length, gauge and thread to suit the work and its location.

3. EXECUTION

Conditions

3.1 HANDLING
Do not deliver any elements to the site which cannot be unloaded immediately into suitable storage conditions. Avoid distortion of elements during transit, storage and handling. Prevent surfaces rubbing together, and any contact with mud, plaster or cement. Keep protective coverings dry.

3.2 PREPARATION
Ensure location and substrate is ready to receive the elements and will allow work of the required standard.

- 3.3 MATERIALS
Select and use metal materials suited to the element, process or finish specified, jointing them as necessary to allow full development of their expected durability with a minimising of potential corrosion.

Assembly

- 3.4 PROTECTION
During fabrication protect all surfaces which will be visible in completed work.
- 3.5 FORMING
Ensure cold formed work is free from warping, buckling and fractures. Form bends with a brake press or by cold rolling. Unless specified otherwise, mitre junctions of identical sections. Form holes without distortion of surrounding metal.
- 3.6 CLEANING
Remove all burrs and sharp arrises which would be visible after fixing, or a hazard to the user.
- 3.7 AFTER CUTTING STAINLESS STEEL
Grind off materials liable to corrode after thermal cutting.
- 3.8 MECHANICAL JOINTS
Ensure mechanical joints are tight with no visible gaps.

Assembly - welding

- 3.9 PREPARATION FOR WELDING
Remove grease, dirt, moisture and oxide from edges to be welded. Remove scale and residue from arc and power cutting by machining or hand grinding.
- 3.10 ACCURACY
Ensure accurate fit using clamps and jigs where practical. Use tack welds for temporary attachment where jiggling is not practical.
- 3.11 WELDS
Welding stainless steel to AS/NZS 1554-6.
Make joints with parent and weld metal fully fused throughout with no inclusions, holes, porosity or cracks.
Use double level butt welds, backing bars to remove heat, jiggling, tack welds and any other measures necessary to minimise distortion. Remove slight distortion by light hammering, taking care not to damage the surface finish.
- 3.12 SPATTER
Prevent weld spatter falling on surfaces of materials which will be self finished and visible in completed work.

3.13 RESIDUES
Ensure complete removal of flux residues and slag.

3.14 BUTT WELDS
Grind butt welds which will be visible in completed work smooth and flush with adjacent surfaces.

Application

3.15 INSTALLATION
Locate plugs accurately and use in accordance with the manufacturer's requirements. Fix plumb, level and true to line. Fix to comply with the reviewed shop drawings and installation details, including brackets, bolts, fixings, bedding compounds and sealants.

3.16 LOADING
Elements must not carry any structural load unless designed to do so. Do not use elements as strutting or support when in place.

Completion

3.17 COMPLETION
Ensure all elements are free of marks or blemishes, with all moving parts working fully and freely.
Replace damaged, cracked or marked elements.
Leave work to the standard required by following procedures.
Remove debris, unused materials and elements from the site.

4231 FIBRE CEMENT SHEET CLADDING

This section deals with the supply, fixing and jointing of fibre cement panels as soffit cladding systems, and as panels to fences.

Note: refer drawings to ascertain the selected cladding material and related jointing system applicable to each project.

1. GENERAL

Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 2908.2 Flat sheets

NZS 3604 Timber framed buildings

NZS 4203 General structural design and design loadings for buildings

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.

Performance

1.2 FIXINGS, WIND

Design and use the fixings appropriate for the wind zone (R) and topographical classification (T) of this site and building height; as required by NZS 3604 and the wind loads on various wall areas as given by NZS 4203.

2. PRODUCTS

Materials

2.1 FIBRE CEMENT SHEET CLADDINGS – EXPRESSED JOINTS

To AS/NZS 2908.2. Medium density, fibre cement autoclaved sheet, 1190 mm wide, with square edges and one sanded face.

Manufacturer/Brand: James Hardie Hardipanel Titan - 9 mm thickness

Edge finish: square edges for expressed joints

Location: soffit linings - refer drawings

2.2 FIBRE CEMENT SHEET CLADDINGS – FLUSH JOINTS

To AS/NZS 2908.2. Fibre cement autoclaved sheet, with rebated edges both sides and one end and a sealed, sanded face.

Manufacturer/Brand: James Hardie Hardipanel Villaboard - 6 mm thickness

Edge finish: tapered edges for flush jointing

Location: soffit linings - refer drawings

2.3 FIBRE CEMENT SHEET FENCE PANELS

To AS/NZS 2908.2. Medium density, fibre cement autoclaved sheet, 1190 mm wide, with square edges and one sanded face.

Manufacturer/Brand: James Hardie Hardipanel Titan - 9 mm thickness

Edge finish: square edges for expressed joints

Location: Fence panels – refer drawings

Components

2.4 SOFFIT BATTENS

Hot dipped galvanised steel 'top hat' components to carry soffit linings.

Manufacturer/Brand: Rondo or equivalent

Location: to support soffit linings - refer drawings

2.5 SCREW FIXINGS

Countersunk Phillips-head type 316 stainless steel self drilling, self tapping, gauged to suit thickness of steel where applicable. Refer to the sheet manufacturer's technical literature for selection and use requirements.

2.6 FLUSH JOINT FINISHING SYSTEM

Reinforced jointing and filling compound, compatible with the substrate panels and with subsequent exterior coatings, in conjunction with joint reinforcing paper tape.

Stopping brand: Nuplex Villastop

Reinforcing tape brand: Marco Perforated Paper Tape (Winstone Wallboards)

3. EXECUTION

Conditions

3.1 DELIVERY

Take delivery of sheets dry and undamaged in pallets and lay horizontally on a smooth level surface.

Protect edges and corners from damage and cover to keep dry until fixed.

Avoid distortion and contact with potentially damaging surfaces. Do not drag sheets across each other, or across other materials.

3.2 SUBSTRATE

Do not commence work until the substrate is of the standard required by the sheet manufacturer for the specified finish; plumb, level and in true alignment.

Application

- 3.3 INSTALL CEILING BATTENS
Install in accordance with the batten manufacturer's requirements.
- 3.4 INSTALL EXPRESSED JOINTED CLADDING SHEETS
Cut edges dry, drill for screws and form holes to the sheet manufacturer's requirements. Scribe and fit sheets with countersunk screws, forming 10 mm expressed joints, all as detailed by the sheet manufacturer and on the drawings. Install to the manufacturer's required details.
- 3.5 INSTALL FLUSH JOINTED CLADDING SHEETS
Cut sheets dry, and scribe fit to fully support all edges and joints. Fit expansion joints to limit finished areas to 9 metre x 6 metres. Flush joints with bedding compound, paper reinforcing tape and finishing compound to flush width of 150 mm. Refer to the sheet manufacturer's requirements and details.
- 3.6 INSTALL EXPRESSED JOINTED SHEETS - FENCES
Cut edges dry, drill for screws and form holes to the sheet manufacturer's requirements.
Fence panel sheets are to be paint finished prior to fixing in place – refer Section 6711 PAINT FINISHES AND PROTECTIVE COATINGS.
- Scribe and fit sheets with countersunk screws, forming expressed vertical and horizontal joints, all as detailed on the drawings and to the manufacturer's required detail.

Completion

- 3.7 COMPLETION
Replace all damaged or marked elements.
Leave work to the standard required for following procedures.
Remove debris, unused materials and elements from the site.

4251 ALUMINIUM COMPOSITE CLADDING

This section deals with the manufacture, supply and installation of prefinished aluminium composite cladding systems.

1. GENERAL

Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS 1397	Steel sheet and strip - Hot-dipped, zinc-coated or aluminium/zinc-coated
AS 1866	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
AS 2848	Aluminium and aluminium alloys - Compositions and designations
NZS 4203	General structural design and design loadings for buildings
AS/NZS 4284	Testing of building facades
AS/NZS ISO 9001	Quality systems - Model for quality assurance in design, development, production, installation and servicing
AS/NZS ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing

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.

Requirements

1.2 SAMPLES

Submit for assessment samples of all materials before beginning fabrication: 300 mm x 450 mm for sheets and 300 mm long for aluminium extrusions. Provide one sample for each material/finish visible in the finished work. In addition provide a sample of a completed joint.

1.3 SHOP DRAWINGS

Provide shop drawings and installation details to show, but not be limited to:

- design calculations
- fully dimensioned elevations of all elements (minimum scale 1:20)
- complete details of construction, connections and all support systems (scale 1:10)
- dimensions of all typical elements and of any special sizes and shapes
- provision for the exclusion and/or drainage of moisture

- jointing details and method of fixing between individual elements and between this installation and adjacent work, including adjustment
- adjustment of fixings to ensure accurate alignment of composite cladding
- sealant types and full size sections of all sealants and backing rods
- provision for thermal movement
- provision for seismic movement and movement under wind loads
- sequence of installation
- co-ordination requirements with other work
- a full schedule of materials, finishes, componentry, hardware and fittings.

Refer to PRELIMINARIES & GENERAL for requirements for submission and review and the provision of final shop drawings.

Guarantees

1.4 WARRANTY

Warrant this work against all failures, including but not limited to a warranty that work will be weathertight, structurally sound and free from distortion and deformation under load, and that materials and finishes will not crack, peel, blister, delaminate or otherwise deteriorate or corrode.

Warranty period: 5 years

Refer to the PRELIMINARIES AND GENERAL section for the required form of warranty agreement and details of when completed warranty agreement must be submitted.

Performance

1.5 FIXINGS, WIND

Design and use the fixings appropriate for the wind zone (R) and topographical classification (T) of this site and building height; as required by NZS 3604 and the wind loads on various wall areas as given by NZS 4203.

1.6 FIXINGS, EARTHQUAKE

Use fixings and methods capable of sustaining the loads appropriate to the area as required by NZS 4203.

1.7 QUALITY CONTROL

Maintain an approved quality control system in accordance with AS/NZS ISO 9001 and/or AS/NZS ISO 9002, covering all stages of design, fabrication, installation and completion of the aluminium cladding and soffits.

- 1.8 PERFORMANCE
Accept responsibility for the weather-tight performance of the completed cladding system, including all penetrations.

2. PRODUCTS

Materials

- 2.1 UNDERLAY
Heavyweight breather type bitumen saturated and fibreglass reinforced kraft paper.
Brand/Manufacturer: Tasman Insulation NZ Bitumac 860 or equivalent approved
Nominal weight: 400 g/m²
Locations: underlay to panels - refer drawings
- 2.2 ALUMINIUM COMPOSITE PANELS
Composite aluminium-faced solid; polyethylene cored, non combustible mineral fibre cored or phenolic-resin cored sheet, factory finished on face side with polyvinylidene fluoride PVF² coating.
Brand: Alpolic by Thermosash Commercial Ltd
Panel thickness: 4 mm
Colour: refer to SCHEDULE OF FINISHES

Components

- 2.3 PANEL STIFFENING
Proprietary folded composite sheet, or galvanised steel top hat sections to AS 1397, coating class not less than Z275, structurally glued and sealed to the back of the panels, as required by the panel manufacturer.
- 2.4 FIXING SECTIONS
Extruded aluminium fixing sections. Aluminium alloy AA 6063-T5 to AS 1866 (designated to AS 2848).
- 2.5 FIXING SYSTEM
Proprietary secret-fixing clamped gasket system, as required by the manufacturer.
- 2.6 FIXINGS AND FASTENINGS
Designed, supplied and installed by the aluminium panel manufacturer.
- 2.7 SCREWS
Type 316L stainless steel with countersunk Phillips heads finished to match surrounding surfaces. Use concealed screws wherever practicable.

- 2.8 RIVETS
Aluminium alloy blind rivets of the same composition as the materials being joined.
- 2.9 SEALANTS
Neutral curing silicone or polymer sealant as required by the panel manufacturer and used as directed. Durability of sealants not less than the material being sealed.
Brand/Manufacturer: as recommended by the panel manufacturer
Colour: black
- 2.10 COMPATIBILITY
All elements and accessories compatible on the electrochemical scale of metals so that no sacrificial corrosion will occur. All elements and accessories of an appropriate quality, ensuring that no reduction in structural integrity or weathertightness occurs during the guaranteed life of the panel system.

3. EXECUTION

Conditions

- 3.1 INSTALLATION
All work to be carried out by competent and experienced installers, who are currently approved by the panel manufacturers or New Zealand distributors, in accordance with the manufacturer's stated requirements and the approved shop drawings. Carry out all cladding manufacture and installation under the control and supervision of a nominated representative of the panel manufacturer.
- 3.2 TOUCH UP
In situ touch up of factory applied finishes is not permitted unless a trial repair is subsequently approved in writing. Replace all other panels with a damaged finish.
- 3.3 HANDLE AND STORE
Handle and store pre-finished panels and materials so that no damage will be done to the form, material, or finish.
- 3.4 UNLOAD
Unload, handle and store preformed and pre-finished panels in accordance with the manufacturer's stated requirements.
- 3.5 DO NOT DELIVER
Do not deliver to site any elements which cannot be immediately unloaded into suitable conditions of storage.

3.6 PROTECTION
Avoid distortion of elements during transit, handling and storage. Prevent pre-finished surfaces from rubbing together. Prevent contact with mud, plaster and cement, or with dissimilar metals.

3.7 DO NOT USE
Do not use adhesive tape, film, papers, or sprayed protective coatings, or masking tape, which might become bonded after exposure to sun or weather. Remove any temporary protection after installation. Remove any protective coating residues immediately.

Assembly

3.8 FABRICATION
Do not start fabrication until shop drawings and material samples have been approved.

Application

3.9 INSTALL UNDERLAY
Install underlay to all exterior surfaces being clad with aluminium composite panels. Fix paper with proprietary three-pronged suspension system, or similar broad-based fixing staples.

3.10 INSTALL PANELS
Install aluminium composite panels in accordance with the drawings, stated design parameters (including joint size and design modules) reviewed and approved shop drawings, approved prototypes and installation details. Co-ordinate with related work. Consult and coordinate as necessary with installers of adjoining work, including window and door installations.

3.11 APPLY SEALANTS
Clean joints with solvent, mask adjoining surfaces, install backing rod or breaker tape and install sealant in accordance with the reviewed shop drawings, sealant profiles and sealant manufacturer's instructions.

3.12 COMPLETE
Ensure the work is complete with all flashings, finishings and trim properly installed so the cladding system is completely weathertight.

Completion

3.13 PROTECTION
Protect all surfaces and finishes for damage as long as practicable, including the retention of all or any protective coatings provided by the panel manufacturer. Remove protective coatings, using only the methods required by the panel manufacturer.

3.14

CLEAN

Trade clean all panel surfaces to remove all marks, dust and dirt to enable a visual inspection of all surfaces at completion of the installation and again at contract completion.

Clean panel surfaces with soft, clean cloths and clean water and in accordance with the panel manufacturer's stated requirements. Finish with a clean squeegee. Do not use abrasive or alkaline materials.

4311 PROFILED METAL ROOFING

This section deals with the supply and fixing of proprietary prefinished overlap rigid sheet metal profiled roofing complete with accessories for a completely water-tight installation.

Note: roofing to be installed with ribs (150mm pitch) on module as set out on drawings.

1. GENERAL

Related work

1.1 RELATED SECTIONS

Refer to 7413 RAINWATER SYSTEMS for rainwater disposal.

Documents

1.2 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 1170.2 Wind actions

AS 1397 Steel sheet and strip - hot dipped, zinc-coated or aluminium/zinc-coated

NZS/AS 1734 Aluminium and aluminium alloys - Flat sheet, coiled sheet and plate

NZS/AS 3566 Screws - Self-drilling - For the building and industries

NZS 3604 Timber framed buildings

NZS 4203 General structural design and design loadings for buildings

New Zealand Metal Roofing and Cladding Manufacturers' Association Inc: Profiled metal roofing design and installation handbook

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.

Guarantees

1.3 WARRANTY

Warrant this work under normal environmental and use conditions against failure of weatherproofing and materials from date of Practical Completion.

Warranty period: 5 years

Refer to 1271 GUARANTEES AND WARRANTIES section for the required form of warranty agreement and details of when completed warranties must be submitted.

Requirements

1.4 QUALIFICATIONS

Carry out work with experienced, competent installers familiar with the products being used and with appropriate qualifications such as the National Certificate in Metal Roofing and Cladding.

1.5 ROOFING SURFACES PROTECTION

Contractor to ensure that all metal swarf resulting from construction material cutting and drilling and the like is removed from the roof surfaces on a daily basis. Contractor is to ensure that no other trades utilise the roof areas as general working areas when fabricating components on site.

Performance

1.6 FIXINGS, WIND

Design and use the fixings appropriate for the wind zone (R) and topographical classification (T) of this site and building height; as required by NZS 3604 and the wind loads on various wall areas as given by NZS 4203 or AS/NZS 1170.2. Allow for specific loadings at corners and the periphery of the roof, where localised pressure factors apply.

1.7 COORDINATE

Coordinate to ensure substrate and preparatory work is complete and other work programmed in the order required for access and completion of the roof.

1.8 PERFORMANCE

Accept responsibility for the weather-tight performance of the completed roofing system, including all penetrations through the roof and junctions with walls and parapets.

1.9 FINISHES

In situ touch up of pre-finished metal roofing is only permitted after receiving written authority. Replace all damaged material.

2. PRODUCTS

Materials

2.1 WIRE NETTING

Galvanised hexagon 75 mm mesh, 1 mm diameter galvanised steel wire.

- 2.2 ROOFING UNDERLAY
 Heavyweight breather type bitumen saturated and fibreglass reinforced kraft paper.
 Brand/Manufacturer: Tasman Insulation NZ Bitumac 860 or equivalent
 approved
 Nominal weight: 400 g/m²
 Locations: underlay to roofing - refer drawings
- 2.3 METAL ROOFING
 Pre-finished hot dipped aluminium/zinc coated formability G550 steel sheet coated to AS 1397.
 Manufacturer/Profile: Dimond BB900
 Base metal / thickness: Zinalume 0.55mm BMT
 Coating brand/type: ColorCote ZRX or Colorsteel Maxx or equivalent
 Colour: refer Finishes Schedule
 Fixing: roof manufacturer's concealed clip system
- 2.4 METAL ROOF FLASHINGS
 Formable grade G300 aluminium/zinc-coated pre-painted aluminium/zinc coated steel to the same standards as the profiled sheets.
 Supplied by the roofing manufacturer to match or to suit the roofing, notched where across profile. Rivet fixings to every 2nd rib of roofing.
 Base metal: Zinalume 0.7mm BMT
 Flashing thickness: as indicated on the drawings
 Coating brand/type: ColorCote ZRX or Colorsteel Maxx or equivalent
 Colour: refer Finishes Schedule
 Flashing cover: minimum 200mm
 Fixing system: screw-fixed
 Jointing system: butt joints & to be secured with under-cloak soakers

Note: overlap joints are not permitted

Components

- 2.5 FIXINGS
 Durability of all fasteners not less than the roofing material being fixed.
 To comply with NZS/AS 3566. Screw type appropriate to the roofing material and the supporting structure, and as required by the roofing manufacturer as part of the complete roofing system.
 Material: stainless steel

- 2.6 SEALANT
Neutral curing silicone or polymer sealant as required by the roofing manufacturer and used as directed. Durability of sealants not less than the roofing material being sealed.
Brand/Manufacturer: Dow Corning 780 Roofers and Plumbers
Silicone or similar approved
Colour: Clear
- 2.7 CLOSURE STRIPS
Non-bituminous compressible, profiled closed cell foam strips to fit the sheet profile.
Brand/Profile: Ecofoam, to suit selected cladding profile
Locations: Exposed edges of sheets; refer drawings
- 2.8 RIVETS
Sealed aluminium, minimum diameter 4.8 mm.
- 2.9 LAP SEALING TAPE
Closed cell, 3mm x 16 mm self adhesive nitrile tape.
- 2.10 ADHESIVE TAPE
Pressure sensitive adhesive tape to the roofing underlay manufacturer's requirements.
- 2.11 FLASHINGS TO PENETRATIONS
Proprietary butyl rubber flashing systems installed to the manufacturer's requirements.
Brand/Manufacturer: Dektite or equivalent approved

3. EXECUTION

Conditions

- 3.1 INSPECTION
Inspect the roof substrate and supporting structure to ensure that it is complete and fully complete, fixed and braced ready for roofing.
- 3.2 STORAGE AND HANDLING
Take delivery of and accept packs of roofing dry and undamaged on delivery. Reject all damaged material. Store on a level firm base with packs well ventilated and completely protected from weather and damage. Do not allow moisture to build up between sheets.
Avoid distortion and contact with damaging substances, including cement. Do not drag sheets across each other and other materials. Protect edges and surface finishes from damage. Use soft, flat sole shoes when fixing and for all other work on the roof.

- 3.3 SEPARATION
Isolate dissimilar materials in close proximity as necessary by painting the surfaces or fitting separator strips of compatible materials. Place isolators between metals and treated timber.

Application

- 3.4 SET OUT
Carefully set out with side laps away from the prevailing wind, with the widths of end sheets the same, all sheets square and oversailing the gutter true to line. Check during fixing to eliminate creep or spread and string lines along purlin centres to keep fastenings in line.
- 3.5 FORMING
Form stop-ends and downturns to the roofing manufacturer's details and techniques using the required tools.
- 3.6 SEAL CUT EDGES
Due to the severe environment seal cut edges of pre-coated steel sheet with edge protection lacquer before fixing to the roofing manufacturer's requirements.
- 3.7 END LAPS
End laps are not permitted, except where specifically detailed.
- 3.8 THERMAL MOVEMENT
Roof fixing and jointing to conform with the roofing manufacturer's requirements for thermal movement.
- 3.9 FIXING GENERALLY
Install and fix in accordance with the New Zealand Metal Roofing and Cladding Manufacturers' Association Inc: Profiled metal roofing design and installation handbook, and to the roofing manufacturer's required fixing patterns and details for each area of the building roofing. Use only screws as required by the roofing manufacturer. Paint colour matched fixings and accessories before installation.
- 3.10 FIX NETTING
Fix wire netting, drawn tight and screwed to purlins with edges butted and wired together to form a complete net.
- 3.11 LAY ROOF UNDERLAY
Pre-cut underlay to required lengths. Lay horizontally starting at the gutter line with succeeding sheets in true alignment and lapping 150 mm. Carefully scribe around and fit neatly to all penetrations. Keep dry and clean until covered in.

- 3.12 MARKING AND CUTTING
Cut only by shearing tools. Do not use black lead pencils for marking aluminium/zinc coated products.
- 3.13 FIX ROOFING SHEETS
Fix sheets in place using the fastening system required by the roofing manufacturer for specified profiles, making due allowance for dynamic local wind pressures on the building and thermal movement in the sheet.
Form stop ends at the upper end of roofing sheets.

Note: roofing to be installed with ribs (150mm pitch) on module as set out on drawings.

- 3.14 FLASHINGS
Flash roof cladding to adjoining components and penetrations to detail, to the New Zealand Metal Roofing and Cladding Manufacturer's Association Inc: Profiled metal roofing design and installation and the roofing manufacturer's requirements. Cut accurately and fix using sealant and rivets to detail and to the roofing manufacturer's requirements to form a weatherproof cover. All laps 200 mm minimum.

**Joints are to be butt joints and secured with under-cloak soakers.
Note: overlap joints are not permitted.**

- 3.15 PENETRATIONS AND JUNCTIONS
Flash and overflash all penetrations through the roof.
Where indicated on the drawings provide proprietary flashing systems, installed in accordance with the manufacturer's requirements.

Completion

- 3.16 COMPLETION
Clean out spoutings, gutters and rainwater pipes on completion of the roof. Replace damaged or marked elements.
Leave this work complete with all necessary flashings and undercloaks all properly installed as the work proceeds so the finished roof is completely weathertight.
Remove debris, unused materials and elements from the site.

- 3.17 PROTECTION
Protect the completed work from damage for the remainder of the construction period. If access is given to the roof for later work, provide properly constructed walkways or platforms to eliminate damage.

4611 GENERAL GLAZING

This section deals with the manufacture, supply and installation of glazing in powder coated aluminium support frames, and includes manifestations where noted on the drawings.

1. GENERAL

Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 1866	Aluminium and aluminium alloys - Extruded rod, bar, solid and hollow shapes
AS 3715	Metal finishing - Thermoset powder coatings for architectural applications
BS 3900	Methods of tests for paints Part C5: Determination of film thickness
NZS 4211	Performance of windows
NZS 4223	Glazing in buildings Part 1: The selection and installation of glass in buildings Part 3: Human impact safety requirements Part 4: Dead, wind and snow loadings
US Federal Specification TT-S-001543A	Sealing compound, silicone rubber base (for caulking, sealing and glazing in buildings and other structures)

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.

Requirements

1.2 QUALIFICATIONS

Carry out fixing by the manufacturer or by a firm nominated and approved by the window manufacturer in writing.

1.3 SHOP DRAWINGS FOR MANIFESTATIONS

Provide shop drawings for review by the engineer before commencing manufacture. Allow 1 week for review. Shop drawings to show, but not be limited to, manifestation graphics layout including dimensions of all typical elements and of any special sizes and shapes.

- 1.4 REVISED SHOP DRAWINGS
Provide a copy of shop drawings revised to include required modifications, before proceeding with any fabrication or erection.

Guarantees

- 1.5 WARRANTY
Warrant this work under normal environmental and use conditions against failure of materials and execution from date of Practical Completion:

Warranty period: 5 years

Refer to 1271 GUARANTEES AND WARRANTIES section for the required form of warranty agreement and details of when completed warranties must be submitted.

Performance

- 1.6 PERFORMANCE OF WINDOWS
The windows, their installation and all fixings to comply with NZS 4211.
- 1.7 POWDER COAT FINISHES
Nominate brand (if offering an alternative), applicator's name and address of plant and submit for review. Applicator to be approved by the coating manufacturer in writing.

Certify on request compliance with this specification and support with control and sampling records. Test for film thickness to BS 3900, part C5, method No.4, using method (b) for certifying thickness and method (a) where any dispute arises as to the thickness provided.

In situ touch up of powder coated aluminium is only permitted after receiving written authority. Replace all damaged material.

2. PRODUCTS

Materials

- 2.1 GLAZING
To comply with NZS 4223, parts 1, 3 and 4.
Brand/type: Metropolitan Glass Tempascreen or similar clear toughened and heat soaked with plastic protective film
Thickness: 12mm minimum
Pattern/Size/Layout: refer Architectural drawings
Pattern coating: double coating ceramic frit
- 2.2 ALUMINIUM CHANNEL FRAMES
Alloy designation to comply with AS/NZS 1866. Branded and extruded for powder coated finishes.

Note: open channel frame ends to be stop-ended.

Brand/type: Metropolitan Glass Tempascreen or similar
clear toughened and heat soaked with plastic protective film
Thickness: 12mm minimum
Pattern/Size/Layout: refer Architectural drawings
Pattern coating/Locations: double coating ceramic frit to side
panels – refer drawings

2.3 GLASS SETTING BLOCKS

Neoprene synthetic rubber, or approved equal.
Width: same as glass thickness
Length 150mm minimum
Hardness: 80 - 90 Shore A Durometer
Thickness: 12mm

2.4 GLAZING SEALANT

Silicone rubber low-modulus (high movement + 50%) moisture-curing
structural glazing adhesive sealant to US Federal Specification TT-S-
0011534A.
Brand/type: Dow Corning 795 Building Sealant
or equivalent approved
Colour: Black

Finishes

2.5 POWDER COAT FINISHES

High performance long-life exterior grade polyester powder organic
coating in accordance with AS 3715 Metal finishing - Thermoset
powder coatings for architectural applications.
Brand/Product: Ameron AG900 System
Colour/Gloss level: Refer Schedule of Finishes
Thickness: 60 - 80 microns

2.6 MANIFESTATIONS

Ceramic frit pattern incorporated with glass to comply with NZS
4223, part 3, 303.1.
Locations: Refer drawings for locations.

3. EXECUTION

Conditions

3.1 DELIVERY

Do not deliver to site any elements which cannot be immediately
unloaded into suitable conditions of storage.
Unload, handle and store elements in accordance with the window
manufacturer's requirements, without distortion, avoiding prefinished
surfaces rubbing together and avoiding contact with mud, plaster
and cement. Keep wrappings dry.

Application

3.2 CONFIRM PREPARATION OF OPENINGS

Confirm that openings have been prepared ready for the installation of all window frames. Do not proceed with window installation until required preparatory work has been completed.

3.3 INSTALLATION

Fix to comply with the reviewed shop drawings and installation details, including flashings, bedding compounds and sealants as required to complete the system.

Use fixings and fastenings recommended by the manufacturer of the component being fixed.

3.4 SEALANT POINTING WORK

Tool sealant to form a smooth fillet or flat bead as required, with a profile and dimensions required by the sealant manufacturer.

Tool sealant to form a smooth fillet, with profile and dimensions required by the sealant manufacturer.

Remove excess sealant from adjoining surfaces, using the cleaning materials nominated by the sealant manufacturer and leave clean.

3.5 MANIFESTATIONS

Ceramic frit pattern incorporated with glass to comply with NZS 4223, part 3, 303.1. Refer to drawings for locations.

Completion

3.6 COMPLETION

In situ touch up of powder coated aluminium is only permitted after receiving written authority. Replace all damaged material.

Take off any temporary protection and thoroughly clean down both sides of all frames and glass, using the method required by the window manufacturer.

Replace damaged, cracked or marked elements.

Remove debris, unused materials and elements from the site.

5518 GENERAL HARDWARE AND FITTINGS

This section deals with the supply and installation of general hardware, furniture, proprietary fittings, signage, and miscellaneous items.

1. GENERAL

Requirements

1.1 SAMPLES

Submit samples on request of any proprietary fittings or hardware elements, along with the relevant manufacturers' technical literature for approval.

2. PRODUCTS

2.1 HARDWARE, FURNITURE, & FITTINGS SCHEDULE

Complete with matching stainless steel fixings to be supplied by the fixture manufacturer.

Fixture	Make/Model/Location/Notes
10-40 Fence	1.8m high safeguard panel fence, mounted to 50mm CHS posts, all hot dipped galvanised mild steel finish.
10-41 Fence	1.2m high safeguard panel fence, mounted to 50mm CHS posts, all hot dipped galvanised mild steel finish.
74-08 Tap fitting	Brass with removable handle
62-01 Tactile Indicators	Polyurethane epoxied stud tactiles to be used. Refer to Civil Specification Sections 8.1 to 8.5 and Common Element Dwg T-01.
62-04 Directional Indicators	Polyurethane epoxied stud tactiles to be used. Refer to Civil Specification Sections 8.1 to 8.5 and Common Element Dwg T-01.
<u>10-34 Bicycle Stand</u>	<u>Proprietary 'Sheffield' type bicycle stand. Type C 316 Stainless steel. Foundations either embedded or surface mount. Foundation to manufacturers recommendation.</u>

10-31 Shelter seat	To be Saligna timber slats, max wax finish with graffiti-guard coating system; mild steel support brackets with powdercoat finish. Street Furniture or similar. Refer Schedule of Finishes
10.36 Bollard	Stainless steel bollard, 114mm diameter with #7 head & flat flange, plant mounted. Stainless steel finish to be Corus Metal vertical brushed satin No.4 finish, to USA Standard USA ASTM A48 or equivalent approved by engineer.
10.38 Removable Bollard	Stainless steel revable bollard, 114mm diameter with #7 head & flat flange, plant mounted. Stainless steel finish to be Corus Metal vertical brushed satin No.4 finish, to USA Standard USA ASTM A48 or equivalent approved by engineer.
10.33 Rubbish Bin	Rubbish bin with stainless steel lid with key lock, to be developed & provided by Street Furniture NZ Ltd, design to be approved by engineer. Stainless steel finish to be electro polished to No.8 "Mirror" finish, to USA Standard USA ASTM A48 or equivalent approved by engineer.

3. EXECUTION

Conditions

3.1 RETAIN

Retain fixtures, fittings and hardware in the manufacturer's original packaging and ensure that units are complete with associated fixings and installation instructions.

3.2 INSPECTION

Before starting the installation of proprietary items, check relevant spaces and building component finishes for any condition that would not allow the proper installation of any unit. Do not proceed until such conditions have been remedied.

Installation

3.3 LOCATE

Locate units at heights and/or locations shown on the drawings, or as required to comply with relevant Codes and Standards. For any dimension not shown or known, request direction from the engineer before proceeding.

3.4 CUTTING AND FITTING

Where cutting and fitting of the substrate is necessary for installing any unit, carry out this work before the painting or finishing of that surface. Remove any hardware when required for painting, placing it in the packaging or carton originally supplied and returning it to the secure store until ready for re-installation.

3.5 INSTALLING UNITS

Install each unit in accordance with the proprietary fixture manufacturer's requirements, using the supplied fixings, and templates and tools supplied or recommended by them. Set units level, plumb and true to line and required location, with moving parts and actions freely and easily operating. Do not make any modifications to supplied units.

Completion

3.6 ADJUST

Adjust and check each operating unit for correct and smooth functioning. Replace those units that cannot be adjusted if they do not function correctly. Clean units and adjoining surfaces upon completing their installation.

3.7 COMPLETION

Replace damaged or marked elements
Leave work with parts fully and freely working and to the standard required by following procedures.
Remove debris, unused materials and elements from the site.
Protect units from damage or marking.

6711 PAINT FINISHES AND PROTECTIVE COATINGS

This section deals with the preparation of unpainted and previously painted surfaces, and the application of decorative and protective paint coating systems, including sealers, primers and graffiti resistant coatings.

1. GENERAL

Documents

1.1 DOCUMENTS REFERRED TO

Documents referred to in this section are:

AS/NZS 2312 Guide to the protection of iron and steel against exterior atmospheric corrosion

AS/NZS ISO 9002 Quality systems - Model for quality assurance in production, installation and servicing

Health and Safety in Employment Act 1992

Occupational Safety and Health Service (OSH):
Guidelines for the provision of facilities and general safety in the construction industry

Master Painters New Zealand Association Inc.:
Specification manual
Painters hazard handbook

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.

Guarantees

1.2 WARRANTY – PAINTING WORK

Warrant this work under normal environmental and use conditions against failure of materials and execution from date of Practical Completion:

Warranty period: 5 years

Refer to 1271 GUARANTEES AND WARRANTIES section for the required form of warranty agreement and details of when completed warranties must be submitted.

Requirements

1.3 QUALIFICATIONS

Painters to be experienced competent workers, familiar with the materials and the techniques specified.

1.4 HEALTH AND SAFETY

Refer to the requirements of the Health and Safety in Employment Act and the Occupational Safety and Health Service (OSH) publication "Guidelines for the provision of facilities and general safety in the construction industry". If the elimination or isolation of potential hazards is not possible then minimise hazards in this work on site by using the proper equipment and techniques as set out in the "Painters hazard handbook". Supply protective clothing and equipment. Inform employees and others on site of the hazards and put in place procedures for dealing with emergencies.

1.5 MATERIAL SAFETY DATA SHEETS

Obtain from each manufacturer the material safety sheet for each paint product used and comply with the required safety procedures. Keep sheets on site.

Performance

1.6 QUALITY ASSURANCE

Maintain quality assurance programmes to AS/NZS ISO 9002 for both preparation and painting/coating, as necessary to assure that work is performed in accordance with this specification and the qualifying requirements of the contract documents.

1.7 INSPECTION OF WORK

Inspection of the whole of the work at agreed stages will be made. Agree a programme with the engineer that will facilitate such inspection, including notification when each part and stage of the work is ready for inspection.

1.8 MANUFACTURER'S INSPECTIONS

Permit the paint manufacturer to inspect the work in progress and to take samples of their products from site as requested.

2. PRODUCTS

Materials

2.1 PAINT SYSTEMS

To the manufacturer's standards for exterior and interior solvent-borne and water-borne paints, undercoats, wood and metal primers, sealers, stains and clear coatings.

Only use thinners or additives within the stated limits for the specific situations they allow.

Refer to 4. SCHEDULES.

2.2 PAINT SYSTEM ACCESSORIES

Fillers, stopping, paint strippers, cleaning agents, etching solutions, mould inhibitors, rust inhibitors, knotting and other commodities used for the surface preparation, as required by the manufacturer of the specified coating.

3. EXECUTION

Conditions

3.1 EXECUTION

To conform with trade practice, including those methods, practices and techniques contained in the Master Painters New Zealand Association Inc.: Specification manual.

3.2 PREPARATION

Prepare surfaces to the coating manufacturer's requirements. Use paint strippers, cleaning agents, etching solutions, mould inhibitors, rust inhibitors, size, stopping, knotting and fillers to the coating manufacturer's requirements.

3.3 SUBSTRATES

Ensure that substrate surfaces are true to line and face and with the preparation to achieve the specified finish.
Sand down any breakdown or damage of pre-primed surfaces to a sound surface and immediately re-prime.
Brush down surfaces immediately before application, to remove dust, dirt and loose material.

3.4 COMPATIBILITY

Check that materials are as required by the paint manufacturers for the particular surface and conditions of exposure, and that they are compatible with each other. Use paint from the same manufacturer for each paint system. If not compatible, obtain instructions before proceeding.

3.5 ANCILLARY SURFACES

The coatings listed in schedules and elsewhere are of necessity simplified. Coat ancillary exposed surfaces to match similar or adjacent materials or areas, except where a fair-faced natural finish is required or items are completely prefinished. In cases of doubt obtain instructions before proceeding.

- 3.6 PROTECTION
Use dropsheets, coverings and masking necessary to protect adjoining fixtures, fittings and spaces from paint drops, spots, spray and damage.

Application - general

- 3.7 EACH COAT
Each coat of paint and the completed paint system to be applied to the requirements of AS/NZS 2312 and to have the following qualities and properties:
- Uniform finish, colour, texture, sheen and hiding power
 - The proper number of coats applied
 - Free of defects such as pinholing, alligatoring, blistering, staining, overspray, peeling, runs, sags and wrinkling.
- 3.8 COATING APPLICATION
Apply coatings strictly in accordance with the manufacturer's stated requirements. Ensure that the manufacturer's latest product data sheets are available for reference during preparation and painting.
- 3.9 COMPATIBILITY
Ensure that materials are as required by their manufacturers for the particular surface and conditions of exposure, and that materials used within each painting system are compatible with each other and are from the same manufacturer.
- 3.10 DRYING TIME
Before handling or applying the next coat of paint, give each coat the required drying time required by the manufacturer. Ensure that surfaces being painted are dry and that ambient conditions are such that condensation does not occur before the paint reaches surface-dry condition.

Application - preparing unpainted metal

- 3.11 CONDITIONS FOR PAINTING
Coat the galvanised steelwork in conditions approved for the application of the specified coatings. Carry out off-site preparation and coating application under cover, in a suitable environment, with adequate lighting and with the air temperature between 10 degrees C and 25 degrees C.

Ensured prepared and painted surfaces are clean and dry. Do not carry out preparation or painting when the ambient relative humidity exceeds 85%, or when the steel surface temperature is within 3 degrees C of the dew point.

- 3.12 SEQUENCE OF OPERATIONS
Complete surface preparation before commencing painting.
Apply paint in the specified sequence using the specified paint.
Allow full drying time between coats to the manufacturer's stated requirements. Do not expose primers, undercoats and intermediate coats beyond a few days before applying the next coat.
- 3.13 PREPARING GALVANISED SURFACES
Remove grease, oil and other solvent-soluble contaminants by wiping and/or brushing with mineral turpentine or white spirit. Finally wipe with a clean solvent. Allow to dry and proceed with the next operation immediately.
- 3.14 SHOP PRIMING
Dust off and apply a coat of primer.
- 3.15 PATCH PRIMING
Clean areas of damaged priming and areas left clear for site jointing to a standard comparable with the shop cleaning specified. Wash off chemical deposits from welding fumes. Apply priming coats to same standard as shop primers, ensuring thorough coating of bolts, nuts and connection areas. Allow for and reprime if the primer fails, or more than 4 weeks elapse before the final coating system is applied.

Application - preparing unpainted linings

- 3.16 PREPARING FIBRE CEMENT BOARD
Check that joints are finished to the required standard. Fill cracks and surface imperfections with the sheet manufacturer's required stopping compound and lightly sand smooth. Remove dust.

Application - preparing painted surfaces generally

- 3.17 MOULD
Sterilise surface mould by washing or sponging the whole surface with a one part sodium hypochlorite household bleach to three parts clean water solution. Allow bleach to act for 30 minutes and wash off with clean water. Wash cloths and sponges regularly in clean water. Treat with anti-mould solution to the treatment manufacturer's requirements.
- 3.18 GAP FILLING
Fill cracks, holes, indented and damaged surfaces with putty, plaster filler, wood filler, or plastic wood, as appropriate and in accordance with the paint manufacturer's requirements. Allow to dry or set before sanding back level with the surface. Prime coat or seal the timber before using putty. Wet cement or gypsum base plasters before applying filler. Use only Portland cement base types, or water-insoluble organic-based gap fillers in exterior or wet areas.

Application - preparing painted surfaces in good condition

3.19 PREPARING SURFACES

Wash down surfaces with either:

- a chlorine based solution; or
 - 5-10 millilitres of ordinary household detergent to 1 litre of warm water; or
 - a solution of 30 grams of trisodium phosphate to 1 litre of water
- Replace solutions frequently and finally wipe over a second time with a clean absorbent cloth.

For surfaces containing heavy smoke and grease deposits, wash down with either:

- mineral turpentine; or
 - a 5% solution of ammonia; or
 - a 1:40 solution of sugar soap and water
- as necessary to remove the deposits. Wipe over with a clean absorbent cloth.

Prepare coatings which have chalked by sanding, brushing, waterblasting or other methods as appropriate.

Lightly sand glossy surfaces to ensure good adhesion of the coatings.

Application - preparing painted surfaces in poor condition

3.20 PREPARING PAINTED TIMBER

Completely remove blistered, flaked, chalked and cracked (due to exposed end grain and knots) paint to give a sound base for repainting. Scrape out damaged or decayed timber and where the area is extensive, arrange to cut out and replace with treated timber, primed (including end grain) before fixing.

Scrape clean loose or soft material, holes and depressions in timber due to damage or defects such as resin or knot holes and surface splits. Remove and replace sprung or loose corroded nails.

Where necessary strip paint back to the original timber surface, using the most appropriate of the following methods:

- burning off using a blowtorch to soften paint without charring, before scraping off with a broad knife
- using an electrically heated hot air stream to soften paint, before scraping off with a broad knife
- sanding using orbital and/or belt sanders
- paint removers used to the manufacturer's requirements
- hand scraping.

Follow OSH guidelines for minimising the hazards of stripping.

3.21 PREPARING PAINTED GYPSUM PLASTER

Remove flaked paint completely from powdery, loose and other unsatisfactory plaster surfaces. Treat powdery surfaces with a solution of 150 millilitres of concentrated phosphoric acid and clean water to make 1 litre. Apply the solution, allow to stand 10 minutes and wash down with clean water. Remove loose, weak and drummy plaster and replastered and allow to cure before proceeding with coatings as for unpainted work.

Confirm that the cause of any efflorescence has been eliminated before wiping it away with a dry rag and making good the damaged surface.

Fill small cracks and damaged surfaces with gypsum plaster or cellulose gypsum compound to just proud of the surface and lightly sand smooth and flush when dry.

3.22 PREPARING PAINTED PLASTERBOARD AND FIBROUS PLASTER

Fill cracks, pores, irregularities and damaged surfaces with the appropriate filler to the paint manufacturer's requirements, trowelled smooth, allowed to dry and lightly sanded to a smooth flush surface. Treat any staining of paint films on plaster as required by the coating manufacturer.

3.23 PREPARING PAINTED CEMENT PLASTER, CONCRETE AND MASONRY

Remove the fine white powder of efflorescence by brushing and then wiping with a clean cloth. Remove faulty mortar by wire-brushing. Make good with fresh mortar to match.

Confirm that the cause of any dampness has been eliminated and that the substrate is dry before applying any coating.

Wire brush moss or lichen affected areas to remove loose, powdery growth. Treat the affected areas with a solution of 200 millilitres of formalin (40% solution) to 800 millilitres of water. Apply the solution and leave for 3 days, or until the moss and lichen turns brown. Scrub off with a hard bristle brush and hose down liberally with water. Swab the affected area using a solution of 1 volume of household bleach to 2 volumes of water. After 30 minutes wash down with clean water.

Remove grease by continued washing with a 1:40 solution of sugar soap and water until completely removed, wash with clean water and allow to dry.

Where necessary strip paint back to the original surface by water or abrasive blasting. Remove chalk dust and dirt when dry by stiff bristle brushing.

- 3.24 PREPARING PAINTED METALWORK
Remove corrosion in whatever form. Sand edges to form a smooth surface with surrounding areas unaffected by corrosion. Use a chemical pre-treatment to remove the last traces of and to inhibit future, corrosion. Clean down completely before spot priming to suit the coating system specified.

Application - before applying final coatings

- 3.25 OFF SITE WORK
Carry out off site preparation and coating under cover, in a suitable environment and with adequate lighting. Store items both before and after coating in a clean, dry area, protected from the weather and mechanical damage, properly stacked and spaced to permit air circulation and to prevent sticking of surfaces.

Application - generally

- 3.26 PAINTING GENERALLY
Paint coatings and systems to comply with AS/NZS 2312, the paint manufacturer's requirements and any additional requirements in this specification.
- 3.27 MIXING
Thoroughly mix paints. Lift any settled pigment and ensure the paint is homogenous.
- 3.28 ENVIRONMENT
Paint exterior surfaces only in favourable weather conditions:
- warm dry days without frost or heavy dews
 - avoid painting in direct sunlight any surfaces that absorb heat excessively
 - as far as possible apply paint in the temperature range 15 deg C to 25 deg C
 - do not paint If temperatures fall outside the range of 10 degrees C and 35 degrees C unless paints with the necessary temperature tolerance have been specified
 - do not apply solvent borne paint if moisture is present on the surface
- 3.29 SEQUENCE OF OPERATIONS
Painting work to generally follow the following sequences:
- complete surface preparation before commencing painting
 - apply paint in the specified sequence using the specified paint
 - allow full drying time between coats to the paint manufacturer's requirements
 - do not expose primers, undercoats and intermediate coats beyond a few days before applying the next coat
 - finish broad areas before painting trim
 - ensure batch numbers of tins are matched for whole areas

- 3.30 PAINT APPLICATIONS
Select brush, roller, or pad and apply paint to the requirements of the paint manufacturer and to obtain a smooth even coating of correct thickness, uniform gloss and colour.
- 3.31 DRYING TIME
Before handling or applying the next coat of paint, give each coat the full drying time as required by the paint manufacturer. Ensure that surfaces are dry and that condensation does not occur before the paint reaches surface-dry condition.
- 3.32 LIGHTLY SAND
Lightly sand primers, sealers, undercoats and intermediate coats to remove dust pick-up, protruding fibres and coarse particles. Remove dust immediately before applying the next coat.
- 3.33 DEFECTIVE WORK
Correct defective work immediately and re-coat as required, following precisely the paint system specified.
- 3.34 EACH COAT
Each coat of paint and the completed paint system to have the following qualities and properties:
- uniform finish, colour, texture, sheen and hiding power
 - the specified number of coats applied
 - no blemishes such as runs, sags, crinkling, fat edges, entrained paint skins, hairs, dust, bare or starved patches, cracks, brush marks, ladder marks and blistering
 - proper covering of corners, crannies, thin edges, cracks, end grain and other difficult places of application

Completion

- 3.35 CLEAN
Clean adjoining surfaces, glass and fittings of any paint contamination. Clean off glass indicators at completion of the building works. Clean glass inside and out to a shining finish.
- 3.36 LEAVE
Leave the whole of this work uniform in gloss and colour, of correct thickness, free from painting defects, clean and unmarked and to the standard required by following procedures.
- 3.37 REMOVE
Remove dropsheets, coverings and masking to leave surrounding surfaces and areas clean, tidy and undamaged. Remove debris, unused materials and elements from the site.

4. SCHEDULES

PAINTING SYSTEMS

To the paint manufacturer's requirements.

Refer to the Schedule of Finishes attached to this specification for selection and location of paint systems.

4.1 SYSTEM 3a – FIBRE CEMENT - BUILDING

Preparation: in accordance with Resene Data Sheet D83

Primer/Undercoats – 2 coats:

Acrylic primer - Resene Quick Dry Acrylic Primer

Undercoat to

35 μ DFT each coat - refer Data Sheet D45

Finish coats – minimum 2 coats:

Water-borne alkyd enamel – Resene Lustacryl (semi-gloss) to 34 μ DFT each coat - refer Data Sheet D310

Locations:

fibre cement

sheet linings to soffits

4.2 SYSTEM 3b – FIBRE CEMENT – FENCE PANELS

Preparation: in accordance with Resene Data Sheet D83

Primer/Undercoat: Acrylic primer - Resene Quick Dry Acrylic Primer

Undercoat to 35 μ DFT - refer Data Sheet D45

Finish coats – minimum 2 coats: Water-borne acrylic – Resene Lumbersider (low sheen) to 34 μ DFT each coat – refer Data Sheet D34

Locations: fibre cement sheet fence panels

4.3 SYSTEM 10 – HOT DIPPED GALVANISED STEEL

Weld touch-up:

Power tool

clean to AS 1627 Part 2 Class 3

Preparation: Degrease, sweepblast

Primer: Primer and sealer – Resene Armourcote 220 for 75 μ DFT - refer

Data Sheet RA34

2nd coat:

Solvent borne acrylic urethane - Resene Armourcote

510 to

minimum 125 μ DFT – refer Data Sheet RA40

3rd coat:

Solvent borne acrylic urethane - Resene Uracryl 403 – high gloss finish colour coat at 50 μ DFT – refer Data

Sheet RA56

Locations:

exposed structural steelwork

4.4 SYSTEM 35 – CONCRETE SURFACES

Preparation: in accordance with Resene Data Sheet D83

Undercoat: self priming
high solids epoxy mastic coat tinted to suit finish
coat & with non-skid additive – Resene Armourcote
510 at 125 to 200 μ DFT & with SRG Industrial Grade non-skid grit -
refer Data Sheet RA40

Finish coat: Urethane-acrylic two-component semi-
gloss finish coating –
Resene Uracryl 402 to 50 μ DFT - refer Data Sheet RA55

Locations: concrete platform surfaces for warning markings and
other areas
– refer drawings;
Note: extent of white painted platform edges to be a
300mm wide strip on platform edge, & front vertical face
down to drip edge approx 100mm

4.5

GRAFFITI RESISTANT COATING

Abrasion and chemical resistant two pack re-coatable acrylic urethane system.

Manufacturer/Supplier: Guardian Protective Coatings or similar approved by AT.

Colour/Tint: refer Schedule of Finishes

Locations: Engineer to advise

7413 RAINWATER SYSTEMS

This section deals with the fabrication of metal gutters and metal downpipes as complete rainwater disposal systems.

1. GENERAL Documents

1.1 DOCUMENTS REFERRED TO Documents referred to in this section are:

AS 1273 Unplasticised PVC (UPVC) downpipe and fittings for rainwater
AS/NZS 1554-6 Structural Steel Welding – Welding Stainless Steels for Structural Purposes

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.

Requirements

1.2 QUALIFICATIONS Installers to be experienced competent workers, familiar with the materials and the techniques specified.

1.3 TEST Test the completed rainwater disposal system with water to ensure gutters are laid to correct falls, that both gutters and downpipes are unobstructed and that no ponding occurs in gutters.

Guarantees

1.4 WARRANTY Warrant this work under normal environmental and use conditions against failure of materials and execution from date of Practical Completion: **Warranty period: 5 years**

Refer to 1271 GUARANTEES AND WARRANTIES section for the required form of warranty agreement and details of when completed warranties must be submitted.

2. PRODUCTS

Materials

- 2.1 METAL GUTTERS
Pre-fabricated stainless steel austenitic 316L grade to BS 7475 gutter system formed as detailed, and supplied complete with matching brackets and screws.
Base metal / thickness: 1.2mm BMT
Finish: refer Schedule of Finishes
Profile/size: refer drawings
- 2.2 GUTTER SUPPORT
15mm thick H3 treated plywood for metal gutter support.
Brand/Manufacturer/Type:
Base metal: galvanised steel
Profile/size: refer drawings
- 2.3 UPVC DOWNPIPES
To suit the spouting system, pipes dry jointed and complete with stand-off brackets, galvanised screws and accessories, brand matched and complete to the manufacturer's specifications.
Profile/size: refer drawings
- 2.4 FIXINGS
Grade 316 stainless steel bolts and self-tapping screws with the type of head, length, gauge and thread to suit the work and its location.
- 2.5 SEALANT
Neutral curing silicone or polymer sealant as required by the component manufacturer and used as directed. Durability of sealants not less than the roofing material being sealed.
Brand/Manufacturer: Dow Corning 780 Roofers and Plumbers Silicone
or similar approved
Colour: clear
- 2.6 BUILDING PAPER
Bituminous kraft paper laminates incorporating inert fibre reinforcement.
Brand/Manufacturer: Gib Black Building Paper heavy weight
Weight: 220 g/m²
Location: used as separation layer underlay to gutter tray

3. EXECUTION

Conditions

- 3.1 HANDLING
Do not deliver any elements to the site which cannot be unloaded immediately into suitable storage conditions. Avoid distortion of elements during transit, storage and handling. Prevent surfaces

rubbing together, and any contact with mud, plaster or cement.
Keep protective coverings dry.

3.2 PREPARATION

Ensure location and substrate is ready to receive the elements and will allow work of the required standard.

3.3 THERMAL MOVEMENT

Make adequate provision in the fixing and jointing of the gutters for thermal movement in the length of the gutters. Provide an expansion joint in gutters over 15 metres in length.

3.4 CORROSION

Separate metals subject to electrolytic action from each other and from treated timber, concrete and other lime substances by space, painting of surfaces, taping, or separator strips.
Gutter trays to be installed over building paper underlays laid on supporting grates.

Assembly

3.5 PROTECTION

During fabrication protect all surfaces which will be visible in completed work.

3.6 FORMING

Ensure cold formed work is free from warping, buckling and fractures. Form bends with a brake press or by cold rolling.
Unless specified otherwise, mitre junctions of identical sections.
Form holes without distortion of surrounding metal.
Remove all burrs and sharp arrises which would be visible after fixing, or a hazard to the user.

3.7 JOINTING

Ensure joints are tight and sealed with no gaps or voids.

Assembly - welding

3.8 PREPARATION FOR WELDING

Remove grease, dirt, moisture and oxide from edges to be welded.
Remove scale and residue from arc and power cutting by machining or hand grinding.

3.9 ACCURACY

Ensure accurate fit using clamps and jigs where practical. Use tack welds for temporary attachment where jiggling is not practical.

3.10 WELDING STAINLESS STEEL

Welding stainless steel to AS/NZS 1554-6.

Use double level butt welds, backing bars to remove heat, jiggling, tack welds and any other measures necessary to minimise distortion. Remove slight distortion by light hammering, taking care not to damage the surface finish.

Make joints with parent and weld metal fully fused throughout with no inclusions, holes, porosity or cracks.

Grind butt welds which will be visible in completed work smooth and flush with adjacent surfaces.

3.11 SPATTER AND RESIDUES

Prevent weld spatter falling on surfaces of materials which will be self finished and visible in completed work.

Ensure complete removal of flux residues and slag.

Application

3.12 INSTALL SUPPORT FRAMES

Install proprietary grates for gutter support as detailed, and secure in place with galvanised screws and clip fixings.

Coat surfaces to be in contact with gutter tray with bituminous product to ensure no metal-to-metal contact.

3.13 INSTALL METAL GUTTERS

Gutter trays to be installed over building paper underlays laid on supporting grates.

Install gutters to structure to minimum falls specified and to outlets on packers as detailed, and clip into place.

Where folds and laps are required, joints shall be silicone sealed and pop riveted to the manufacturer's recommendations.

Cut out neatly for and fit the pre-formed downpipe droppers and silicone seal the lap joints.

3.14 INSTALL UPVC DOWNPIPES

Assemble downpipes, dry jointed and complete, fit to outlets, galvanised screw fix with pipe clips as required to rigidly stand plumb and discharging into the stormwater gully or pipe inlet to the downpipe manufacturer's required practice.

Completion

3.15 COMPLETION

Replace damaged or marked elements.

Leave the whole of this work discharging completely and freely into the drainage system and free of all debris. Leave work to the standard required by following procedures.

Remove debris, unused materials and elements from the site.

8311 LANDSCAPING

OUTLINE SCOPE OF WORK

Generally the contract works shall include but not be limited to the following:

- i Removal of areas of weeds and/or vegetation as defined in the contract by spraying, physical removal and disposal off site, commencing at least 6 weeks prior to the date of planting implementation.
- ii Excavation and/or filling and re-grading of the site as necessary.
- iii Preparation of planting bed areas, tree pits, drainage, scarification, supply and installation of approved topsoil or garden mix.
- iv Supply and planting of all trees, shrubs and groundcover in accordance with the planting plans and plant schedules, inclusive of topsoil, garden mix, stakes and mulch.
- v Preparation and installation of external lawn areas.
- vi Re-instatement of site areas affected by construction works as required.
- vii Co-ordination and liaison with all other contractors regarding implementation and completion of the works.
- viii Maintenance of planted areas for 12 months.

The planting is to be undertaken in accordance with the layout as identified on the drawings. It includes all specimen tree, shrub and ground cover planting.

1. GENERAL

Requirements

1.1 QUALIFICATIONS

Contractors are to be experienced competent workers, familiar with the materials and the techniques specified. Supply evidence of experience and competence on request.

1.2 SITE MEETING

The contractor shall review and scope extent of area to be planted on site with the engineer prior to tender and prior to commencement of weed clearance and site preparation, followed by a meeting on completion of same and prior to the implementation of planting.

1.3 PLANT QUALITY

The contractor shall source all plant material to ensure that the best nursery stock available is secured. Individual species shall be of even height and form, symmetrically shaped and from the same seed source.

All trees, plants and shrubs shall be made available at various nurseries for inspection and approval by the engineer prior to any planting work commencing. The engineer has the right to reject any plants that in his/her opinion do not meet the specified standards.

Where possible, plants are to be sourced locally, or from areas with a similar climate, and be grown under conditions similar to, or harsher than, those at the location of the development. All plants shall be hardened off before delivery to the site.

1.4 TOP SOIL QUALITY

If there is any doubt as to the quality of topsoil provided for this contract, then the engineer will require the contractor to arrange for the product to be analysed and any deficiencies shall be remedied at the contractor's expense.

1.5 ALTERNATIVES

The contractor shall advise the engineer of any concerns he/she has with site or ground conditions, site preparation conditions scheduled, proposed eradication measures, or if he/she does not agree with any of the plant species scheduled.

The contractor shall advise the engineer should a plant or tree species, grade or an even line of specified trees not be available, with a view to discussing alternatives. Any substitutes proposed shall be the nearest equivalent species, variety and size to the original.

The contractor shall obtain approval for any variations from the engineer in writing a minimum of 10 days prior to scheduled planting works.

1.6 PLANT LOSS

The contractor shall replace any plants that die within the works and agreed maintenance period, at the contractors expense, with others of the same species unless an alternative species is agreed with the engineer in writing.

2. PRODUCTS

Materials – soil and soil preparation

2.1 TOPSOIL

Good quality loam of a workable consistency stripped from its original location to a maximum depth of 200 mm:

- free of pernicious weeds, straw, stones, sticks, clay lumps
- free of foreign matter exceeding 25 mm dimension.
- pH value between 6.5 and 7.5
- humus content greater than 50%.

The contractor is to liaise with and gain approval from the engineer regarding the potential to use existing topsoil stockpiled on site. If soil is to be stockpiled on site for future use, the method for storage is to be confirmed with the engineer.

2.2 GARDEN MIX

Thoroughly mixed medium of 60% compost and 40% bark, pumice and fertiliser by volume.

Brand/Manufacturer: Living Earth 'Garden Mix', or equivalent approved by the engineer.

2.3 BACKFILLING

Thoroughly mixed medium of 30% garden mix and 70% topsoil by volume.

2.4 HERBICIDES

Post-emergence selective chemical to control broadleaf weeds and/or a non-selective chemical. Submit for review the proposed chemical and area of use.

Materials – seeding and turfing

2.5 GRASS AND LAWN, SOWN

Areas maintained with weed-eaters are to be sown with grass. Grass to be sown at a rate of 10 grams per square metre.

Grass to consist of:

- 40% Turf Ryegrass
- 15% Brown Top
- 20% Chewing's Fescue
- 15% Prestige White Clover
- 10% Sub Clover

Areas to be maintained with mowers are to be sown with Lawn.

Lawn to be sown at a rate of 50 grams per square metre.

Lawn to consist of:

- 70% Ryegrass (winter active)
- 28% Fescue
- 2% Brown Top

Contractor to confirm required grass lawn species with engineer.

Materials – other

2.6 STAKES

Rough sawn radiata pine H4 treated.

Size/length: 50 mm x 50 mm, length to suit tree/plant size

20 mm x 20 mm, length to suit tree size

2.7 MULCH
Bark mulch – the contractor is to specify supplier and trade name with tender and to the engineer for approval.

2.8 TIMBER EDGING
Timber edging shall be 100x25 pinus radiata H4 treated with 50x50 x 500mm long H4 pegs.

3. EXECUTION

Conditions

3.1 DELIVERY
Delivery of plants and materials is the contractor's responsibility and he/she is to meet all costs. The contractor shall ensure that adequate protection is given to all plants and their root systems to preclude failure due to lack of moisture or exposure during their transportation to site.

Only deliver material to the site that can be immediately placed in its final location from the delivery vehicle.

There are to be no secure plant storage areas on the site. The contractor will be responsible for all costs associated with the storage and care of plants.

All trees, plants and shrubs shall be planted on the day of delivery as far as is practicable and no later than 1 day after delivery. It is the contractor's responsibility and he/she is to meet all costs in ensuring that plants are kept protected and well watered on site prior to planting and not damaged by the sun and drying winds.

The contractor is to advise the engineer of his/her intention to use open ground species if these have not been specified.

3.2 EXISTING SERVICES
Check for services in the area of this work. Avoid interference or damage to them.

3.3 PLANTING AREAS
Ensure that areas for planting are clean, ready to be worked and clear of any continuing work by other trades. Do not start until work area is ready.

3.4 WEED CONTROL
Ensure that the entire site is prepared so as to ensure that competition for the proposed plants from all weeds and grass varieties, particularly those classified as noxious weeds and visually undesirable weeds, are controlled in an acceptable manner.

Chemical herbicides are to be used with caution, and applied strictly in accordance with the manufacturer's instructions. Damage caused by spray drift shall be made good at the contractor's expense.

The contractor is responsible for the pre-planting weed control required to ensure successful plant establishment, and on-going weed control.

3.5 TREWORK

Prior to commencing work all vegetation requiring removal is to be identified. Tree work is to include complete removal and selective removal of lower branches to allow clearance from rail corridor.

3.6 QUALITY OF SHRUBS AND PLANTS

Provide shrubs and plants which are best nursery stock, healthy and vigorous, with well developed root systems, in balance with the amount of foliage growth, well branched, symmetrically shaped of a normal habit, free of disease, pests and physical damage, and all tagged with the growers' own tag. Reject all root bound plants and those with spirally bound root systems.

Containerised plants shall be in a potting mix suitable to the species, with containers sized to suit the plant size and stage of development.

No bare-rooted stock is to be provided unless previously agreed in writing with the engineer.

3.7 QUALITY OF TREES

Provide trees of good form with single dominant stems, with all side branches evenly spaced and less than 1/3rd of the diameter of the main stem. Main stems shall be straight and vertical with occasional diversions allowable of less than 5% at any point. All side branches shall be set at angles that are natural for the particular species.

Reject all trees with evidence of included bark at any of the branch collars, double or co-dominant leaders, damaged bark, wounds or defects.

The root system shall be vigorous, well-developed, healthy, radiate evenly from the base of the tree, and feature a large proportion of fine roots in relation to the main roots. Root systems shall be in balance with the amount of foliage growth on the plant, with no evidence of girdling roots, and rooted throughout the container without being root bound.

No open ground trees are to be used.

Application – preparation for planting

3.8 AREAS OF COMPACTED GROUND

Areas of compacted ground shall be lightly disked and cultivated to a depth of 100mm to assist in creating a suitable planting bed.

3.9 TOPSOIL

Ensure that stones, debris, tufts of grass, roots, and foreign matter is removed from all areas to be planted prior to placement of topsoil.

3.10 PREPARATION OF PLANTING HOLES

The base and sides of holes are to be broken up to allow water infiltration and root growth as required.

Planter holes are to be 3 times the width of the planter bag and 1½ times the depth. Backfill with 70/30 mix of topsoil and garden mix.

3.11 PREPARATION OF PLANTING AREAS

Thoroughly spray planting areas that contain weed growth with a non-selective herbicide. Apply using protective clothing, in dry, still-air conditions to the spray manufacturer's requirements.

Form channel between garden areas that abut footpaths, kerbs or edges to ensure that mulch is retained within the garden.

Garden beds to carpark areas: Spread minimum of 200mm depth (allowing for settlement) of approved garden mix.

3.12 PREPARATION OF GRASS AND LAWN AREAS

Spray areas to be grassed for weed growth with a non-selective herbicide. Apply using protective clothing, in dry, still-air conditions to the spray manufacturer's requirements.

Break-up / scarify surface of areas. Spread with 50mm of topsoil. Rake to a fine tilth, level and smooth with run-offs to drainage outlets. Apply selective herbicide.

3.13 SITING

Position and space out trees, groundcover plants and shrubs in locations and quantities shown on the drawings and in the plant schedule.

Application – planting

3.14 PLANTING GENERALLY

Plants are to be set back from the garden edge or kerb as specified in the planting schedule.

Plant holes, planting and back-filling for all plants shall be in accordance with good horticultural practice and techniques. Plants should be set in the holes so that the soil level, after

settlement, will be at the original soil mark on the stem of the plant and level with the surrounding ground.

Ground is to be lightly compacted without damaging roots. Any damaged major roots shall be cut cleanly. No plant roots shall be left exposed on the surface.

3.15 BLOCK PLANTING

In areas of block planting, plants shall be spaced evenly to ensure that when established they will completely fill the areas indicated as precisely as possible. The extent of the area to be filled by each species shall be defined by plants spaced around the perimeter. The remaining plants shall then be used to fill the area in a formal manner using straight lines and regular geometric patterns.

Refer to plant schedule for spacing and set-back distances.

3.16 PREPARATION FOR PLANTING LARGE TREES AND SHRUBS

Excavate planting holes to three times the diameter and 1½ times the depth of the root-ball. Where depth exceeds the depth of the topsoil, carry on down into subsoil a further 150 mm, breaking it up and mixing in peat or a clay-killer before replacing. Scarify the sides of holes in clay soils.

3.17 PLANTING LARGE TREES AND SHRUBS

Specimen trees shall be pegged out on site by the contractor for final approval by the engineer.

Drive two plumb stakes, located to avoid wind-contact with the tree or shrub at opposite sides of the planting hole. Keeping rootball intact place each plant plumb with its best side facing into the prevailing wind. Backfill in 150 mm layers using rod or fingers to evenly firm without compaction to a level that will allow the top of the root ball to finish flush with surrounding ground. When completed, firm each plant in by heeling. Tie plants at $\frac{2}{3}$ the height of the main stem leaving enough play for a small amount of natural movement.

Water in immediately after planting to saturation level in surrounding soil and thoroughly wet all foliage. Spread 100 mm over newly planted areas. Ensure that bark mulch is adequately released from the base of all plants and is not in contact with stems/trunks to prevent collar rot.

Where specimen trees are planted into lawn/grass areas, a 'ring' of mulch (1-metre min. in diameter) is to be spread around the trunk.

All necessary pruning shall be done at time of planting.

- 3.18 **PLANTING SHRUBS AND GROWDCOVERS**
Keeping rootball intact, place each plant plumb with the top of the rootball at the top of the plant mix. Backfill material using fingers to evenly firm without compaction, before finally firming the plant with the base of the palm of the hand. Water in immediately after planting to the saturation level of surrounding soil. Spread 100 mm layer of bark over newly planted areas.
- 3.19 **MULCHING**
Spread mulch evenly to a minimum depth of 100mm.
- 3.20 **SOWING GRASS/LAWN**
Rake to a fine tilth, level and smooth with run-offs to drainage outlets. Spread grass seed at half the required rate in each of two directions at right angles, using an approved spreader. Lightly roll and compact. Water deeply and keep moist without any run-off of water until germination is complete. Continue watering as necessary until the end of the contract. First cut only when growth is a minimum of 100 mm and only down to 50 mm.
- 3.21 **WATERING**
All plants shall be watered thoroughly at the time of planting if soil conditions are dry. Watering of plant beds shall be sufficient to provide 200mm soil depth penetration. The rootballs of specimen trees are to be thoroughly watered.

Completion

- 3.22 **CLEAN UP**
Clean up around trees, shrubs and beds. Remove surplus plant mix from the site.
Clean up around lawns. Remove surplus soil, and take away from the site.
Remove debris, unused materials and elements from the site.
- 3.23 **IMMEDIATE MAINTENANCE**
Carry out watering, weeding, cultivating, and controlling of insects, fungal and other diseases. Repair broken stakes and ties. Replace trees and shrubs that do not survive.
Carry out watering and weeding and replace lawn areas that do not survive.

Long term maintenance

- 3.24 **MAINTENANCE PERIOD**
Ongoing maintenance shall consist of all generally accepted horticultural practises required for the optimum growth and health of plants, as covered in the general maintenance clause of this contract. It shall also include a series of tasks scheduled at regular intervals throughout the 12 month maintenance period.

The ongoing maintenance contract will operate as a measure and value contract with payment made on the successful completion of scheduled tasks. Scheduled tasks include: - refer monitoring sheet.

3.25 MONITORING

The contractor shall visit and walk over the entire planting area of the site at maximum 1 month periods. A Site Monitor Sheet (refer appendix), shall be completed during the site visit indicating existing site and plant conditions. The monitoring process allows the contractor to gauge the condition of planted material on a regular basis and to request additional routine or one off tasks to be carried out. A copy of the monitor sheet shall be submitted to the client's representative on a monthly basis for comment, approval and payment.

3.26 WEEDING

Weeding shall be carried out at maximum 1 month intervals. Weeding shall include spraying and/or hand releasing of weed and grass species from within and around the plant mulch layer. During high growth rate periods, weeding may need to be carried out at a greater frequency than the scheduled intervals and the contractor shall be responsible for requesting additional weeding operations within the site monitor sheet.

3.27 SPRAY DRIFT

The contractor shall replace any plants that die or have areas of dieback as a result of spray drift.

3.28 BARK MULCHING

Mulching maintenance involves the replenishing of ~~chipper~~ mulch material to levels similar to the original 100mm layer at time of planting.

3.29 GRASS AND LAWN MOWING

The initial mowing of grass areas is to be carried out by the contractor prior to the areas being handed over to the client's representative.

All newly grassed areas shall be maintained in a healthy cover of grass, free of bare patches, grass pests and diseases, cracks and slips, throughout the whole of the maintenance period.

Oversow bare patches of soil and lawn/grass between plants or lightly grassed areas to produce a premium grade grass cover, as required each autumn of the ongoing maintenance period.

3.30 EMERGENCY TANKER WATERING

In the event of extended or unseasonable drought conditions, lack, disruption or restriction of nearby water and irrigation sources, etc.

contractors are asked to submit a price for the use of water tankers for irrigation purposes.

Water tanker movements shall be restricted and shall be discussed with the engineer and approved by the owner's representative. Watering of individual plants to be carried out by hand or tanker hoses. Watering shall saturate the soils around the plant rootball to field capacity.

The price submitted shall allow for all associated watering costs including all call out and delivery charges, on site time allowances, delivery hoses, pumps, and personnel to carry out irrigation works.

3.31 COMPLETION OF ONGOING MAINTENANCE

The contractor shall notify the engineer on completion of the 12 month maintenance contract.

The engineer and an AT representative shall inspect the work and notify the contractor of any faults or substandard areas to be remedied prior to the granting of a Final Completion Certificate.

On the successful granting of a Final Completion Certificate, the 5% retention of the 1 year maintenance costs, shall be returned to the contractor and the maintenance of planted areas formally handed over to AT.

SCHEDULE OF FINISHES

Component	Material/Finish	Colour/Finish
Profiled metal roofing & flashings	ColorCote ZRX	Pacific White
Aluminium Fascias	Alpolic Stove Lacquer finish by manufacturer	M9010 - White
Gutter tray	Stainless steel	Standard polished No.2B finish
Fibre cement board soffits	Refer Section 6711 Paint Finishes and Protective Coatings – <u>System 3a</u>	Match to standard Alpolic composite panel colour M9010 – White
Shelter Steel masts	Refer Section 6711 Paint Finishes and Protective Coatings – System 10 for steel with hot-dip galvanised finish	Resene Armadillo 2GR10
Shelter Stays, fixings and connection plates	Refer Section 6711 Paint Finishes and Protective Coatings – System 10 for steel with hot-dip galvanised finish	Resene Armadillo 2GR10
Shelter Hidden structural steel	Galvanised steel finish	-
Shelter Horizontal glazing support beams (top and bottom)	Refer Section 6711 Paint Finishes and Protective Coatings – System 10 for steel with hot-dip galvanised finish	To match Orica powdercoat colour 58728 Silver Quill
Shelter Seat support brackets	Orica Powder Coatings	Orica 58728 Silver Quill
Steel lighting masts	Refer Section 6711 Paint Finishes and Protective Coatings – System 10 for steel with hot-dip galvanised finish	Resene Armadillo 2GR10
Light poles	Refer Section 6711 Paint Finishes and Protective Coatings – System 10 for steel with hot-dip galvanised finish	To match luminaire manufacturer (We-ef) standard colour and finish RAL 9007 Grey Aluminium

SS handrails	Stainless steel	Standard polished No.2B finish
Steel Handrails	Galvanised steel finish	-
Concrete platform coping / edge	Refer Section 6711 Paint Finishes and Protective Coatings – System 35	M9010 - White
Graffiti resistant coatings	Refer Section 6711 Paint Finishes and Protective Coatings Extent to be determined by engineer	Finish to be clear gloss
10-40 Fence	Galvanised steel finish	
10-41 Fence	Galvanised steel finish	
10-42 Gate	Galvanised steel finish	
10-43 Balustrade	Galvanised steel finish	
10-44 Balustrade	Galvanised steel finish	
10-45 Balustrade	Galvanised steel finish	
10-46 Balustrade	Galvanised steel finish	
Fibre cement fence panels	Refer Section 6711 Paint Finishes and Protective Coatings – System 3b	Match to standard

STRUCTURAL SPECIFICATIONS

Table of Contents

1	Technical Specification General Notes	1
1.1	General.....	1
1.2	Construction Review.....	2
1.3	Materials.....	2
2	Concrete.....	3
2.1	General.....	3
2.2	Related Documents.....	3
2.3	Concrete Supply.....	3
2.4	Concrete Strength	4
2.5	Concrete Slump.....	4
2.6	Mix Requirements	4
2.7	Materials.....	5
2.8	Mix Design	6
2.9	Concrete Testing	6
2.10	Rejection of Concrete	6
2.11	Formwork and Falsework	7
2.12	Penetrations	9
2.13	Surface Finishes.....	9
2.14	Handling and Placing	11
2.15	Chutes.....	11
2.16	Pumping.....	11
2.17	Notice to Engineer.....	11
2.18	Time Limits	12
2.19	Placing	12
2.20	Concrete Compaction	12
2.21	Construction Joints.....	12
2.22	Curing and Protection.....	13
2.23	Repair of Concrete	13
3	Reinforced Block Masonry	15
3.1	General.....	15
3.2	Related Documents.....	15

3.3	Masonry Units.....	15
3.4	Mortar	15
3.5	Grout and Grouting	16
3.6	Reinforcement	16
3.7	Blocklaying	17
3.8	Bracing During Construction	18
3.9	Temperature Extremes.....	18
3.10	Testing	18
4	Reinforcement	19
4.1	General.....	19
4.2	Related Documents	19
4.3	Materials.....	19
4.4	Certification and Marking.....	20
4.5	Storage and Protection	20
4.6	Cleaning of Steel	20
4.7	Fabrication	20
4.8	Bending Bars On Site.....	21
4.9	Laps and Splices	21
4.10	Welding Splices	21
4.11	Placing and Fastening	21
4.12	Inspection and Rejection	21
5	Screw Piles	23
5.1	Related Documents	23
5.2	General.....	23
5.3	Method Statement	23
5.4	Piling Programme.....	23
5.5	Pile Design	23
5.6	Design Loads.....	23
5.7	Design Life	23
5.8	Design Certification.....	24
5.9	Bore Information	24

5.10	Nature of Ground and Subsurface Conditions	24
5.11	Unsuitable Strata	24
5.12	Construction	24
6	Foundation Excavation and Backfilling	27
6.1	General.....	27
6.2	Related Documents	27
6.3	Site Investigation Information	27
6.4	Excavation	27
6.5	Classification of Materials	27
6.6	Disposal of Spoil	28
6.7	Existing Utilities	28
6.8	Support Excavation.....	28
6.9	Backfilling	29
7	Precast Concrete Construction	31
7.1	General.....	31
7.2	Related Documents	31
7.3	Penetrations	31
7.4	Construction	31
7.5	Concrete and Reinforcement.....	31
7.6	Tolerances	32
7.7	Surface Finish.....	32
7.8	Inspections	32
7.9	Transportation and Erection of Units.....	32
7.10	Cement Grouting	33
7.11	Welding	33
7.12	Proprietary Splices.....	33
7.13	Handling and Storage	33
7.14	Shop Drawings	34
8	Fabrication and Erection of Structural Steelwork	35
8.1	General.....	35
8.2	Standards of Performance.....	37

8.3	Supply of Materials.....	38
8.4	Fabrication.....	39
8.5	Erection.....	41
8.6	Inspection of Completed Work.....	43
9	Steel Handrails and Other Minor Steelwork.....	45
9.1	General.....	45
9.2	Verification of Dimensions	45
9.3	Materials.....	45
9.4	Fabrication.....	45
9.5	Welding	46
9.6	Bolting.....	46
9.7	Coating Systems	46
9.8	Galvanising.....	48
9.9	Erection.....	49
9.10	Dry-Pack Mortar.....	49
10	Protective Coatings.....	51
10.1	General.....	51
10.2	Related Documents.....	51
10.3	Accreditation and Conformation	51
10.4	Materials.....	51
10.5	Surface Preparation of Steelwork	51
10.6	Painting Steelwork	52
10.7	Galvanising and Metal Spray.....	52
11	Bored Cast-In-Situ Piles	55
11.1	Scope	55
11.2	Related Documents.....	55
11.3	Subsoil Conditions.....	55
11.4	Materials.....	55
11.5	Boring	56
11.6	Inspections	59
11.7	Construction.....	59

Technical Specification General Notes

1.1 General

Scope and Use

This Specification covers notes that apply to all subsequent sections of the technical specification.

This Specification forms part of the Contract Documents.

Other Documents

Read this Specification in conjunction with the other Contract Documents.

New Zealand Building Code

Refer to the following New Zealand Building Code clauses and approved document paragraphs for the criteria and/or methods that must be used to establish compliance with the Code.

B1/VM1	Structure -	General
		2.0 Loadings
		3.0 Concrete
		5.0 Steel
		7.0 Foundations
		8.0 Siteworks
F5	Construction and demolition hazards	

Definitions

The Contractor is the Person with overall responsibility for construction of the building, so named in the Contract Documents and as defined by NZS 3910.

The *Engineer* is the Engineer to the Contract as defined by NZS 3910.

The *Principal* is as defined by NZS 3910.

Person is as defined by NZS 3910.

The *Contract Documents* and *Drawings* are as defined by NZS 3910.

Related Documents

Documents listed in the Technical Specifications which follow refer to their latest issue complete with amendments that are current at the time of preparing the Contract Documents.

Documents listed and cited in the Technical Specifications are deemed to form part of this Specification. However, this Specification takes precedence when it is at variance with the cited document.

The listed documents are available for viewing, by arrangement, at URS New Zealand office, or at the Hera Information Centre.

Acts that relate to this Technical Specification are:

Building Act 2004

Health and Safety in Employment Act 1992

1 Technical Specification General Notes

Dangerous Goods Regulations, Flammable Liquids 1985

Acts listed above include any amendments that are current at the time of preparing the Contract Documents.

Health and Safety

All work covered by this Specification must be undertaken in accordance with the requirements of the Health and Safety in Employment Act (see Clause 1.1.4 herein) and the Contractor's health and safety workplan.

Any party undertaking work, in accordance with this Specification, which introduces hazards on site shall comply with the following.

Prior to commencing work, any party bringing hazards onto the site shall inform the Contractor of:

- the nature of these hazards
- the measures that have been put in place to minimise these hazards
- the procedures that have been put in place for dealing with emergencies

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.

1.2 Construction Review

All stages of construction shall be subject to review. The extent of review shall be nominated by the Engineer, taking into account appropriate factors. These requirements shall form part of the Contract Documents.

1.3 Materials

Unless specifically noted otherwise, all materials shall be new and be of the type and quality suited to the application. No specified material may be substituted without the approval of the Engineer.

Concrete

2.1 General

This section of the Specification covers the supply, handling and placing of all concrete to be provided for structural purposes, the supply and erection of all falsework and formwork and the requirements for all surface finishes in this Contract.

2.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein. The version of each standard to be used in this contract shall be the version including all amendments current at the time of tender submission.

NZS 3101	Concrete Structures Standard (including latest amendments March 2006)
NZS 3104	Specification for Concrete Production
NZS 3109	Concrete Construction (including amendment 2 March 2004)
NZS 3111	Methods of Test for Water and Aggregate for Concrete
NZS 3112	Methods of Test for Concrete - Parts 1, 2 & 4
NZS 3113	Chemical Admixtures for Concrete
NZS 3114	Concrete Surface Finishes
NZS 3121	Water and Aggregate for Concrete
NZS 3122	Portland and Blended Cements (General and special purpose)

2.3 Concrete Supply

All concrete shall be normal weight concrete.

All concrete other than base or site screed concrete shall be either Special or High Grade Concrete produced in a plant having a performance record consistent with the grade of concrete specified and complying with the requirements of NZS 3104 as amended herein and, with the relevant provisions of NZS 3109.

Clause 2.9.4 of NZS 3104 shall not apply. All ready mixed concrete shall be supplied in agitator trucks complying with NZS 3105.

Each batch delivered shall be accompanied by a delivery docket certifying the cement type, maximum aggregate size, specified strength, slump, date, time mixing completed, and time water added at the plant. At the completion of the Contract a schedule of delivery docket numbers for all concrete supplied cross referenced with the location the concrete was placed shall be forwarded to the Engineer.

In addition to the provisions of NZS 3104 Clause 3.4.2 and NZS 3109 Clause 6.8.2, the following shall apply:

No water shall be added to the concrete after it has left the mixing plant without:

- i) the permission of the Engineer
- ii) a set of test cylinders being taken from the mix in question, tested in accordance with NZS 3112, Part. 2, all at no cost to the Contract.

2 Concrete

Where approval has been given to the Contractor to place concrete by pumping the mix supplied shall be one designed for that purpose.

Base or site screed concrete may be Ordinary Grade Concrete and may be batched in accordance with NZS 3109.

2.4 Concrete Strength

Unless shown otherwise on the Drawings, all concrete shall have the following minimum 28 day compressive cylinder strength:

Concrete Type	Strength
Structural Concrete	30 MPa
Prestressed Concrete	50 MPa
Blinding or Site Screed	10 MPa

2.5 Concrete Slump

Maximum nominated slumps at delivery shall be:

Type of Construction	Maximum Nominated Slump
Walls and components less than 200mm thick, columns and beam junctions	120mm
Floor slabs cast on the ground	80mm
Heavy mass construction	60mm
Other concrete	100mm

2.6 Mix Requirements

For durability reasons the concrete mix shall meet the following requirements appropriate for the exposure classification of the concrete member.

Exposure Classification	Maximum W/C ratio	Minimum cement content (kg/m ³)
B1	0.50	270
B2	0.40 - 0.45	320
C	<0.40	350

The exposure classification shall be as follows:

2 Concrete

Surface and Exposure Environment	Exposure Classification
In contact with the ground	A2
Above ground exterior environment	B1

2.7 Materials

In addition to or in substitution for the provisions of the relevant NZ Standards, the following requirements shall apply:

Cement

Cement shall be type GP General Purpose Portland Cement complying with NZS 3122.

The Contractor shall advise the Engineer in writing which brands of cement he intends to use for the various types of construction in the Works. Generally only one brand of cement shall be used throughout the Works to maintain uniformity of colour and to establish undivided responsibility for cement quality. No change in the brand of cement used shall be permitted without the prior written approval of the Engineer.

Aggregates

If the aggregates used have a potential to react expansively with cement alkalis, the reactive alkali in the concrete mix shall not exceed 2.5 kg/m³. Determination of total reactive alkali content shall be in accordance with C & CA Report No. TR3 "Alkali Aggregate Reaction".

The Contractors mix design shall state if the aggregates used have a potential to react expansively with cement alkalis.

No change in the source of supply of aggregate or water shall be permitted without prior approval of the Engineer. The Engineer may order sampling and testing of aggregate and/or water, to be carried out by an independent testing laboratory. In the event of unsatisfactory performance, the cost of testing shall be borne by the Contractor.

Admixtures

Delete Clause 6.5 of NZS 3109 and substitute the following provisions:

- The Contractor shall supply details of the types and rates of application of the admixtures that he proposes to use.
- No admixture shall be used without the prior written approval of the Engineer.
- Where admixtures are approved they shall comply with NZS 3113 and be used in accordance with the manufacturer's instructions.

Chloride

In addition to Clause 6.6 of NZS 3109:

The use of calcium chloride in any concrete shall not be permitted.

The use of any chloride containing admixture shall not be permitted.

2 Concrete

The use of unwashed beach sand shall not be permitted.

Measurement

The provisions of Clause 2.7.1.2 of NZS 3104 shall be varied to provide that the measurement of cement by bags will be permitted only for Ordinary Grade concrete.

2.8 Mix Design

Mix Design

The Contractor shall provide a mix design, for concrete to be supplied, to the Engineer for review at least three days before concrete is to be supplied to site. No structural concrete shall be placed for which there is not an agreed mix design.

Change of Mix

Notification shall be given to and approval obtained from the Engineer before any change is made to an agreed mix design during the Contract.

2.9 Concrete Testing

Concrete acceptance testing shall be carried out in accordance with NZS 3109 and NZS 3112 with the following additional or amending provisions.

- The Contractor shall supply all materials, labour and equipment required to prepare test samples of concrete delivered to the site.
- Compression testing shall be carried out at the cost of the Contractor by an independent laboratory approved by the Engineer.
- Slump tests shall be taken for each delivery of concrete and the results recorded by the Contractor.
- A set of specimens for compression tests shall consist of four specimens from each sample of concrete, one of which is to be tested at 7 days and the remainder at 28 days after casting.
- Test results shall be faxed to the Engineer within two days of the test date.

Where the results of 7 day tests indicate, in the opinion of the Engineer, that the concrete strength may be deficient, the Engineer may direct the Contractor not to place any further concrete until the cause of the low results has been ascertained and the Contractor has taken such steps as may be necessary to ensure that future production of concrete will comply with the Specification.

Test blocks made to determine stripping times or the influence of the weather on strength shall be treated as required in NZS 3112, Part 2, Clause 3.5.3 except where accelerated curing is employed in which case they shall be subjected to the same curing cycle as the structure which they represent.

2.10 Rejection of Concrete

Slump Tests

Concrete having a slump value outside the tolerance limits specified in Clause 9.3 of NZS 3109 will be liable for rejection at the discretion of the Engineer.

2 Concrete

Compression Tests

Where compression test results do not comply with the specified strength requirements the concrete concerned may be rejected at the discretion of the Engineer, in accordance with Clauses 9.5.6 and 9.5.7 of NZS 3109.

If the Contractor disputes the test results he may elect to arrange confirmatory tests on cores of hardened concrete in accordance with Clause 9.5.7 of NZS 3109. In this case he shall notify the Engineer of his intention in writing within one week of the rejection order and before removing any concrete. The tests shall be done by a testing authority approved by the Engineer. If the test proves the concrete to be satisfactory, the Engineer may approve reasonable costs incurred in making the confirmatory tests as an extra to the Contract.

2.11 Formwork and Falsework

Contractor's Obligations

The Contractor shall design and construct all falsework and formwork to provide adequate rigidity and strength to support safely all loads occurring during construction without appreciable settlement or deflection and to produce concrete sections consistent with the specified cambers, tolerances and finishes.

Engineer's Approval

If required the Contractor shall submit to the Engineer detailed plans and design calculations of the falsework and formwork for approval.

These plans shall indicate the amount to be allowed for settlement and deflection under the construction loads. Approval shall in no way relieve the Contractor of his responsibility with respect to the Building Act or for satisfactory performance.

Until the Engineer's written approval is obtained, no work shall proceed on the construction of falsework or formwork.

Design Criteria

In the design of falsework and formwork due consideration shall be given to the following:

- the wet weight of concrete
- the weight of formwork
- loads incidental to construction operations including the effect of impact and vibration loads during the placing and compaction of concrete.
- wind or other lateral loads
- distortion due to pressure loads from wet concrete
- additional loads resulting from placement of concrete by pumping.

In multistorey work the falsework design shall take account of the fact that the all-up weight of wet concrete, formwork and construction loads will usually exceed the design live load for the floor below.

The deflection of any single supporting beam shall not exceed 1/900 of its span and for any cantilever beam the deflection shall not exceed 1/300 of its free length.

2 Concrete

Falsework Construction

Falsework shall be founded on firm secure footings.

Provision shall be made by means of wedges or jacks, for adjusting the height of the formwork. This is to allow for settlement and to provide camber as well as to permit gradual lowering of the formwork during striking.

Adequate bracing shall be provided both transversely and longitudinally.

Formwork Construction

Forms shall be built in a substantial and workmanlike manner and shall be entirely free from warps, misalignment or bulges.

Forms shall be built and maintained so as to produce mortar tight joints and smooth even faces.

Except in cases of curved or special surfaces where form lining may be specified, forms for all fair-faced concrete surfaces shall be surfaced with steel, resin bonded plywood especially manufactured for concrete work or other materials which will produce the surface finish specified in Clause 2.13, Surface Finishes.

Soffit formwork shall be constructed with a camber of uniform curvature, of $1/360$ of the span unless otherwise specified.

The methods of construction shall be such that vertical surfaces can be stripped without disturbing the boxing or supports to beam, slab or arch soffits, which are required to be left in place for a longer period.

Unless otherwise specified or approved, forms for high sections such as walls and columns shall be provided with washout ports or traps of adequate size and spacing at the bottom of all concrete lifts to allow thorough cleaning of the surface of the concrete from all rubbish, wood shavings, loose aggregate, etc. before commencing the next lift. The formwork shall be inspected immediately before any concreting is commenced to ensure that all such material has been removed.

Forms shall be filleted or chamfered at all sharp corners, and shall be given a slight bevel at all projections to ensure easy removal without damage to the concrete.

Bolts, and other metal fittings used in formwork erection shall be constructed so as to permit their easy removal to a depth of at least 50mm from the face without injury to the concrete and so that upon their removal the cavities left are of the smallest possible area.

Forms may be re-used, subject to the approval of the Engineer, and provided they still satisfy the requirements of this Specification.

Surfaces of re-used forms which are to come in contact with concrete shall be thoroughly cleaned before erection.

The inside surface of all forms shall be given a coat of an approved release agent which shall not stain or adhere to the concrete. If form release oil or similar material is used, it shall be applied prior to placing the reinforcing steel, so as to avoid fouling of the surface of the steel. Waste oil shall not be used as form oil.

In addition to the provisions of this clause, formwork shall comply with the requirements of Clause 2.13, Surface Finishes.

2 Concrete

Formwork for concrete spans shall be adjusted prior to concreting with sufficient allowances in height to:

- i) Offset the estimated settlement and deflection of formwork under load from concreting as shown on the approved falsework plans.
- ii) Allow for the specified camber shown on the Drawings to offset the long-term dead weight deflection of the spans.

During placing of concrete all temporary struts or blocks shall be removed from the inside of forms as the concrete reaches that level.

If, during placing, undue settlement, bulging or other defects become apparent in the formwork, the Contractor shall cease placing and shall take all necessary steps to the satisfaction of the Engineer to remedy such defects.

Removal of Falsework and Formwork

No formwork shall be struck without the approval of the Engineer, and methods of removal likely to cause overstress in the concrete shall not be used.

The times of removal of formwork from the various parts of the structure shall be the minimum times in days, with due allowance for mean temperature, as given in NZS 3109 Clause 5.4 Table 5.3.

Where construction loads are required to be distributed to lower floors or if adequate strength has not been attained or where the control of early age creep deflections demand, then beams, slabs and cantilevers shall be propped beyond the minimum stripping times.

The sequence of striking shall be as shown on the Placing Diagram, or, if not shown, shall be as approved by the Engineer. For continuous slab, girder or arch spans the falsework shall not be removed from any one span until the above periods have elapsed after the placing of the last concrete in immediately adjacent spans.

2.12 Penetrations

The Contractor shall refer to all associated Architectural, Mechanical and Electrical Drawings, specifications and manufacturer's literature for dimensions and details of rebates, chases and cast-in items not specifically shown on the Structural Drawings, but which are required to be included for satisfactory completion of the work.

All embedded items shall be accurately located, plumbed as required and supported against displacement.

2.13 Surface Finishes

The classification and standard of acceptance for all specified finishes shall conform with the requirements of NZS 3114 as modified and extended by the following clauses. The surface finishes shall be as listed on the Drawings. Where not shown on the Drawings surface finishes shall be as listed in NZS 3114 Table 1 for formed surfaces and Table 2 for unformed surfaces.

2 Concrete

Sample Reference Panels

The Contractor shall provide sample panels of specified finishes as and when required in the Contract Documents. Panels shall be prepared in accordance with Clause 104.4 of NZS 3114 and any special requirements in this Specification or shown on the Drawings.

Formed Finishes

All surfaces cast against formwork (eg. walls, columns, beams, bridge abutments, piers and vertical or near vertical surfaces) shall be produced with the finishes specified herein or shown on the Drawings.

All such finishes shall comply with the standard classified finishes "F1 to F6" as specified in NZS 3114 and any additional special finishes "FNZ" specified herein or shown on the Drawings.

Where special exposed aggregate textured or profile surfaces are required they shall be formed in accordance with Section 2 of NZS 3114 and classified as "FNE" or "UNE" as appropriate.

Form oils used shall not stain or adhere to the concrete surface or impair the adhesion of any specified coating.

Where a formed surface is to be the base for plaster coats or tiled surfaces a rough surfaced lining material may be used and form oil dressings shall be kept to a minimum. Surfaces showing residual form oil deposits likely in the opinion of the Engineer to affect the adhesion of a subsequent coating shall be thoroughly scrubbed with detergent and flushed with fresh water to remove all traces of the residual material.

All joints in forms shall be constructed so as to prevent grout leakage. All joints in forms for F5 and F6 shall be constructed without visible misalignment and sealed against water loss using suitable sealing strips or compounds.

All tie holes for finishes F4 to F6 shall be filled with sand cement mortar as specified for finishes F1 and F3 in Section 105 of NZS 3114. The cement shall be the same brand as used in the parent concrete.

The filled tie hole for finishes F5 and F6 shall match the shade and texture of the parent concrete as near as is practical. If the colour match is not satisfactory in the opinion of the Engineer, he may direct that the whole surface be bagged as described in Clause 2.23.1, to achieve a uniform colour.

Unformed Finishes

All surfaces, generally horizontal or near horizontal formed without the use of formwork such as on-ground slabs, pavements, suspended slabs, topping screeds and bridge decks, shall be produced with the finishes specified herein or shown on the Drawings.

All such finishes shall comply with the standard classified finishes U1 to U11 as specified in NZS 3114 and any additional special finishes "UNX" specified in this Specification or shown on the Drawings.

Unless specified or approved otherwise all screeding shall be carried out by using appropriate screeds operated over side forms accurately set out to the correct profile with due allowances for specified cambers.

Where approval is obtained from the Engineer to use Wet Screeding (Point Screeding) and using screeds less than 3 metres in length the specified control tolerances for gradual deviations listed in Table 3 of NZS 3114 may be reduced at the discretion of the Engineer. The reduced tolerances shall

2 Concrete

be the specified tolerances multiplied by the ratio of the screed length to 3 metres. The surface shall be checked using a straight edge having a similar length to that of the screed.

Side forms may be either fixed or temporary and constructed of either wood or metal and shall comply with Clause 2.13.2

Floating shall only be commenced after the moisture film has disappeared and initial stiffening of the concrete surface has taken place.

Mechanical steel trowelling for a U3 finish may be performed using machines of either the rotating trowel type or the compacting type combining a rotating disc and hammers. The latter type is preferred.

Where textured finishes U5 or U6 are specified the surface shall be allowed to set sufficiently after floating to retain the broom or tyne marks. The type of broom or tyne employed shall be approved by the Engineer.

Where a U6 finish is specified the brooming or tyning shall be such as to remove all laitance and to provide an adequate key for bonding of the topping.

2.14 Handling and Placing

The methods of handling concrete and the sequence to be adopted in placing shall be notified in writing by the Contractor and subject to the approval of the Engineer, and shall thereafter not be varied without further approval.

Notwithstanding any previous acceptance of methods proposed, the Engineer may order their use to be varied or discontinued should it be found that unsatisfactory concrete is being produced.

2.15 Chutes

Metal or plastic lined chutes may be used but where steep slopes are required the chutes shall be either equipped with baffle boards or be assembled in short lengths which reverse the direction of movement.

Equipment made from metal containing aluminium shall not be used to transport concrete.

2.16 Pumping

Concrete may be placed by pumping provided that an agreed concrete mix, designed for pumping is used and that approved equipment is employed.

2.17 Notice to Engineer

The Contractor shall advise the Engineer when he intends to commence placing concrete. A minimum of 48 hours notice shall be provided. No concrete shall be placed until the Engineer is satisfied that the requirements of this Specification and the Drawings relating to formwork, reinforcement and construction joints have been complied with entirely. No concrete shall be placed in the absence of the Engineer without his prior approval.

2 Concrete

2.18 Time Limits

Concrete not placed and vibrated in forms after 90 minutes have lapsed from the stated time that water was added at the plant may be rejected by the Engineer.

Concrete not placed in its final position in the forms within 30 minutes after discharge from the mixer or agitator truck, or before initial set has occurred shall not be used. For concrete mixes containing accelerating admixtures the time of 30 minutes shall be reduced to 15 minutes.

2.19 Placing

Concrete shall be placed and compacted so as to avoid segregation of materials, displacement of reinforcing, separation between layers of adjacent parts, zones of poor compaction or areas of weak concrete such as may be evidenced by honey combing in the finished work.

The maximum permitted free fall drop of concrete is 2m and the lateral flow shall be restricted to 1m unless otherwise approved by the Engineer.

2.20 Concrete Compaction

All compaction of concrete shall be carried out in accordance with Clause 7.6 of NZS 3109 as further modified by the following provisions.

- a) All concrete shall be thoroughly compacted during and immediately after depositing, by means of approved power driven immersion vibrators of a size suitable for the section being poured.
- b) Special permission shall be obtained from the Engineer for the use of form vibrators in sections inaccessible to the immersion type of vibrator.
- c) Vibrators shall be used in such a manner as to prevent displacement of reinforcing, damage to formwork, and the transfer of vibration to concrete which has taken only its initial set.

2.21 Construction Joints

General

All construction joints shall be formed in accordance with Clause 5.6 of NZS 3109 as further modified or added to by the following Clauses. Generally all joints shall be Type B.

Construction joints shall be located only at the specified positions either shown on the Drawings or specified herein unless otherwise approved by the Engineer.

Where construction joint locations are not indicated, the Contractor shall submit his proposals to and obtain approval from the Engineer before proceeding with the construction of the section in question.

In construction joint proposals the size and layout of areas to be poured shall be generally in accordance with Clause 2.21.2 so that shrinkage cracking is avoided.

Joints in adjacent structural elements shall be made to line up such that compatible shrinkage movements occur.

Unless detailed otherwise on the drawings, Beams shall be poured monolithically with slabs. Upstands shall be poured monolithically with slabs, or beams.

2 Concrete

Location of Joints

Unless otherwise approved or specified elsewhere construction joints shall generally be located in the following positions:

- a) For in-situ beams and suspended slabs joints shall be formed near midspan at a maximum spacing of 15 metres.
- b) For columns and walls joints shall be formed immediately below and above beams and slabs.
- c) For suspended slabs and toppings the maximum area poured in one operation shall not exceed 120 square metres, with a maximum dimension of 15 metres. This area shall be reduced to 80 square metres where specified tolerances demand fixed screeds.
- d) For slabs on the ground the above maximum may be increased by 50% where the increase is not incompatible with construction joint locations in foundation beams.

Slabs

For all slabs provision shall be made for shrinkage control joints within the pour to be formed by either sawcutting or another approved method. Sawcuts, if used, shall be carried out as soon as possible without damaging the concrete surface and not more than 48 hours after the concrete is poured. The cuts shall be to a depth of one quarter of the slab thickness and true to line for the full length of each cut.

The maximum spacing between sawn control joints or control joints and construction joints shall be 6m for suspended slabs and 5m for slabs on the ground.

For toppings similar provisions for shrinkage control joints shall be made but the maximum spacing and areas, shall be reduced to comply where appropriate with manufacturer's specifications and to prevent shrinkage cracking.

Bridge deck slabs and toppings on bridge decks shall not have shrinkage control joints unless detailed on the drawings.

2.22 Curing and Protection

When concreting in hot weather, the work shall, where practicable, be protected from the direct rays of the sun and from drying winds. Concreting shall not be commenced when heavy rain is falling or threatening and if rain commences during a pour, the Contractor shall protect the work to prevent damage to the concrete or to any newly finished surfaces until the concrete has set to such a stage as to withstand leaching of the cement.

In the event of a deterioration in weather, the Engineer shall be the sole judge of whether concreting may continue or not.

2.23 Repair of Concrete

The repair of minor surface defects and structural defects to concrete shall comply with Section 7.7 of NZS 3109.

The repair of all minor surface defects and structural defects of concrete shall be carried out in accordance with Section 7.7.5 of NZS 3109 except as further provided herein.

No repairs to either class of defect shall be carried out without the approval of the Engineer.

2 Concrete

All repaired concrete shall have the same strength, durability and surface finish as the parent concrete unless otherwise approved by the Engineer.

Formed Surfaces

Abrupt changes in excess of the specified limit shall be either ground off to a minimum standard of 1 in 20 height to length, or in accordance with Clause 105.6.5 of NZS 3114 and the resulting surface finished to match the colour and texture of the surrounding concrete.

Gradual deviations shall be corrected using methods approved by the Engineer and the resulting surface finished to match the surrounding concrete.

The repair of all surface defects shall be carried out to the standards specified either in NZS 3114 or elsewhere in this Specification, appropriate to the class of finish required. Except where specified otherwise in this Specification repairs to surface defects for finishes F3 to F6 shall be carried out as follows:

- a) Immediately after the removal of formwork the defective surface shall be stoned to remove all small projections and fins and thoroughly wetted, then allowed to approach a surface dry condition.
- b) A sand cement grout shall be applied to the surface by means of either wood or cork floats or clean burlap or sponge rubber pads as appropriate. The grout shall be thoroughly rubbed into all air holes and other defective areas using a circular motion.
- c) After the grout has stiffened sufficiently any surplus shall be removed with an appropriate float or pad.
- d) When visibly dry (after about 2 hours) the surface shall receive a further rubbing down with a burlap or sponge rubber pad.
- e) Finally the surface shall be stoned when the concrete has sufficiently hardened, normally not less than 28 days after pouring.
- f) The grout used shall consist of 1 part cement to 1 1/2 to 2 parts fine sand by volume and shall be mixed to the consistency of thick paint.
- g) The sand used shall be from the same source as the fine aggregates used in the parent concrete and shall all pass a 600micron sieve and not more than 10% should pass a 150 micron sieve.

Unformed Surfaces

Abrupt changes in excess of the specified limits shall be corrected as for formed surfaces (refer Clause 2.23.1), but with reference to the notes related to Table 3 of NZS 3114 for grinding requirements.

Gradual deviations in excess of the specified limits shall be corrected as for formed surfaces (refer Clause 2.23.1) for grinding requirements.

Reinforced Block Masonry

3.1 General

This section of the Specification covers the supply of materials and the construction of all reinforced block masonry in this Contract.

3.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein.

AS/NZS 4455	Masonry Units and Segmental Pavers
NZS 4210	Masonry Buildings: Materials and Workmanship
NZS 4230	Code of practice for the Design of Masonry Structures

Masonry shall be Grade A,B or C as shown on the Drawings and as defined in NZS 4230. If no grade is shown on the Drawings it shall be assumed to be Grade B.

3.3 Masonry Units

All masonry units shall be manufactured in accordance with AS/NZS 4455 by an approved manufacturer. All units shall be of uniform colour and texture and free of cracks, chips or other defects.

For all cells grouted construction open end bond beam Type 2016 blocks shall be used.

For reinforced cells only grouted construction, standard Type 2001 blocks shall be used together with Type 2014 bond beam blocks and type 2005 open end blocks where necessary to accommodate the reinforcing.

3.4 Mortar

The mortar shall consist of four parts of clean sand to half part of hydrated lime mixed and allowed to slake for not less than 24 hours before use. Immediately before use one part of Portland Cement shall be added to give a mix of proportions 1:½:4 for cement, lime and sand respectively, measured by volume.

Alternatively, an approved plasticiser may be used in place of the lime, mixed in accordance with the manufacturer's instructions. Examples are Daracen by W R Grace Limited, Febflow SP2 by Cory-Wright, Pozzolith by Embecon or approved equivalent.

If a batch of mortar which has been prepared for use has stiffened due to lapse of time, workability may be restored by the addition of water and thorough remixing. Retempering water shall be added to a basin formed by the mortar and the mortar carefully worked into it. Retempering by dashing water over the mortar shall not be permitted.

Any mortar not used within one and a half hours after the addition of cement shall be discarded

3 Reinforced Block Masonry

3.5 Grout and Grouting

Material

Grout shall be fine grout complying with Section 2.3 of NZS 4210. If the grout is to be pumped it shall be suitable for that purpose.

Coarse grout with a maximum aggregate size of 13mm may be used only if approval is obtained from the Engineer.

Method of Grout Placement

Grouting shall preferably be done by the high lift grouting method with the use of an expansive admixture, such as Darexpan by W R Grace Limited, described under Clause 2.12 of NZS 4210.

The admixtures shall be added to the mix on site in accordance with the manufacturer's written instructions immediately before commencement of the filling operation.

For Grade C masonry, rodding of the grout will be an acceptable means of achieving the consolidation required under Clause 2.12 of NZS 4210. It is essential that the grout has a spread value within the range 450mm to 530mm specified in Clause 2.3.2.1 (c) of NZS 4210.

For Grade A and B masonry, consolidation shall be by vibration.

On completion of grouting a weighted board shall be placed on top of the wall or alternative approved means taken to prevent spill over of the expanding grout.

Alternatively, if approved by the Engineer, the grouting may be performed without using an expansive admixture by either of the following two methods:

- a) The high lift grouting method including consolidation and reconsolidation as described in Clause 2.13 of NZS 4210.
- b) The low lift grouting method described in Section 2.14 of NZS 4210.

For any of the above methods, grouting shall not commence until the mortar has attained sufficient strength, but in any case not sooner than 12 hours after completion of mortaring.

3.6 Reinforcement

In addition to the requirements of Clause 2.1.4 NZS 4210 the following provisions shall be complied with.

All reinforcing shall be supplied and placed in accordance with the detailed Drawings, including standard detail Drawing SD20.

Vertical bars shall return not less 250mm into the top bond beam and into lintel beams over openings.

Horizontal bars shall be continuous around corners. At the end of a wall or opening horizontal bars shall be either hooked around the vertical bars or turned down 250mm into the end vertical cell.

All reinforcing bars larger than 6mm diameter shall be high tensile deformed steel (Grade 500E) unless shown otherwise on the Drawings.

3 Reinforced Block Masonry

3.7 Blocklaying

In addition to the requirements of Section 2.7 of NZS 4210 the following clauses shall be complied with.

Tanking

Masonry surfaces to which tanking membranes are to be applied shall have mortar joints flush with the surface.

Registered Masons

All concrete masonry work shall be carried out by masons registered under the NZCMA registration scheme, unless otherwise approved by the Engineer.

The registered mason shall check set-out of masonry and reinforcement, check on quality of materials and workmanship, continuously supervise grouting and ensure the adequacy of propping and stays to masonry. The registered mason shall report in writing to the Engineer at least every week on the standards of materials and workmanship.

First Course Blocks

The first course shall be constructed of open-end bond-beam blocks laid upside down to facilitate cleaning out of the bottom of the wall prior to grouting. Bottom course shall be fully grouted.

Clean-Out Openings

Where the high lift grouting method is to be used temporary clean-out openings shall be provided at every vertical bar at the bottom of each lift.

Where the low lift grouting method is to be used temporary clean-out openings shall be provided where necessary at the bottom of each lift to ensure satisfactory cleaning out and inspection.

For both high and low lift grouting methods, the clean-out openings shall be cut neatly with a circular saw.

The opening shall have a minimum height of 100mm above the footing by 100mm width, where they will be concealed by a skirting or other trim. Where they will be exposed in the finished work they shall be cut to 100mm in width by the full height of the block and closed off with plaster material. It is noted however that this will compromise the aesthetic standards.

Items To Be Cast In

All anchors, bolts and other items shown on the Drawings to be cast in shall be secured in place before grouting commences.

Control Joints

Vertical control joints shall be constructed in the positions shown on the Drawings. Where not shown they shall be placed in accordance with Figure 13.1 of NZS4229 and approved by the Engineer. The spacing of the joints should be uniform where possible.

3 Reinforced Block Masonry

Control joints shall be coordinated with large penetrations, openings, and joints in slabs above and below.

The control joints shall be constructed in accordance with the details shown on the Drawings. Where not shown the joint face of the control blocks shall be painted with a primer compatible with the sealant material, before laying. The vertical joint mortar shall be raked out to a depth of 18mm on each face. Alternatively a backing rod may be used in an unmortared joint. An elastomeric joint sealant such as "Silaflex MS", by Fosroc or equivalent shall then be run in each joint in accordance with the manufacturer's instructions.

Cleaning of Blockwork

Any mortar or grout droppings to visible surfaces shall be cleaned off as soon as they occur so as to give a clean blockwork finish.

Cutting of Blockwork

When cutting of block units is necessary cuts shall be made neatly and true with a circular saw.

3.8 Bracing During Construction

Temporary bracing shall be provided to all concrete masonry work where necessary to resist all loads until they are structurally complete.

3.9 Temperature Extremes

The precautions listed in Sections 2.18 and 2.19 of NZS 4210 shall be complied with when construction occurs in extremes of temperature.

3.10 Testing

Compressive Strength of Mortar and Grout

Compressive tests on samples of mortar and grout shall be carried out in accordance with Appendix 2.A of NZS 4210. Curing, capping and testing shall be carried out by a TELARC-registered laboratory.

Masonry-to-Mortar Bond Tests

These shall be carried out in accordance with Appendix 2.B of NZS 4210. Testing shall be done by a TELARC-registered laboratory.

Tests to Confirm Design Compressive Strength

In areas of Grade A masonry so noted on the Drawings, tests shall be carried out in accordance with Appendix B or C of NZS 4230 to confirm the compressive strength assumed in design. Tests shall be carried out by a TELARC-registered laboratory.

Reinforcement

4.1 General

This section of the Specification covers the supply, fabrication and placing of all reinforcement required in the Contract.

4.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein. The version of each standard to be used in this contract shall be the version including all amendments current at the time of tender submission.

NZS 3101	Concrete Structures Standard (including latest amendments)
NZS 3109	Concrete Construction (including latest amendment)
AS/NZS 4671	Steel Reinforcing Materials
CCANZ IB No. 79	CCANZ Information Bulletin No. 79 Recommended Industry Practice on Bending and Re-Bending of Reinforcing Bars.

4.3 Materials

All reinforcing bar shall comply with AS/NZS 4671. The bar designations shown on the drawings shall be interpreted as follows:

Designation	Bar Type and Grade
R	Plain round reinforcing bar. Grade 300E
D	Deformed reinforcing bar. Grade 300E
HR	Plain round reinforcing bar. Grade 500E
HD	Deformed reinforcing bar. Grade 500E
RB	Reidbar deformed reinforcing bar. Grade 500E

All reinforcement shall be Grade 300E or Grade 500E to AS/NZS 4671 unless specifically noted otherwise on the drawings. Grade 250N, 500N, 500L and/or quenched and self-tempered bars shall not be used without the specific approval of the Engineer.

All reinforcing mesh shall comply with AS/NZS 4671 and NZS 3422.

All spacer bars and hangers shall be mild steel.

All cover spacers shall be either:

- concrete blocks of an approved size and shape made with 10mm maximum size aggregate. The blocks shall be of equal durability to the surrounding concrete in terms of NZS 3101. Concrete cover spacers shall not be used on surfaces exposed in the finished structure,
- plastic chairs of an approved type.

All wire used for tying reinforcement shall be soft black iron wire between 1.20mm and 2mm diameter.

4 Reinforcement

4.4 Certification and Marking

All reinforcing bar or mesh shall be delivered to either the site of the works or the fabrication yard in unbroken bundles clearly labelled for identification and accompanied by maker's certificates in accordance with AS/NZ 4671.

In addition to the requirements of the above site bundles shall only be broken after identification and approval by the Engineer or his authorised representative with the appropriate certification.

The Contractor shall prepare bar bending schedules and all fabricated bar reinforcing shall be tagged for identification before delivery to site. Each delivery of fabricated reinforcing bar shall be accompanied by schedules identifying the location of the bars in the structure.

4.5 Storage and Protection

All steel shall be stored immediately on delivery to the site in approved weatherproof racks so that it is clear of the ground and vegetation and protected at all times from damage or surface deterioration.

4.6 Cleaning of Steel

The surface of the steel reinforcement shall comply with the requirements of NZS 3109 Clause 3.4 at the time of concreting. The Contractor shall obtain the approval of the Engineer for any cleaning methods proposed to achieve this condition.

Undue delay between cleaning and concreting may result in an additional cleaning operation by the Contractor being ordered by the Engineer.

Special care shall be taken to ensure that reinforcing is not coated with dried concrete or cement paste at the time of placing the surrounding concrete.

4.7 Fabrication

All reinforcement shall be handled in accordance with NZS 3101 (including Amendment No. 3) and CCANZ Information Bulletin No. 79.

All reinforcement shall be cold formed to the shapes and dimensions shown on the Drawings. Bends and hooks shall comply with NZS 3109 Section 3 Table 3.1.

Reinforcing at wall intersections and bond beams shall be detailed as shown in Figure 10.3 of NZS 4229.

Deformed bars shall be bent around rollers rather than fixed pins.

No reinforcement shall be used with undesigned kinks or bends.

Reinforcement shall be straightened before bending when so directed by the Engineer without additional payment.

No reinforcement shall be either bent or straightened in a manner that will damage the material.

Rebending of reinforcement shall not be permitted unless approved by Design Engineer. Rebending shall be carried out strictly in accordance with manufacturer's recommendations.

4 Reinforcement

All tie wire shall be bent in to ensure it does not protrude into the cover concrete.

Larger diameter reinforcing bars or higher grade bars shall not be substituted for the bars nominated on the Drawings without the written approval of the Engineer.

4.8 Bending Bars On Site

Site Bending of reinforcement is not permitted except where approved by the Design Engineer. Rebending of Grade 500E reinforcement shall not be permitted under any circumstance.

Bending shall be carried out in accordance with manufacturer's recommendations. A purpose built tool shall be used for bending bars to achieve the correct bend diameters.

Bending of bars with diameters greater than 16mm is not permitted.

4.9 Laps and Splices

All reinforcement shall be supplied in the full lengths indicated on the Drawings.

Laps at locations other than those either specified or shown on the Drawings will not be permitted unless approved in writing by the Engineer.

4.10 Welding Splices

The welding of reinforcing bars shall not be permitted unless noted on the Drawings or otherwise specified or approved in writing by the Engineer. Grade 500E reinforcing bars shall not be welded under any circumstances.

Where approved, welded splices shall conform with NZS 3109 Clause 3.7.2.

4.11 Placing and Fastening

All reinforcing shall be accurately placed and fixed in the positions shown on the Drawings and secured against displacement during the placing and compaction of the concrete.

Distances from the forms shall be maintained using stays, ties, hangers, plastic chairs as specified in Clause 3.3, or by other approved devices.

Steel chairs or hangers shall be provided to support all top reinforcing bars not supported by either reinforcing stirrups or ties.

The reinforcement shall be secured at intersections and to supports with tie wires. Ties and supports shall be located at sufficiently close intervals to maintain the rods in their correct positions.

Starter bars protruding from concrete shall be secured from movement, such as vibration, wind and accidental disturbance.

4.12 Inspection and Rejection

After placement the reinforcement shall be inspected and approved by the Engineer or his representative before any concrete is placed. At least 24 hours notice shall be provided for inspection and approval. The removal of all formwork preventing proper inspection shall be allowed for.

4 Reinforcement

Concrete placed before inspection and approval shall be liable to rejection and removal.

Screw Piles

5.1 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein. The version of each standard to be used in this contract shall be the version including all amendments current at the time of tender submission.

AS/NZS 1170	Loading Standard.
AS 2159	Piling Design and Installation.

5.2 General

This Specification covers the general requirements for the construction of screw tension piles socketed into medium to stiff soils.

5.3 Method Statement

The Contractor shall provide a detailed 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 to the Engineer prior to commencement of piling work on Site. The Engineer's review of the Contractor's method statement shall not relieve the Contractor of its obligations to meet the requirements of this Specification.

5.4 Piling Programme

The Contractor shall submit a detailed programme for the execution of the piling work prior to piling work commencing on Site.

5.5 Pile Design

The requirements specified 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 the specified loads and performance to this specification.

Pile design to comply with AS/NZS 1170 and AS 2159.

5.6 Design Loads

The required design loads are shown on the drawings.

5.7 Design Life

The design life is to be not less than 100 years. For unprotected steel the sacrificial corrosion rate shall be in accordance with AS 2159.

5 Screw Piles

5.8 Design Certification

Provide a Design Producer Statement (PS1) in the ACENZ/IPENZ format or an approved equivalent format for clauses B1 and B2 of the New Zealand Building Code before commencing construction work.

5.9 Bore Information

If bore information is included in the drawings or documents it shall not be regarded as part of the contract. The Contractor shall place his own interpretation on the information shown.

5.10 Nature of Ground and Subsurface Conditions

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 inform the Engineer of any circumstances which indicates, in the Contractor's opinion, that ground conditions differ from those reported or which could have been inferred from ground investigation reports or preliminary pile results.

Should the Contractor consider that such a change in the ground conditions could not have been reasonably foreseen by an experienced contractor when tendering and will in the Contractor's opinion change the construction methodology or substantially increase the Contractor's costs, then redress may be sought in accordance with the unforeseen physical conditions of the project Conditions of Contract.

No warranty is expressed or implied that any information, opinions or conclusions, given in any factual or interpretative ground investigation report, supplied 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 it may draw from any information made available to it.

5.11 Unsuitable Strata

If, in the opinion of the Engineer, unsuitable strata are encountered during boring operations, further investigation of the underlying strata by means of core borings may be required at the direction of the Engineer. This shall be done at schedule rates to be supplied with the tender.

5.12 Construction

General

Construction is to comply with AS 2159.

Setting Out

The Contractor shall be responsible for the accurate setting out of all work. Piles shall be located in the positions indicated on the Drawings and shall be straight and of the required rake throughout their length.

5 Screw Piles

Tolerance

The maximum tolerance for the plan position of the pile head shall be 75 mm. The rake shall not vary by more than 4 degrees from the required value or +/- 20 mm.

Installation Records

Installation records shall include the following:

- Pile Reference number.
- Shaft and helix dimensions and diameters.
- Installation pressures.
- Length of pile.
- Date of installation.

Construction Certification

Provide a Construction Producer Statement (PS3) in the ACENZ/IPENZ format or an approved equivalent format before Practical Completion.

Foundation Excavation and Backfilling

6.1 General

This section of the Specification covers all excavation required for the construction of footings, walls and ground slabs to the dimensions shown on the Drawings, together with backfilling where required.

Bulk excavation, filling, clearing and other work related to site development, underground services, roads, paths, landscaping etc are not covered by this specification and are specified elsewhere.

6.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

NZS4202	Method of Measurement of Building Works
NZS4204P	Code of Practice for Foundations for Buildings not requiring Specific Design
NZS4205P	Code of Practice for Design of Foundations for Buildings

6.3 Site Investigation Information

Any borelogs or other site investigation information shown on the Drawings or included herein is provided only for the information of the Contractor. No warranty as to the correctness or completeness of the information is given and it shall be the responsibility of the Contractor to interpret the information or carry out further investigations for his own purposes.

6.4 Excavation

Dimensions

The Contractor shall excavate to the total structure dimensions shown on the Drawings together with any additional allowance for working space for form work prescribed in Clause 3.4.1, NZS 4202. The total structure dimensions shall include provision for 50mm minimum thickness of site concrete under all foundations except ground slabs and for any requirement for drainage course, hardfill or other details shown on the Drawings.

Unsuitable Foundations

Any unsuitable or doubtful foundation conditions shall be brought to the attention of the Engineer who will make any decisions and give any instructions required to remedy the condition.

Any unsuitable foundation conditions arising from disturbance of the soil by the Contractor, or failure by the Contractor to maintain adequate drainage and any over excavation shall be good by the Contractor at his own cost.

6.5 Classification of Materials

For the purposes of this Specification, earthworks materials will be classified as follows:

6 Foundation Excavation and Backfilling

Rock Material

Rock material shall be that which cannot be excavated by a conventional bulldozer, tracked loader or tracked excavator having net engine power up to 300 kilowatts and which requires to be loosened for excavation by ripping or blasting.

Type W Material

Type W material shall be material, which because of its inherent properties of grain size, water content or organic content is excavated as a special operation requiring the attendance of plant nor otherwise required during the excavation process.

Material shall not be classified as Type W when its condition is due to the Contractor's operations or failure to provide adequate surface drainage or a reasonable time has not been allowed after rainfall to allow the material to return to its normal condition.

Type A Material

Type A material shall be all excavated material which does not fall within the classification for Rock or Type W material.

6.6 Disposal of Spoil

Any excavated material required for backfill or site works shall be stockpiled as directed by the Engineer. All surplus spoil shall be removed from the site and disposed of at the total cost of the Contractor.

6.7 Existing Utilities

The attention of the Contractor is drawn to the provisions of the General Conditions of Contract regarding underground and overhead utilities. Where the Drawings show any such utilities to be affected by proximity to the foundations or other portions of the structure, the Contractor shall carry out protective measures.

The Contractor shall provide adequate and continuous drainage from the foundation excavations. All seepage and surface water shall be discharged by means of temporary sumps, drains or pumps as required.

Any foundation materials softened as a result of the Contractor's failure to provide adequate drainage shall be removed and replaced with approved compacted hardfill at the cost of the Contractor.

6.8 Support Excavation

In addition to the general provisions in the General and Special Conditions of Contract, the Contractor shall take all specific measures required to ensure the stability of the excavation including any shoring, underpinning or face strutting. Such measures shall extend to the safety and stability of the surrounding ground and adjoining buildings and services. The Contractor shall provide the required notice to the Department of Labour, Local Authority and adjoining owners.

6 Foundation Excavation and Backfilling

6.9 Backfilling

Bearing Areas

Backfill under foundation beams or footings where required as a result of over-excavation by the contractor or excavation of unsuitable foundations as instructed by the Engineer shall be carried out with approved hardfill. Such backfill shall be consolidated to not less than 92% of the maximum dry density of the soil as determined by NZS 4402, Test 4.1.3.

Where the Engineer determines that backfilling with excavated material is necessary to preclude differential settlement, such material shall be selected to the approval of the Engineer and consolidated to provide an average undrained shear strength of 120 kPa in any group of 10 tests with no single test less than 100 kPa. Backfilling with excavated material shall not be carried out without the written instruction of the Engineer.

Pad Footing

In addition to any backfill as specified, a hardfill layer shall be provided under pad footing. Materials for this purpose shall be 40mm to 12mm graded crushed aggregate to 150mm compacted thickness blinded with 25mm compacted thickness of non-abrasive sand so as to produce a surface which will not damage the damp proof membrane. Each layer of material shall be consolidated separately after thorough wetting to an extent which will not unduly saturate the subgrade. Consolidation shall be carried out with a 5 tonne wheeled roller or equivalent vibrating roller.

Precast Concrete Construction

7.1 General

This section of the Specification covers the manufacture, transport and erection of precast concrete units together with ancillary in-situ works.

7.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein.

NZS 3101	Code of Practice for the Design of Concrete Structures
NZS 3109	Concrete Construction
NZS 3114	Concrete Surface Finishes
NZS 4203	Code of Practice - General Structural Design and Design Loadings for Buildings
PCI Committee Tolerances for Precast and Prestressed Concrete, PCI Journal, Jan/Feb 1985, pp 26-112.	

7.3 Penetrations

Preform all penetrations over 100 mm square in locations as shown on the Drawings. Immediately prior to manufacture, the Contractor shall obtain from the Engineer confirmation of all penetrations required.

7.4 Construction

Unless shown otherwise, all units shall be constructed monolithically, and no construction joints shall be formed within the unit without the Engineer's approval.

Units shall be individually marked for their respective locations on the job, consistent with the manufacturer's shop drawings.

Units shall be delivered crack free. Units shall not be placed in the works until they achieve the greater of the time to reach the 28 day compressive strength or 14 days minimum curing.

7.5 Concrete and Reinforcement

All concrete and non-prestressed reinforcement used shall comply with the relevant provisions of other parts of this Specification.

Concrete admixtures shall not be used without the specific approval of the Engineer.

Units shall be properly cured until the required release strength (as determined by field test cylinders) has been reached. Curing shall be either by continuous moist curing, or low pressure steam, or other accelerated curing processes approved by the Engineer.

Low pressure steam curing shall be limited as follows:

- i) The temperature of the enclosure shall not exceed 50 degrees C within five hours of casting.

7 Precast Concrete Construction

- ii) Maximum temperature of the enclosure shall not exceed 80 degrees C, or as approved by the Engineer.

Concrete used in the units shall be High Grade and specified strength not less than 40 MPa, or higher if shown on the Drawings.

Prestressing reinforcement shall comply with NZS 3109.

7.6 Tolerances

Permissible manufacturing deviations shall be in accordance with the PCI Committee report.

7.7 Surface Finish

The top surface of the platform units shall be exposed aggregate.

The surfaces of units to receive in-situ concrete or grout shall have stiff broomed (U3) finish of good keying quality. Edge and soffit forms shall be F4 finish or as otherwise shown on the Drawings. No bagging or patching of boney concrete shall be permitted without prior inspection and approval by the Engineer. Finishes to infill sections in materials other than reinforced concrete shall have high tolerance finishes appropriate to the material being used.

The inside vertical surfaces of shell beams and horizontal joints of wall panels shall be roughened to an amplitude of 5 mm.

7.8 Inspections

The Contractor shall obtain from the manufacturer, and notify the Engineer in writing of his programme for casting of the units at least two weeks in advance of casting, so that periodic inspections may be made during progress of the work.

Key inspection times requiring notification are during manufacture, after manufacture (prior to despatch to site), and after erection but prior to grouting etc. It shall remain the Contractor's responsibility to obtain from the manufacturer precast units complying in all respects with the Drawings, Specifications and "as-built" details of the supporting structure.

7.9 Transportation and Erection of Units

General

Precast units shall be placed true to line, level and plumb within at least the tolerances given in NZS 3109 for in-situ concrete. The Contract Documents may call for stricter tolerances.

Permissible manufacturing deviations shall be in accordance with the PCI Committee report.

Units shall be protected from damage or overstress during handling, transportation and storage on the site.

Cutting or modification of the units in any form shall not be permitted unless within the limits of this Specification and as authorised by the Engineer.

7 Precast Concrete Construction

7.10 Cement Grouting

Where cement grouting is required, a proprietary premixed low viscosity, high wetting, non-shrink grout shall be used and applied strictly in accordance with the supplier's recommendations. The grout shall have a strength of 10 MPa greater than that of the concrete elements to be joined.

Reinforcing bars to be grouted shall be clean and free from all oil, paint and mill scale. Holes to receive grouted bar shall be drilled with a percussion drill (not diamond drilled), washed clean and scrubbed out with a wire bottle brush. Preformed holes shall be formed with a corrugated metal former. Oil-free air shall be used to clean out the holes immediately prior to grouting.

The preferred method of grouting vertical bars without proprietary splice sleeves, is to measure out the calculated volume of grout and place in the hole, then place the bar to be grouted. Bar spacers shall be used to locate bars centrally in the hole.

For horizontal bars, the holes shall be formed with inlet and outlet ports. The components shall be located in their final locations and the grout space sealed. Grout shall be injected under pressure through one port and continued until neat air-free grout exudes from the second port. The ports shall then be closed off.

Grouting between concrete surfaces shall be carried out in either of the ways described above depending on whether the grout space has a greater vertical or horizontal dimension respectively. Grout volume shall be calculated and compared with that actually used in order to ensure complete filling of the grout space. The perimeter of the grout space shall be effectively sealed to prevent grout loss.

Grout shall be left to set without shock and vibration for at least 3 days or until it has reached a strength of 20 MPa.

7.11 Welding

Welding of embedded plates and the like shall be in accordance with NZS 4701.

Welding of reinforcing bars shall be carried out without Engineer's approval.

7.12 Proprietary Splices

Proprietary reinforcing bar splicing systems (eg NMB splices, swaged couplers) shall be installed strictly in accordance with the manufacturer's written instructions.

7.13 Handling and Storage

Units shall be handled, transported and stored so that no damage or soiling is caused to them.

Units shall be stored on dunnage at appropriate support points. Support points shall be selected to avoid cracking, damage and sagging of the precast unit.

Dunnage shall be non-staining.

The Contractor shall be responsible for the design and provision of lifting eyes. Lifting eyes shall be made good such that locations shall not be visible in the finished structure. Lifting eyes made from stainless steel shall have at least 10mm cover of cementitious mortar. Lifting eyes made from

7 Precast Concrete Construction

galvanised mild steel shall have the minimum covers of cementitious mortar equivalent to those covers specified for the reinforcement within the same element – as specified on the Drawings. Non-galvanised lifting eyes shall not be used.

Webs of beams shall be kept vertical with the top flange uppermost at all times.

7.14 Shop Drawings

The Design Engineer shall be supplied with two sets of shop and erection drawings for review prior to fabrication.

Shop drawings should include details of all reinforcing, section dimensions, surface finishes, cast in inserts, holes, penetrations and cover requirements. Lifting lugs etc that are required for transportation and erection purposes shall also be indicated on shop drawings.

Discrepancies between the interpretation of the design concept, as presented in these drawings, and the requirements of the Design Engineer shall be noted by the review and shall be resolved prior to fabrication commencing.

Fabrication and Erection of Structural Steelwork

8.1 General

Scope and Use

This Specification covers the fabrication and erection of structural steel for buildings and the welding of headed shear studs onto the building structural steelwork.

This Specification forms part of the Contract Documents.

Other Documents

Read this Specification in conjunction with the other Contract Documents.

New Zealand Building Code

Refer to the following New Zealand Building Code clauses and approved document paragraphs for the criteria and/or methods that must be used to establish compliance with the Code.

B1/VM1	Structure -	General 2.0 Loadings 5.0 Steel
F5	Construction and demolition hazards	

Definitions

The Contractor is the Person with overall responsibility for construction of the building, so named in the Contract Documents and as defined by NZS 3910.

The Engineer is the Engineer to the contract as defined by NZS 3910.

The Principal is as defined by NZS 3910.

Person is as defined by NZS 3910.

The Contract Documents and Drawings are as defined by NZS 3910.

Related Documents

Documents which relate to this Specification are:

AS/NZS 1111	ISO metric hexagon commercial bolts and screws
AS/NZS 1112	ISO metric hexagon nuts, including thin nuts, slotted nuts and castle nuts
AS 1214	Hot-dip galvanised coatings on threaded fasteners (ISO metric coarse thread series)
AS/NZS 1252	High strength steel bolts with associated nuts and washers for structural engineering
AS 1397	Steel sheet and strip – Hot-dipped, zinc-coated or aluminium/zinc-coated
AS/NZS 1554.1	Structural steel welding Part 1: Welding of steel structures
AS 1554.2	Structural steel welding Part 2: Stud welding (steel studs to steel)
AS/NZS 1554.5	Structural steel welding Part 5: Welding of steel structures subject to high levels of fatigue loading
AS 1627	Metal finishing - Preparation and pre-treatment of surfaces – Parts 0-9
AS 1897	Electroplated coatings on threaded components (metric coarse series)
AS/NZS 2312	Guide to the protection of iron and steel against exterior atmospheric corrosion
NZS 3404	Steel structures standard

8 Fabrication and Erection of Structural Steelwork

	Part 1: steel structures standard
	Part 2: commentary
AS 3750.9	Organic zinc rich primers
AS 3894. 3	Site testing of protective coatings
	Part 3: determination of dry film thickness
NZS 3910	Conditions of contract for building and civil engineering construction
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
NZS 4711	Qualification tests for metal-arc welders
AS/NZS 9002	Quality systems - Model for quality assurance in production, installation and servicing
AS/NZS HB62	Safe erection of steelwork
BS 8202.1	Coatings for fire protection of building elements Part 1: code of practice for the selection and installation of sprayed mineral coatings
BS 8202.2	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
ISO 2063	Metallic and other inorganic coatings: thermal spraying: zinc, aluminium and their alloys
WTIA	Flame cutting of steels, WTIA Technical Note No. 5
WTIA	Health and safety in welding, WTIA Technical Note No.7
IPENZ/ACENZ	The briefing and engagement of consultants

Documents listed above and cited in the clauses that follow are deemed to form part of this Specification. However, this Specification takes precedence when it is at variance with the cited document.

Documents listed above refer to their latest issue complete with amendments that are current at the time of preparing the Contract Documents.

The above documents are available for viewing, by arrangement, at URS New Zealand office, or at the Hera Information Centre.

Acts which relate to this Specification are:

Building Act 2004

Health and Safety in Employment Act 1992

Dangerous Goods Regulations, Flammable Liquids 1985

Acts listed above include any amendments that are current at the time of preparing the Contract Documents.

Existing Structures

When matching new steelwork to existing structures and where shown on the drawings, the Contractor shall verify specified dimensions against site measurements, prior to fabrication and report discrepancies to the Engineer.

When carrying out cutting or welding operations on existing structures, appropriate precautions shall be taken to minimise the risk of fire.

Appropriate precautions to be taken, when red-hot or molten metal could contact combustible material, shall comprise:

8 Fabrication and Erection of Structural Steelwork

- i) One hand held fully charged fire extinguisher or operational fire hose to be immediately accessible at all times, and
- ii) All non-essential combustible materials, dust etc. to be cleared away before welding or cutting takes place.

Contract Programme

Progress this work in accordance with the Contract Documents.

Shop and Erection Drawings

The Contractor shall supply the Engineer with two sets of shop and erection drawings for review prior to fabrication. Allow ten working days for review.

Discrepancies between the interpretation of the design concept and the Contract Documents, as presented in these drawings, and the requirements of the Design Engineer shall be noted by the reviewer and shall be resolved prior to fabrication commencing.

Health and Safety

All work covered by this Specification must be undertaken in accordance with the requirements of the Health and Safety in Employment Act (see section 6.1.4 herein) and the Contractor's health and safety workplan.

Any party undertaking work, in accordance with this Specification, which introduces hazards on site shall comply with the following.

Prior to commencing work, any party bringing hazards onto the site shall inform the Contractor of:

- the nature of these hazards
- the measures that have been put in place to minimise these hazards
- the procedures that have been put in place for dealing with emergencies

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.

8.2 Standards of Performance

General

All work shall be performed in accordance with this Specification, the related documents to this Specification and the qualifying requirements of the Contract Documents.

Construction Review

All stages of fabrication and erection shall be reviewed in accordance with NZS 3404 Clause 1.6.3.

The extent of review shall be nominated by the Engineer, taking into account the factors identified in NZS 3404 Part 2 Commentary Clause C1.6.3. These requirements shall form part of the Contract Documents.

8 Fabrication and Erection of Structural Steelwork

The extent of inspection of each component of construction shall be determined in accordance with section 6.6 of this Specification.

The Contractor shall provide one copy of weld procedure sheets to the Engineer for review prior to fabrication.

The Contractor's Quality Plan this must incorporate the requirements of the above clauses of this Specification.

Materials

Certification shall be provided to the Engineer for steels in accordance with NZS 3404 Clause 2.2.2 and for fasteners and welding consumables in accordance with NZS 3404 Section 2.

Fasteners

Bolts, nuts and washers shall comply with, and be installed to, the requirements of NZS 3404 Sections 2 and 15.

Tolerances

Tolerances for holding down bolts, columns, beams and other members shall comply with Section 15 of NZS 3404 Part 1.

The Contractor shall be responsible for placement of holding down bolts and other structural components cast into the concrete.

8.3 Supply of Materials

Structural Steel

Structural steel shall comply with NZS 3404 Clause 2.2.1.

Welding Consumables

Welding consumables shall comply with AS/NZS 1554.1 and NZS 3404 Clause 2.6.4.5.

Steel Shear Studs

Steel shear studs shall comply with AS 1554.2.

Bolts, Nuts and Washers

Bolts, nuts and washers shall comply with the standards listed in NZS 3404 Clauses 2.3.1 or 2.3.2.

Bolts, nuts and washers forming a permanent part of an exterior structure subject to a protective coating shall be galvanised. Property class 4.6 or 8.8 bolts, nuts and washers shall be galvanised to AS 1214.

Protective Coatings

Only surfacing materials from a recognised approved manufacturer shall be used. The Contractor shall obtain from the manufacturer a written statement that the material to be used complies with the

8 Fabrication and Erection of Structural Steelwork

Specification and that all coats are compatible and are suitable for the purpose for which they are intended. All materials shall be stored, handled, prepared and applied in strict accordance with the manufacturer's printed instructions, a copy of which shall be furnished to the Engineer.

All paints, coating materials, thinners etc shall be delivered to site in the manufacturer's original sealed containers with labels intact and seals unbroken. They shall be stored in a well ventilated, weather protected area specifically assigned for this purpose. The storage area shall be kept clean and tidy at all times.

The Contractor shall supply, operate and maintain in good working order such gauges and equipment as are required to ensure the correct thicknesses of each coat and of the full paint system.

All paint stock, tools, plant, instruments and thickness gauges, staging, or any other material or equipment used or to be used in the performance of the coating application, shall be subject to inspection by the Engineer or his Representative.

Paint, tools, instruments, materials and equipment, not conforming to this Specification and to the painting and coating system applicable to the project shall be liable to rejection.

All such rejected paint and equipment shall be replaced or rectified by the Contractor at no additional cost to the Principal.

All warning notices and storage recommendations shown on the coating manufacturer's labels shall be strictly observed. Manufacturer's data sheets and paint system specifications shall be available on site for inspection by the Engineer.

The time specified for induction prior to application, and maximum pot life of catalysed materials shall be complied with. When the pot life is reached, the spray pot shall be emptied, the equipment cleaned and new material catalysed.

Paint or coating materials which have exceeded their marked shelf life, or have livered, gelled or otherwise deteriorated shall not be used.

8.4 Fabrication

Workmanship

Fabrication procedures shall comply with NZS 3404 Clause 14.3.

Rejection of a Fabricated Item

This shall be considered in accordance with NZS 3404 Clause 14.1.1.

Surface Finish

Surface finishes of as-supplied steel shall comply with the appropriate material standard specified in NZS 3404 Clause 2.2.1.

Surface finishes of cut edges shall comply with NZS 3404 Clause 14.3.3.4 for "normal" applications unless specified otherwise.

Rust grade on as-supplied steel shall not exceed Grade "C" to AS 1627 Part 9.

Weld spatter shall be removed from all surfaces to receive protective coatings.

8 Fabrication and Erection of Structural Steelwork

Sharp edges and corners of members to receive coating system Nos. S3 and S4 shall be rounded.

Identification

Throughout the fabrication, the grade of steel shall be identified in accordance with NZS 3404 Clause 14.2.2.

Tolerances

Tolerances for fabricated steelwork shall comply with NZS 3404 Clause 14.4.

Architecturally exposed structural steelwork (AESS) may need more stringent controls on cross section tolerances than those specified in NZS 3404 Clause 14.4.3. Particular members requiring this shall be identified in the Contract Documents as AESS members, along with the tolerances required for these members.

Lifting slings or cradles for lifting AESS members shall be constructed so as to minimise damage to the steel surface and to any surface coating applied prior to erection.

Cutting

Cutting shall comply with NZS 3404 Clause 14.3.3.

Welding of Structural Steel

Welding shall comply with the standards listed in NZS 3404 Clause 14.3.4.

For the welding of structural steel, welding personnel shall be qualified in accordance with Clause 4.11 of AS/NZS 1554.1 or AS/NZS 1554.5, as appropriate. Details of qualifications shall be submitted to the Engineer, prior to commencement of welding on that project by that person.

Butt welds shall be ground flush without loss of parent metal.

Welding of Steel Shear Studs to Steel

For the welding of steel shear studs to steel, welding personnel shall be qualified in accordance with Clause 4.1 of AS 1554.2.

For the welding of steel shear studs to steel, the Contractor shall provide a producer statement to the Engineer that the procedural control procedures of Clauses 4.1 and 4.2 of AS 1554.2 have been complied with.

The steel surface onto which shear studs are to be welded shall be free of paint, oil, loose or thick scale, slag, dirt and, where necessary, moisture.

After the welding of steel studs to steel, the Contractor shall remove the arc shields from the base of the studs and leave the surface to which the studs have been welded clean and tidy.

Holing

The formation of holes for bolted construction shall comply with NZS 3404 Clause 14.3.5.

8 Fabrication and Erection of Structural Steelwork

Bolting

Bolting procedures shall comply with NZS 3404 Clauses 15.2.4 and 15.2.5.

Notation of bolting categories

Bolting Category	Bolt Standard	Bolt Property Class	Tension Method	Tensioned 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

In bearing type connections, where the thread position relative to the shear plane is to be controlled:

N = threads included in shear plane (this applies unless noted otherwise)

X = thread excluded from the shear plane

Crane Rails

The following details shall be given on the Drawings or in the Contract Documents:

- i) The material and section profile
- ii) The resilient seating to be used between the crane rail and the crane runway girder
- iii) The fastening system to be used between the crane rail and the crane runway girder
- iv) The method of joining individual lengths of crane rail.

Length of individual crane rails shall be not less than 3 metres

Tolerances for crane rails shall be as follows:

- i) Horizontal distance apart of crane rails across the building shall be accurate to within 3 mm of the specified distance.
- ii) Difference in elevation between crane rails across the building shall not exceed 5 mm.
- iii) Difference in plan and elevation at joints between adjacent crane rails shall not exceed 0.5 mm.
- iv) All points along each crane rail shall be within 3 mm of their specified location in plan and elevation.

On completion of the crane rail erection, the Contractor shall supply the Engineer with a plot showing the actual position, to within 0.5mm, of each crane rail, throughout its length, with respect to its theoretical position.

8.5 Erection

Workmanship

Erection practices and procedures shall comply with SAA/SNZ HB 62 and with NZS 3404 Clause 15.2.

8 Fabrication and Erection of Structural Steelwork

Rejection of an Erected Item

This shall be considered in accordance with NZS 3404 Clause 15.1.1.

Starting Time

Start erection when approval is given by the Contractor or by the Engineer, whoever has the appropriate authority.

Delivery, Storage and Handling

These shall comply with NZS 3404 Clause 15.2.2.

Assembly and Alignment

Assembly and alignment shall comply with NZS 3404 Clause 15.2.3.

Tolerances

Tolerances for erected steelwork shall comply with NZS 3404 Clause 15.3.

Baseplates and Holding Down Bolts

Enlargement or other site rectification of holes in baseplates is not permitted, without the approval of the Engineer.

Holding down bolts and other structural components to be cast into concrete shall be checked for correct location by a surveyor prior to concrete placement. Components shall be secured to prevent their movement during concrete placement.

Drilled-in holding down bolts shall not be substituted for cast-in holding down bolts without the approval of the Engineer.

Bending or displacement of holding down bolts is not permitted.

Grouting at Supports

Grouting at supports shall be in accordance with NZS 3404 Clause 15.5.

Grouting at supports shall be undertaken by the Contractor.

The grout used shall be a cement-sand grout, containing an approved non-shrink additive, and having a minimum compressive strength of 35MPa at 28 days, or alternatively shall comprise a dry pack of 1:2 cement : sand mortar, hammered in tight to ensure the complete filling of space beneath the steelwork.

Tamping dry pack mortars underneath baseplates shall be by means of wooden tampers. All drypacked bases shall be finished to give a dense mortar surface of 45° slope from baseplate edge unless otherwise directed.

All exposed surfaces shall be cured for 7 days by covering surfaces with damp hessian or application of an approved curing membrane.

Beach sand shall not be used in the grout or mortar specified above.

8 Fabrication and Erection of Structural Steelwork

8.6 Inspection of Completed Work

Weld Inspection

The extent of independent NDE weld inspection shall be as specified in accordance with Appendix D of NZS 3404, except that:

Weld category	Extent of NDE, %			
	Visual means (see Note 3)		Other means	
	Visual scanning (see clause 7.3 of AS/NZS 1554.1)	Visual examination to table 6.2 of AS/NZS 1554.1 (See Note 4)	Magnetic particle or liquid penetrant (See Notes 7 and 8)	Radiography or ultrasonics to table 6.3 of AS/NZS 1554.1 (See Notes 5 and 6)
GP	100	25	0 to 10	Nil
SP	100	25 to 100	0 to 10	0 to 15
Extra	N/A	25 to 100	10	0 to 15

Notes refer to table in NZS 3404, Appendix D.

Additional inspection shall be required if weld defects are found during inspection. The frequency of these shall be in accordance with the values listed as “extra” in the above table. Costs for these tests shall be borne by the Contractor.

Repair of defective welds shall be in accordance with Clause 5.8 of AS/NZS 1554.1 or AS/NZS 1554.5.

Inspection of Bolted Connections

Independent inspection of bolted connections shall be undertaken by the Engineer.

Inspection shall be to Clause 15.4.1 of NZS 3404, with the extent of inspection of a given sample of joints determined in accordance with Clause C15.4 of NZS 3404.2 and the frequency of inspection (i.e. the number and frequency of visits to site) determined by Clause 6.6.3 below.

Inspection of Fabricated and Erected Steelwork

Independent inspection of fabricated and erected steelwork shall be undertaken by the Engineer.

The extent of independent inspection of fabricated and erected steelwork shall be determined in accordance with Clause C1.6.3 of NZS 3404.2.

Shear Stud Welding Inspection

Shear studs shall be inspected in accordance with Clause 6.1 of AS 1554.2 and studs which fail this test shall be replaced.

In addition, at locations specified prior to commencement of construction, further studs shall be inspected by one of the following means:

1. Either 1% of the studs shall be subject to the 15° bend test specified in AS 1554.2 Clause 6.1,
or

8 Fabrication and Erection of Structural Steelwork

2. 50% of the studs shall be ring tested in accordance with the provisions of the HERA Steel Design and Construction Bulletin (HERA DCB) Issue No. 44.

Defective studs from above shall be replaced and further studs tested, until the number of studs tested satisfactorily equals the number involved in 1 or 2 above.

This testing shall be carried out by the Contractor and the results reported to the Engineer.

This testing will typically be undertaken by the construction reviewer or by an independent inspector.

Steel Handrails and Other Minor Steelwork

9.1 General

This section of the Specification covers the requirements for the supply, fabrication and erection of handrails and other minor steelwork in this Contract.

Work shall comply with the relevant requirements of NZS 3404 “Steel Structures Standards” and AS/NZS 2312 “Guide to the protection of iron and steel against exterior atmospheric corrosion” together with the further provisions herein.

9.2 Verification of Dimensions

Where the new steelwork is being placed onto or connecting with an existing structure, the Contractor shall check and verify all dimensions and levels on site before commencing fabrication of new structural steel. Any discrepancy so found between the Drawings and the site dimension shall be referred immediately to the Engineer who shall direct any amendments as necessary.

Handrails shall follow the vertical gradient of the bridge at the height nominated on the drawings.

Handrails post shall be vertical, similarly light poles shall be installed truly vertical.

Balustrade infills shall have upright members vertical and all other members parallel with the gradient of the bridge.

9.3 Materials

Steel shall comply with section 2 of NZS 3404. The steel shall be of first quality free from laminating or any other defects which affect its structural soundness. It shall be clean and free from dirt, or other deleterious substances. Pitted or heavily rusted steel will not be accepted. It shall not exceed Rust Grade A or B as defined in AS 1627, Part 9. The steel shall be free of dents, twists, kinks or any other defects which in the opinion of the Engineer, affect its structural soundness or appearance. All members shall be of a single length unless shown to the contrary on the Drawings or approved by the Engineer.

Steel to be galvanised shall be suitable for that purpose, and in particular, the silicon content of steel to be galvanised shall be advised to the galvaniser so that the galvanising process can be suitably modified.

Unless noted otherwise on the Drawings, rolled steel sections and steel plate shall comply with BS EN 10025 Grade 430A, and hollow sections shall comply with AS 1163 Grade G250.

Cold rolled steel purlins shall comply with AS/NZS 4600 and shall be galvanised cee sections manufactured by an approved fabricator. Square holes shall be punched for standard end connections using M12 coach bolts.

9.4 Fabrication

The maximum amount of work shall be carried out in a properly equipped shop under the supervision of a competent Shop Foreman, experienced in the type of work. Marking out, and cutting shall be carefully done and shall be checked by a competent Foreman. Members before welding shall be straight and true to shape, without bends, twists or indentations. During erection, members shall fit

9 Steel Handrails and Other Minor Steelwork

together in their proper position with ease. No straining of members in order to bring them into proper position will be allowed.

Cutting shall be carried out by flame cutting or sawing. Shearing will only be permitted if the Contractor can demonstrate that his equipment will produce a consistently clean undistorted edge.

All exposed sharp edges or corners shall be lightly ground after fabrication to ensure that galvanising and/or paint will adhere to these edges. Building up poor cutting with weld metal will not be permitted.

All open ended hollow sections exposed to the weather shall be capped with 3mm plate and seal welded, unless specifically denoted otherwise.

The dimensions given in the Drawings and the tolerances given in this section are those applying when the work is at a temperature of 150C. Allowance shall be made for thermal effects when cutting materials or checking dimensions at other temperatures.

Unless noted otherwise in the Drawings, the minimum dimensional accuracy required on structural members shall be as specified in NZS 3404.

9.5 Welding

All welding and welding procedures shall comply with the requirements of AS/NZS 1554.1 and the additional requirements of this Specification. Unless specifically shown on the Drawings, all welds are category GP.

The Engineer will arrange for inspection by experienced personnel both before material leaves the fabrication shop and on site.

9.6 Bolting

Bolted joints shall use either snug-tight bolts or high-strength bolts with a specified pretension as shown on the Drawings. Where the type is not designated bolts shall be assumed to be snug-tight, Class 4.6.

All bolts, coach bolts, nuts, locknuts and washers shall be hot dip galvanised. All holding down bolts cast into concrete shall be hot dip galvanised.

Where sliding joints are detailed on the drawings the nut shall be secured finger tight against the steel work and the locknut shall be secured snug tight against the nut.

The length of bolts, coach bolts or holding down bolts shall be chosen by the Contractor so that at least one thread projects from the nut but no more than five.

9.7 Coating Systems

The coating systems to be applied to each member are shown in the Drawings and shall be applied in accordance with the Specification. The Contractor may submit for the Engineer's approval a written proposal for an alternative coating system but no such alternative shall be applied without the written approval of the Engineer. Any work carried out with an unauthorised system or using materials from an unauthorised manufacturer shall be deemed to be work not complying with this Specification and shall be liable to rejection.

9 Steel Handrails and Other Minor Steelwork

Any conflict between this Specification and the recommendations of the Manufacturer shall be referred to the Engineer for a decision.

Paint colours will be advised by the Engineer but each coat in a multi-coat system shall be different in tint.

Surface Preparation

All surfaces to be coated shall be clean, dry and free from dust, oil and grease. Cleaning shall be as required for the coating system specified herein and in accordance with the following details.

Blast Cleaning

Where blast cleaning is specified in the schedule of coating systems it shall be carried out in accordance with AS 1627 Part 4 and this Specification. All oil and grease shall be removed with solvent cleaning prior to blasting in accordance with previous section of this Specification.

Power Tool Cleaning

Where power tool cleaning is specified in the schedule of coating systems, it shall be carried out in accordance with AS 1627 Part 2 and this Specification.

Solvent Cleaning

Where solvent cleaning is specified in the schedule of coating systems, it shall be carried out in accordance with AS 1627 Part 1 and this Specification.

All surfaces to be painted which do not require blasting or power tool cleaning shall be solvent cleaned.

Paint Coating Application

General

Surfaces to be painted shall be clean, dry and free from dust, oil or grease. Applications shall conform to NZS 7703 and the further provisions herein.

The dry film thickness of the coating will be tested by the Engineer using a magnetic dry film thickness gauge in accordance with AS 1580, Method 108.1.

The coating dry film thickness as specified in the Schedule of Coating systems are nominal values. No single measurement shall be more than 10% below the specified thickness and not more than 15% of the measurements shall be below the specified nominal thickness.

The Contractor shall supply, operate and maintain in good working order such gauges and equipment as are required to ensure the correct thicknesses of each coat and of the full paint system.

All paint stock, tools, plant, instruments and thickness gauges, staging, or any other material or equipment used or to be used in the performance of the coating application, shall be subject to inspection by the Engineer or his Representative.

Paint, tools, instruments, materials and equipment, not conforming to this specification and to the painting and coating system applicable to the project shall be liable to rejection.

All such rejected paint and equipment shall be replaced or rectified by the Contractor at no additional cost to the Principal.

9 Steel Handrails and Other Minor Steelwork

All warning notices and storage recommendations shown on the coating manufacturer's labels shall be strictly observed. Manufacturer's data sheet and paint system specifications shall be available on site for inspection by the Engineer.

The time specified for induction prior to application, and maximum pot life of catalysed materials shall be complied with. When the pot life is reached, the spray pot shall be emptied, the equipment cleaned and new material catalysed.

Paint or coating materials which have exceeded their marked shelf life, or have liveried, gelled or otherwise deteriorated shall not be used.

Paint shall be applied by a skilled applicator consistently achieving a high standard of workmanship. The applicator shall be thoroughly conversant with the application of the type of paint specified. Any technical problems concerning application of the paint shall be reported immediately to the Engineer and further application of the paint suspended.

Paint shall be applied evenly to produce a uniform coating to the dry film thickness specified.

Painting shall be suspended if any of the following conditions occur:

- a) The surface temperature is below 13°C or exceeds 32°C.
- b) The surface temperature drops to less than 3°C above the ambient dew point.
- c) The relative humidity exceeds 90%.
- d) Inclement weather such as rain, snow, fog, mist or dust.
- e) Excessively high winds.

The completed paint system or coating shall be of uniform thickness, free of runs, sags, pinholes and bubbles, mudcracking, dry overspray, grit inclusion etc. All such imperfections shall be removed or made good to the satisfaction of the Engineer.

The preferred method of application for high-build coatings is by airless spray. The use of conventional air spray is also acceptable, but care must be taken to ensure that the correct air and fluid pressures, and adequate fluid flow are maintained to give correct application. Brush application shall be used only on those areas which cannot be spray coated due to difficult access or complex shape.

9.8 Galvanising

General

Members shown on the Drawings as being galvanised shall be pre-cleaned in accordance with previous section of this Specification.

The fabricator shall allow for any additional work required to suit the galvanising process, e.g. Provision of drain holes in sealed hollow sections to the approval of the Engineer, and allowance for coating thickness in tightly toleranced situations.

Drain holes shall be located in positions where they can be sealed in the final structure.

Application

The galvanising shall conform to AS/NZS 4680.

9 Steel Handrails and Other Minor Steelwork

The thickness of the galvanised coating shall be at least 600 gm/m² and at least 84 micrometers thick as measured by a magnetic measuring device. For light gauge handrails and RHS posts this will require blast cleaning of the steel surface to ensure good adherence.

Light, W section guard-rails shall have a galvanised coating of at least 400 gm/m² and at least 56 micrometers thick as measured by a magnetic measuring device.

Metal spray galvanising may be accepted as a substitute for hot dip galvanising at the discretion of the Engineer and only after submission by the Contractor of an acceptable procedure.

The galvanised coating shall be continuous, adherent, as smooth as possible and free from any defect detrimental to the end use of the article.

Members with galvanised surfaces that will subsequently be painted shall be air dried. All other members shall be quenched and chromate passivated in the usual manner.

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

9.9 Erection

General

Unless shown to the contrary on the Drawings, or unless prior approval to the contrary is given by the Engineer it is the Contractor's responsibility to ensure that all members after erection and after the application of all dead loads are level, plumb and straight.

Steelwork stacked on site prior to erection shall be adequately covered with polythene or other protective sheeting to keep the steel dry. This protection shall be provided whether the steel is painted or unpainted. The steel shall be stacked clear of the ground and shall be covered as soon as it is delivered to the site and shall remain covered until it is erected.

All penetrations in hollow sections shall be permanently and effectively air sealed to minimise internal corrosion.

9.10 Dry-Pack Mortar

Dry-pack mortar shall consist of dry sand and ordinary Portland cement in the ratio 2:1 by weight. The mortar shall be mixed dry initially and sufficient water added to produce a consistency tending to be crumbly after thorough and uniform mixing. The consistency shall be such that when compressed in the hand the mortar binds firmly together without exuding moisture.

Tamping dry pack mortar underneath baseplates shall be by means of wooden tampers.

All dry-packed bases shall be finished to give a dense mortar surface of 45° slope from baseplate bottom edge unless otherwise directed. All exposed surfaces shall be cured for 7 days by covering surfaces with damp hessian or application of an approved curing membrane.

An approved pre-packaged dry pack mix such as Sika Grout 212 may be used instead of mortar.

All surfaces to be dry-packed shall be clean, with all laitance, grease, oil dirt removed prior to dry-packing. Water for surface soaking, mixing and curing shall be potable quality.

9 Steel Handrails and Other Minor Steelwork

Concrete surfaces on which dry pack is to be placed shall be thoroughly soaked with water for 2 hours prior to grouting. Immediately prior to grouting the water shall be removed leaving a damp film.

Protective Coatings

10.1 General

This Section of the Specification covers the preparation for and the supply and application of protective coatings in this Contract.

10.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

AS/NZS 2312	Guide to the Protection of Structural Steel Against Atmospheric Corrosion by the use of Protective Coatings
AS 1580	Methods of Test for Paints and Related Materials
AS 1627	Preparation and Pre-treatment of Metal Surfaces Prior to Protective Coatings
AS/NZS 2311	Guide to the Painting of Buildings
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

10.3 Accreditation and Conformation

Work not conforming to this Specification shall be re-applied to the satisfaction of the Engineer and the cost of such re-work shall be borne by the Contractor.

10.4 Materials

Only surfacing materials from a recognised approved manufacturer shall be used. The Contractor shall obtain from the manufacturer a written statement that the material to be used complies with the Specification and that all coats are compatible and are suitable for the purpose for which they are intended. All materials shall be stored, handled, prepared and applied in strict accordance with the manufacturer's printed instructions, a copy of which shall be available on site for inspection by the Engineer.

All warning notices and storage recommendations shown on the coating manufacturer's labels shall be strictly observed. All paints, coating materials, thinners etc shall be delivered to site in the manufacturer's original sealed containers with labels intact and seals unbroken. The Contractor shall supply, operate and maintain in good working order such gauges and equipment as are required to ensure the correct thicknesses of each coat and of the full paint system.

10.5 Surface Preparation of Steelwork

All surfaces to be coated shall be clean, dry and free from dust, oil and grease. Cleaning shall be as required by the manufacturer for the coating system specified herein and in accordance with the following details.

The extent of steelwork surface preparation for the protective coating selected shall be determined in accordance with AS/NZS 2312 Section 5 and shall follow the requirements of the relevant standard or standards listed therein. The written specifications of the paint manufacturer shall also be complied with.

10 Protective Coatings

No area of prepared steel shall be coated before approval of the preparation has been given by the Engineer.

Solvent Cleaning

Where solvent cleaning is specified in the schedule of coating systems, it shall be carried out in accordance with AS 1627 Part 1 and this Specification.

All surfaces to be painted which do not require blasting or power tool cleaning shall be solvent cleaned.

Alternatively, the use of aqueous alkaline detergent cleaners with high pressure water or scrubbing equipment may be used in accordance with Section 5.3 of AS/NZS 2312. This is the preferred method for large areas of cleaning.

Blast Cleaning

Where blast cleaning is specified in the schedule of coating systems it shall be carried out in accordance with AS 1627 Part 4 and this Specification. Abrasive shall be selected to achieve the minimum and maximum profile height requirements of the paint manufacturer. All oil and grease shall be removed with solvent cleaning prior to blasting in accordance with Clause 7.5.1 of this Specification.

Power Tool Cleaning

Where power tool cleaning is specified in the schedule of coating systems it shall be carried out in accordance with AS 1627 Part 2 and this Specification.

10.6 Painting Steelwork

For specification of the painting systems, refer to the Architect's specification.

10.7 Galvanising and Metal Spray

General

Members shown on the Drawings as being galvanised shall be pre-cleaned in accordance with Section 7.5 of this Specification.

The fabricator shall allow for any additional work required to suit the galvanising process, eg. provision of drain holes in sealed hollow sections to the approval of the Engineer, and allowance for coating thickness in tightly toleranced situations.

Application

Galvanising process shall be in accordance with Clause 5.3 of AS/NZS 2312 and AS/NZS 4680.

The thickness of the galvanised coating shall be at least 600gm/m² and at least 85 micrometres thick as measured by a magnetic measuring device.

The galvanised coating shall be continuous, adherent, as smooth as possible and free from any defect detrimental to the stated end use of the article.

10 Protective Coatings

Post-Treatment

Contact surfaces of high strength bolted joints shall be mechanically treated as directed by the Engineer to ensure the slip factor assumed in the design.

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

For post treatment of the galvanised structural steel which receives painting coat in addition to the galvanising, two options may be applied:

Option A:

Typical Uses	Surface Preparation	Primer	Intermediate	Finish
Galvanised steel – colour finish	Degrease as per AS1627.1. Abrade or sweep blast to roughen surface.	As per Architect's specification		As per Architect's specification

Option B:

Do not perform quenching in water with sodium dichromate after galvanising. Sweep blast with non-metallic abrasive (ilmenite or fine garnet) under reduced blasting pressure- Refer AS/NZS 4680.

Bored Cast-In-Situ Piles

11.1 Scope

This section of the Specification covers the supply of materials for and the construction of piles socketed into rock and designed to carry the pile loads by a combination of side shear on the walls of the socket and end bearing on the base of the socket.

11.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

NZS	3404	Steel Structures Standard
AS/NZS	1554.1	Structural Steel Welding
BS EN	10025	Hot Rolled Products of Non-alloy Structural Steel

11.3 Subsoil Conditions

Site Investigation Information

Any borelogs or other site investigation information shown on the Drawings or included herein is provided only for the information of the Contractor. No warranty as to the correctness or completeness of the information is given and it shall be the responsibility of the Contractor to interpret the information or carry out further investigations for his own purposes.

Unsuitable Strata

In the event of unsuitable strata being encountered during boring operations, further investigation of the underlying strata by means of core borings may be required at the direction of the Engineer.

11.4 Materials

Steel Casing

a) Quality

Steel for casing shall be mild steel to BS EN 10025, Grade Fe 430.

b) Thickness

Where a minimum thickness is indicated on the Drawings or elsewhere this shall be considered as the minimum requirement for contribution to the permanent strength of the pile. Notwithstanding any minimum thickness so specified the Contractor shall in any case provide casing with sufficient thickness to provide stability under all loads during construction including ground pressure, water pressure and forces imposed as a result of the Contractor's installation method.

c) Forming

The casings shall be manufactured from plates rolled to circular shape or spirally wrapped and welded and shall be brought to the site with all shop welds completed.

11 Bored Cast-In-Situ Piles

d) Welding

All welding shall conform with the requirements of AS/NZ 1554.1. The manufacturing shall be of sufficient accuracy to ensure that units may be welded together on the site without excessive tomming and propping. Adjacent sections of shells to be welded together shall mate within the tolerance necessary to produce an acceptable weld in terms of the welding specification.

If the casing is to be considered as contributing to the permanent strength of the cylinders. All joints including field joints shall be full strength butt welds.

If the casing is required only for support during construction of the cylinder the welds shall be sufficient to carry the construction loads.

Alternative Liners

In some circumstances alternative casings in concrete may be allowed but details of any proposed alternative system shall be included with the tender.

Concrete

All concrete used in the cylinders shall be Special Grade, in accordance with the Concrete Section. The minimum 28 day crushing strength shall be as shown on the Drawings. The slump shall be 100-130mm to ensure that the concrete will pass through the reinforcing cage and form the full diameter of the bore without excessive ramming or vibration.

Reinforcing

The reinforcing shall be supplied and fabricated in accordance with the Reinforcement Section.

The reinforcing for each pile shall be as detailed in the Drawings. The winding shall be securely fixed by tying at every crossing of the vertical rods, to form a rigid cage. The vertical rods shall not be lapped except where shown on the Drawings.

At the lower end of the cage a circular steel band 75mm wide by 3mm thick shall be fitted and welded to the vertical rods so that the cage does not drift whilst concrete is being placed and compacted. Mild steel spacer hoops and lifting hoops shall be provided to the reinforcing cage as necessary to enable the Contractor to comply with the requirements of this Specification with regard to assembly and placing of the cage. Except for the bottom band no welding to of the vertical reinforcing shall be permitted.

If welded hoops are used and the splices are made on the cage the longitudinal bars shall be shielded from weld splatter.

11.5 Boring

Location and Alignment

Piles shall be located in the positions indicated on the Drawings and shall be straight and of the required rake throughout their length. The maximum tolerance for the plan position of the pile head shall be 30mm. The rake shall not vary by more than 1 degree from the required value and variation

11 Bored Cast-In-Situ Piles

from straight alignment shall not exceed one part in three hundred of any part of the length of the cylinder.

Where piles are sleeved to provide a clear annular gap around an inner structural pile, any two mutually perpendicular measurements of the annular gap shall not vary by more than 40mm.

The Contractor shall make good at his own cost any piles that are outside the above tolerances to the satisfaction of the Engineer.

If piles that are out of position can be satisfactorily incorporated within the supported beam system by beam widening or the like then the mislocation may be accepted by the Engineer if so requested by the Contractor. In that event the Contractor shall be responsible for all additional costs incurred in or arising from the modifications to suit the piles including any engineering design necessary to verify structural adequacy.

Founding Depth

The foundation levels shown on the Drawings are based on information available at the time of preparation of the Drawings and shall be used for tender purposes. The actual depth of each foundation will be determined by the Engineer after evaluation of each pile excavation, and will depend upon the depth at which the Engineer determines that the design requirements for bearing and fixity have been met.

Where shown on the drawings testing at each pile location will be required to prove founding and lateral resistance.

Method of Construction

The Contractor shall be responsible for all measures and all expenses direct and indirect to construct piles to the satisfaction of the Engineer down to the required founding level with bases giving the specified bearing regardless of the materials or conditions encountered, including any or all of the following natural and artificial obstructions:

Ledge rock, rock or any form of cemented strata, boulders of any size, logs, loose sand, concrete blocks, flowing water, hot water, natural gas or any other obstruction whatsoever.

Before construction commences the Contractor shall provide for the Engineer's approval a method statement outlining the proposed method of construction together with details of plant to be used.

Casing

Where the piles are to be manually excavated, cleaned or inspected the casing must satisfy statutory safety requirements.

The casing shall be installed so as to support the soils outside the cylinder in an undisturbed state.

In soils where in the opinion of the Contractor over excavation is necessary to sink the casing and the soils are sufficiently stable to permit such over-excavation the voids between the casing and the original ground shall be filled by grouting or other approved means before the cylinder is concreted except where the casing is to be withdrawn.

The Contractor shall monitor the position of the bottom of the casing and the bottom of the excavation at all times.

11 Bored Cast-In-Situ Piles

A positive surcharge of water, above groundwater pressure shall be maintained inside the casing during excavation and before penetrating rock if required to prevent heave of the base.

If a "run-in" occurs the Contractor shall stop work and advise the Engineer who will advise the remedial action required which shall be carried out at the Contractor's expense.

Casings shall be sunk to a depth sufficient to exclude inflow of groundwater from strata above.

Cutting Ring

It will be the responsibility of the Contractor to ensure that each casing can penetrate any materials likely to be encountered during driving. To ensure that this can occur without buckling he shall securely fix to the low edge of the first section whatever reinforcement he may in his judgement consider necessary, within the limits of what is shown on the Drawings.

Any sharpening or hardfacing, mild steel or hardened steel ring which may be added shall be wholly at the expense of the Contractor.

Tolerances

The out-of round tolerance for casings, immediately prior to concreting shall nowhere exceed 25mm measured as the difference between any two mutually perpendicular diameters in the same plane at right angles to the longitudinal centre line of the shell.

Further, the average of any two diameters so measured shall not vary by more than 25mm from the average of any other two diameters so measured or from the diameter shown on the Drawings. The casings shall be cut off at the level specified with a tolerance of + 10mm.

Excavation and Cleaning of Rock Sockets

The minimum depth of the rock socket shall be shown on the drawings unless the written approval of the Engineer is given to a variation in depth.

Rock sockets may be excavated by hand or by any rotary or percussive drilling method that can penetrate the class of rock anticipated in the design to form sockets of the length required by the design. In addition, the method of excavation must be such that the socket base and sidewalls are free of debris and smeared material or can be brought to a satisfactory condition of cleanliness and roughness as further specified herein, and to the satisfaction of the Engineer. Sockets may be drilled in the dry or under water. Where the pile construction is intended to be carried out primarily by drilling methods, the Contractor shall either have on-site cleaning buckets and sidewall cleaning tools for the pile diameters being constructed or shall have all the necessary equipment to carry out cleaning by hand or other methods to the approval of the Engineer.

The rock socket sidewalls shall be free of soil and/or crushed rock to the extent that the natural rock is exposed over at least 80% of the socket sidewall. The sidewall roughness must have undulations greater than 5mm. To achieve this a grooving tool may need to be used.

The base of the socket shall be free of debris or slush so that the natural rock is exposed over the entire base area of the socket.

Where the use of cleaning tools fails to achieve the required sidewall cleanliness and base cleanliness, then alternative methods, such as hand cleaning, shall be required.

11 Bored Cast-In-Situ Piles

11.6 Inspections

Dewatering

All pile excavations shall be dewatered prior to inspection and concreting, provided however that where the Engineer directs that concrete shall be placed by tremie pipe or bottom dump bucket in accordance with other clauses of this specification dewatering prior to concreting will not be required.

Casing Inspection

The Contractor shall make available to the Engineer a suitable light capable of being lowered down inside the casing for the purpose of examining the casing. Where the casing is damaged, buckled, deformed, leaking or in any way unsatisfactory in the opinion of the Engineer, such casing may be rejected or remedial measures shall be taken as instructed by the Engineer.

Should it be necessary for any reasons for personnel to descend into the pile excavation (including inspection and repair, etc) the Contractor shall take adequate precautions as will be acceptable to the controlling authorities and to the Engineer to protect personnel and shall fully comply with the requirements of the Health and Safety in Employment Act 1992 relevant Regulations.

Socket Inspection

All rock sockets shall be inspected by an experienced geotechnical engineer or engineering geologist or other delegated representative of the Engineer who shall be satisfied that:

- i) the socket is founded wholly within the type and condition of rock required by the design.
- ii) the socket base is underlain by rock equivalent to or better than the class of rock in which the socket is located;
- iii) the dimensions of the socket are in accordance with the design;
- iv) the sidewall cleanliness and roughness and the base cleanliness are in accordance with other clauses of this specification.

The Contractor shall supply the inspecting officer with all logged details and any other information in his possession which is required for the inspection report.

11.7 Construction

Disposal of Bored Material and Surplus Water

All surplus water and material from the pile excavation shall be removed from the site as the work proceeds so that the site may be kept clean and dry. The Contractor shall supply all necessary plant, such as sludge pumps and transport for this purpose. The obtaining of any approvals required in this respect shall be the responsibility of the Contractor.

Placing Reinforcing

The cage shall be positioned accurately in the casing to the approval of the Engineer to ensure that the stipulated cover to the steel rods is maintained throughout.

11 Bored Cast-In-Situ Piles

The top of the cage shall be oriented so as to provide spaces between the pile reinforcing for the pile cap reinforcing.

The cage reinforcing shall extend sufficiently above the top of the pile concrete to provide anchorage as detailed on the Drawings.

Concreting

Piles shall be pumped dry before placing any concrete unless the Engineer directs that concrete may be poured by tremie pipe under water or approved bottom dump bucket or a concrete pump.

For piles with less than 50mm of water in the base, concrete shall be poured into the pile via a funnel such that concrete can drop to the pile base without impact on the reinforcing cage. The concrete need not be vibrated except for the top 1500mm of the cylinder.

Where groundwater inflow is such that more than 50mm of water will be present by the time of placing concrete, then concrete shall be poured using the tremie method. The tremie shall consist of a watertight tube closeable at the lower end by gate or ball. It shall be filled with concrete and lowered to the bottom before the gate is opened, after which it is to be operated so that the flow of concrete is uniform. A specially designed concrete mix having a slump of not less than 150mm shall be continuously poured through the tube which may be progressively withdrawn provided that the end of the tube shall remain below the concrete surface at all times. If the charge is lost then the tremie is to be withdrawn and the procedure recommenced.

Concrete vibration shall be in accordance with other specification clauses except in the case of tremie concrete, in which case vibration shall not be used unless directed otherwise by the Engineer.

If a bottom dump bucket is used it shall be of a type that will discharge the concrete symmetrically about its axis. It shall enable fresh concrete to be placed directly on top of the previously placed charge of concrete and in no instance must the concrete be allowed to fall freely. The top of the bucket shall be fitted with double overlapping canvas flaps, or other approved covers if depositing of concrete under water is approved.

No driving or belling shall be carried out adjacent to a pile which has just been concreted, for a period of at least 24 hours.

Concreting of the cylinder shall be carried out in one complete operation without construction joints unless the base is belled as described below. If during a pour a stoppage results from unforeseen circumstances and an initial set would occur before pouring could be continued, a construction joint shall be formed in such a manner as to provide a key as instructed by the Engineer between the portions of the pile poured separately.

Before fresh concrete is deposited against concrete which has already hardened, the surface of the hardened concrete shall be roughened and subsequently thoroughly cleaned of all loose matter and laitance and flushed out with clean water. While still wet the surface shall be covered with neat cement slurry or an approved proprietary bonding mix, after which concreting is to be continued without delay.

Piles shall be concreted within 24 hours of inspection and approval by the Engineer.

11 Bored Cast-In-Situ Piles

Concrete shall extend at least 250mm above pilecap soffit level unless agreed with the Engineer otherwise. After 14 days curing, the top concrete of the pile shall be broken off down to a level 50mm above pilecap soffit level, or such other levels as may be shown on the Drawings.

CIVIL SPECIFICATIONS

Table of Contents

1	Quality Assurance and Testwok	1
1.1	General.....	1
1.2	Quality Assurance Level.....	1
1.3	Contract Quality Plan	1
1.4	Samples	2
1.5	Quality Control Testing.....	2
1.6	Hold Points	2
2	Earthworks and Sediment Control	3
2.1	General.....	3
2.2	Scope of Works	3
2.3	Related Documents.....	3
2.4	Erosion and Sediment Control Plan.....	3
2.5	Materials.....	4
2.6	Construction	4
2.6.1	Cut to Waste	4
2.6.2	Cut to Fill – Salvage for Reuse	4
2.6.3	Fill	4
2.7	Testing and Acceptance	4
2.8	Inspections	4
2.8.1	Compaction Testing.....	5
2.8.2	Subgrade	5
2.9	General Requirements for Erosion and Sediment Control.....	5
2.10	Wheel Wash	6
3	Demolition	7
3.1	General.....	7
3.2	Related Documents.....	7
3.3	Tenderers to Inform Themselves	7
3.4	Permits	7
3.5	Procedure and Programme.....	7
3.6	Safety	8
3.6.1	General	8

3.6.2	Safety Supervisor.....	8
3.6.3	Fire.....	8
3.6.4	Explosives	8
3.6.5	Foundations	8
3.7	Nuisance	8
3.7.1	Dust and Mud	8
3.7.2	Noise.....	8
3.7.3	Traffic.....	9
3.7.4	Storage	9
3.8	Disconnection of Services.....	9
3.9	Disposal of Material.....	9
3.9.1	Material Ownership	9
3.9.2	Disposal.....	9
4	Foundation Excavation and Backfilling	11
4.1	General.....	11
4.2	Related Documents.....	11
4.3	Site Investigation Information	11
4.4	Excavation	11
4.4.1	Dimensions.....	11
4.4.2	Unsuitable Foundations.....	11
4.5	Classification of Materials	12
4.5.1	Rock Material.....	12
4.5.2	Type W Material.....	12
4.5.3	Type A Material.....	12
4.6	Disposal of Spoil	12
4.7	Existing Utilities	12
4.8	Dewatering.....	12
4.9	Support Excavation.....	13
4.10	Backfilling.....	13
4.10.1	Bearing Areas.....	13
5	Asphalt Concrete Works.....	15
5.1	General.....	15

5.2	Scope of Works	15
5.3	Related Documents	15
5.4	Materials	15
5.4.1	Tack Coat / Membrane Seal	15
5.4.2	Asphaltic Concrete	15
5.5	Construction	16
5.5.1	Membrane Seal	16
5.5.2	Stockpiling	16
5.5.3	Asphaltic Concrete	16
5.5.4	Weather Limitation	17
5.6	Testing and Acceptance	17
5.6.1	Adhesion Agent	17
5.6.2	Asphaltic Concrete	17
5.6.3	Acceptance/Rejection	17
5.6.4	Surface Shape	18
6	Stormwater and Drainage	19
6.1	General	19
6.2	Related Documents	19
6.3	Pipes	19
6.4	Materials	19
6.4.1	Concrete and Cement Grout	20
6.4.2	Water	20
6.4.3	Bedding Materials	20
6.4.4	Drainage Hardware	20
6.5	Pipe Laying	20
6.5.1	Excavation	20
6.5.2	Hand Excavation	21
6.5.3	Extra Excavation	21
6.5.4	Subsoil Drainage	22
6.5.5	Minimum Cover over Pipes	22
6.5.6	Pipe Bedding	22
6.5.7	Laying Practice	23

6.6	Construction	23
6.6.1	Manholes, Catchpit Manholes and Chambers	23
6.6.2	Catchpits	24
6.6.3	Subsoil Drains	24
6.7	Backfilling	24
6.8	As-built Details	25
7	Non-Structural Concrete.....	27
7.1	General.....	27
7.2	Related Documents.....	27
7.3	Construction	27
7.4	Tolerances, Inspections and Testing	27
7.5	Inspections	28
7.6	Testing	28
8	Traffic Sign and Tactile Indicators.....	29
8.1	General.....	29
8.2	Scope of Works	29
8.3	Related Documents.....	29
8.4	Tactile Indicators & Sign.....	29
8.5	Construction	29

Quality Assurance and Testwork

1.1 General

It shall be the responsibility of the Contractor to demonstrate to the Engineer that conformance with the specified requirements is achieved.

In accordance with Clause 6.4.4 of the General Conditions of Contract, works shall not be covered up before the relevant test results demonstrating compliance with the specification have been present to the Engineer. If the Contractor wishes to cover up unapproved work to facilitate the continuation of work without the provision of compliant test results, the written approval of the engineer must first be obtained. Should the test results subsequently indicate non-compliance with the specification, any costs and/or time delay associated with reconstruction and reinstatement of the relevant portion of the works will be borne by the Contractor.

If the Engineer believes that the test results presented by the Contractor are not representative of the whole section of work for which approval is being sought independent testing of the areas of work in question may be undertaken. In this case, the Engineer may grant partial approval of sections of work and those areas not approved shall be left uncovered until the Engineer arranges testing. This will normally take up to three working days. No claims for time extensions due to delays in approval will be considered unless this period is exceeded. Should these additional tests indicate non-compliance with the specification the costs may be deducted from payment due to the Contractor.

1.2 Quality Assurance Level

This Contract has been assessed as requiring a high quality assurance level as defined by a system meeting ISO quality standards complies.

1.3 Contract Quality Plan

The Contractor shall prepare a Contract Quality Plan and provide this to the Engineer within five Working Days of the Date of Acceptance of Tender. The Contract Quality Plan shall, as a minimum, meet the requirements of ISO 9002 and must contain sufficient detail to clearly demonstrate that the Contract Works will be constructed in accordance with the contract documents. The plan shall describe those aspects of the Contractor's quality system that will be adopted for the contract and shall address, as a minimum, the following:

- a) The quality requirements specific to the Contract Works
- b) How the Contractor will plan the work to satisfy those requirements
- c) How the Contractor will manage the Contract Works to comply with the plan
- d) How the Contract Works will be inspected and tested for compliance with the quality requirements
- e) How test results will be recorded as evidence of compliance with the quality requirements.

The Contract Quality Plan shall identify the quality assurance system that the Contractor proposes to use on the contract and shall address, as a minimum, the following:

- a) Management Structure – identifying personnel responsible for quality aspects of the contract;
- b) Materials – how Materials will be sourced and their quality controlled such that only those of specified quality are incorporated in the Contract Works;
- c) Subcontractors – how their work will be controlled to ensure compliance with the overall plan;
- d) Non-Conformance – how work and Materials that do not comply with the specified standard will be identified and dealt with;

1 Quality Assurance and Testwok

- e) Documents – how they will be controlled and records will be kept;
- f) Inspection and Testing Plan, including acceptance criteria and tolerances;
- g) Internal Auditing – systems to be used to verify compliance with Quality Plan;
- h) Preparation, submission , implementation and management of the programme

The Engineer will review the Contract Quality Plan and provide comment to the Contractor within 5 Working Days. Sections of the plan that relate to specific aspects of the works, e.g. sealing, may be submitted separately so that the overall plan, and those sections that relate to work which will be undertaken early in the contract, may be approved relatively quickly.

The Contractor shall re-submit the plan, incorporating the Engineer's comments, within 2 Working Days of receipt of the Engineer's review.

No work other than establishment, setting out and site preparation shall commence on Site until the Engineer has accepted the overall Contract Quality Plan and those sections of the plan that relate to the work the Contractor wishes to undertake.

1.4 Samples

Where other sections of this Specification require samples to be provided, the samples shall be submitted to the Engineer for approval sufficiently in advance of the Materials which the samples represent being required to be incorporated within, or used upon, the Contract Works, and prior to placing orders and/or purchasing. Samples shall be submitted with assurance of availability and date of supply that will not cause delays to the Contract Works. Samples approved by the Engineer will become the quality control standard and shall be retained with care on Site for comparison throughout the contract.

1.5 Quality Control Testing

The Contractor shall supply all materials, equipment and labour and perform all test work on Materials and workmanship as required by the various sections of the Specification.

All testing shall be undertaken by an IANZ registered laboratory supervised by personnel with IANZ signatory approval. The test results shall be on standard forms with IANZ marking, the original supplied to the Engineer and a copy retained by the Contractor. The Engineer reserves the right to arrange independent testing to measure compliance of any Materials or workmanship.

Testing frequencies shall be in accordance with the requirements set out in the relevant sections of this Specification.

1.6 Hold Points

Before proceeding with construction of certain items the Contractor shall complete the relevant quality documentation detailed under Preliminary and General Section of the Project Specifications. This documentation shall be signed off by the Contractor's on Site Quality Representative as approved before submission to the Engineer for acceptance.

Submission of the documentation is required at least two days before the scheduled commencement of an activity and, unless advised otherwise by the Engineer, work may start when scheduled.

Earthworks and Sediment Control

2.1 General

This section of the Specification sets out the requirements for earthworks and associated quality control testing.

All work shall be carried out in accordance with NZTA Specification F/1, except where amended by this specification, conditions of Outline Plan of Work (OPW) and Resource Consent, and Building Consent, Conditions of Designation and the requirements of the Auckland Regional Council Technical Publication No 90 (ARC TP90). Permanent works shall be constructed to the lines, levels and grades shown on the Drawings and as required by the Specification.

2.2 Scope of Works

This specification includes the following work and activities:

- a) Development of an Erosion and Sediment Control Plan
- b) Sediment and silt control prior to undertaking earth works including diversion of clear water;
- c) Excavation of all cuts, including excavations below platform level for platform foundation and trench excavation for ducting.
- d) Carting of excavation material to fill, or to waste;
- e) Construction of the fills and subgrade; shaping, trimming, grassing, and maintaining of the works; all in accordance with the Drawings and Specification;
- f) Supply of all materials, tools, plant, labour and supervision necessary for construction of the whole of the Works in accordance with the Project Specification and Drawings
- g) Inspection and maintenance of erosion and sediment control devices during construction;
- h) Emergency response planning.

2.3 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein.

This specification shall be read in conjunction with the following:

- TP90 ARC Guidelines for Erosion and Sediment Control
- Preliminary and General Specification (Section 1)
- NZTA F/1 – Earthworks Construction (latest edition)
- NZS 4402 - Methods of testing soils for civil engineering purposes (latest edition)
- NZTA F/4 - Fence Construction (latest edition)
- NZS 4431 - Code of Practice for Earth Fill for Residential Development
- Regional and Local Authority Resource Management Act requirements and conditions of resource consents
- Occupational Safety and Health Code of Practice for Excavation

2.4 Erosion and Sediment Control Plan

The Contractor shall prepare and submit to the Engineer an Erosion and Sediment Control (E&SCP) demonstrating how all land disturbance activities will be managed on site. No work may commence on site until the Auckland Council has approved the relevant section of the E&SCP.

2 Earthworks and Sediment Control

2.5 Materials

All materials are as classified in NZTA F/1, Section 8. Silt control devices (ie hay bales, silt fences, silt retention ponds) shall be as per Auckland Regional Council TP90 guidelines.

2.6 Construction

2.6.1 Cut to Waste

Definition of Terms shall be as per NZTA F1.

All excavations/cuts shall be carried out in fully drained conditions with no free water on the working surfaces. Where it is impracticable to maintain excavations of unsuitable materials in a fully drained condition, the Engineer shall have discretion to relax this requirement to the degree that is necessary. Cut areas shall be sloped and graded adequately so that they do not pond water or allow it to infiltrate, and drains shall be installed or pumping carried out as necessary on a regular basis, to remove water from the areas of operations, or to drain water as soon as it is seen to pond.

All cut surfaces at grades less than 1 vertical to 2 horizontal (1V : 2H) shall be sealed off at the end of each day's work with rubber tyred plant to prevent erosion and protect all exposed material. All excavations / cuts shall be carried out in a safe manner, with any temporary slopes graded so that the stability of such slopes is maintained for the duration of the Works.

2.6.2 Cut to Fill – Salvage for Reuse

All suitable granular materials shall be salvaged to use as basecourse materials for access / haul road construction.

2.6.3 Fill

Before fill is placed in any area, the Engineer shall be notified by the Contractor to allow an inspection of the stripped and/or removal of unstable materials to see that this prior work meets the specified requirements.

Material which by the Contractor's operation has been made unsuitable for direct placement as Engineered Fill, shall be made suitable at the Contractor's cost. No payment will be made if such unsuitable materials are placed in waste disposal areas. The recovery of these materials from disposal areas and treatment necessary for placement as fill shall be at the Contractor's cost.

2.7 Testing and Acceptance

The Contractor shall interrupt or divert operations as necessary to permit the Engineer to conduct any inspections and tests required with complete safety and accuracy of test results.

2.8 Inspections

The Contractor shall facilitate inspection by the Engineer at all times during construction. If so requested the Contractor shall, at no extra cost, remove surface layers to reach the level at which testing is required.

2 Earthworks and Sediment Control

Construction of new stages shall not commence until after the Engineer's inspection and approval of the current stage. Engineer's inspections are required as follows:

- a) After setting out of clearing area and prior to all clearing.
- b) Inspection that all unsuitable material has been removed prior to filling (note may also be required for survey purposes as required by the Engineer).
- c) Inspection of completed subsoil drainage.

2.8.1 Compaction Testing

The tests will be used to determine the classification and compaction standards of fill materials for acceptance purposes. Informal or non-standard test methods may be employed to obtain rapid indicative results, but these methods shall not be used for acceptance purposes. If the Contractor proceeds and subsequent laboratory tests show inadequacies then placed material is to be stripped and work re-done. No payment will be made for any associated stripping or re-work.

2.8.2 Subgrade

During the progress of the work, the contractor may carry out such compaction tests, CBR tests or other tests as considered necessary to confirm pavement designs and to check standards of construction. As part of the subgrade finishing operation, the entire surface shall be subject to uniformity test rolling.

The Contractor shall perform this test rolling in the presence of the Engineer using the same compaction equipment as used to meet the specified compaction requirements for the material forming the subgrade. Any area showing weaving or permanent deformation is unacceptable. No sub-base material shall be placed on prepared carriageway subgrade fill areas until the Engineer has inspected and approved the subgrade.

2.9 General Requirements for Erosion and Sediment Control

The following general requirements shall apply:

- a) All erosion and sediment control (E&SC) works shall conform to ARC TP0 and local authority requirements;
- b) All E&SC works shall conform with Auckland Regional Council publication: 'Technical Publication No 90, Erosion and Sediment Control Guidelines for Land Disturbing Activities' unless otherwise approved by the ARC;
- c) Contractor's staff overseeing the E&SC works shall be qualified to ARC's minimum requirements;

The Contractor shall undertake and provide evidence of daily monitoring of all erosion and sediment control features to ensure correct installation and operation is maintained.

During the construction period, the Contractor shall comply with the agreed E&SCP together with any standard or special requirements of the local authority (Auckland City and Papakura District Council) and Auckland Regional Council. All silt control measures in the agreed E&SCP are to be installed and fully operational prior to the commencement of any stripping or excavation other than for the silt control works themselves.

2 Earthworks and Sediment Control

The Contractor shall take all necessary measures to prevent excessive water logging of surface materials yet to be excavated or compacted or both, and to prevent fill material from being eroded and re-deposited at lower levels, and shall install silt control measures.

General measures to be adopted in the establishment and management of erosion and sediment control are:

- The surfaces of fills and cuts shall be graded to prevent ponding.
- Temporary diversion drains shall be constructed above excavation areas to intercept clean surface run-off and to lead drainage away to a stable watercourse or piped stormwater system, or at the base of excavations to direct contaminated water to the silt pond
- Excavations shall progress in such a manner to ensure water flows from the excavation area are directed to a silt pond. Where final bunds or other cut off devices at the low end of any excavation are to be removed, these shall be removed and replaced within one working day when weather conditions are fine.
- Surface water shall be prevented from discharging over batter faces by drains formed to intercept surface run-off and discharge via stable channels or pipes, preferably into stable water courses or piped stormwater systems.
- The upper surface of fills shall be compacted with rubber tyred or smooth wheeled plant when rain is impending, or when the site is to be left unattended.
- Temporary barriers or fences choked with brush, sacking or the like, shall be used to reduce flow velocities and to trap silt where appropriate.
- All earthwork areas shall be hydro-seeded as soon as possible after completion of the earthworks and drainage works.
- All vehicles leaving the earthworks area shall have wheels washed.
- Machinery shall be kept clear of any watercourse at all times except for specific works within a watercourse as specified.
- The site shall be stabilised against erosion as soon as practicable and in a progressive manner as land disturbance activities are completed.

2.10 Wheel Wash

The Contractor shall wash all wheels of every vehicle leaving area covered by the erosion and sediment control works utilising a wheel wash facility. All wheels shall be washed using hand held hoses and pressurised water unless approval is obtained from the controlling authority for machine washing.

The spaces between tandem wheels of vehicles shall be carefully washed to ensure soil is not trapped in these areas. Wheels will be washed over the whole surface of the tyres – this may require the movement of the vehicle to expose the section of tyre on the roadway.

Truck bodies will be washed only if required due to the presence of soil on such parts of vehicles. The Contractor shall ensure the operator of the wheel wash hoses and works in a safe manner and that vehicles are stopped while the operator is within 3 metres of the vehicle.

Demolition

3.1 General

This Specification covers the general requirements for demolition of the existing rinse rack structures including pavement construction, and concrete works.

3.2 Related Documents

This Section makes reference to various standards or statutes to which the work must conform; these may in turn require reference to other documents. In all cases the statutes and standards below are to be the latest editions including all amendments current at the time of tender.

- New Zealand Building Code
- Health and Safety in Employment Act 1992
- Health and Safety in Employment Regulations 1995
- Health and Safety in Employment (Asbestos) Regulations, 1998
- OSH Approved Code of Practice for Demolition
- OSH Approved Code of Practice for the Safe Erection and Use of Scaffolding
- OSH Approved Code of Practice for Excavation and Shafts for Foundations
- Guidelines for the Provision of Facilities and General Safety in the Construction Industry
- AS/NZS 3012 Electrical Installations – Construction and Demolition Sites
- New Zealand Electricity Regulations 1997
- New Zealand Electricity Act 1992
- Local Authority's Standard Practice for Infrastructure Development and Road Opening
- In addition the work shall comply with any relevant by-laws of the Local Authority having jurisdiction.

3.3 Tenderers to Inform Themselves

Where Drawings, Specifications or descriptions of works to be demolished are included in the Tender Documents, these are supplied for information only and shall not form part of the Contract. The Tenderers shall be responsible for carrying out sufficient investigations to inform themselves of the extent and complexity of the works. No claims which are based on unforeseen circumstances will be considered in so far as they rely on information supplied at the time of tender. Due allowance shall be made in the tendered prices and programme to allow for all demolition, shoring or other temporary works needed to carry out the Contract works.

3.4 Permits

The Contractor is responsible for obtaining and paying for all permits for demolition, excavation, construction or removal.

3.5 Procedure and Programme

The sequence, timing and method of demolition shall be the responsibility of the Contractor, who shall provide a detailed programme of the demolition work to the Engineer as part of their Construction Methodology report.

The programme shall outline the order in which the components of the structure are proposed to be demolished and the procedures which are proposed to achieve this. No demolition shall commence

3 Demolition

until the programme and procedures have been approved by the Engineer, and any subsequent variation in procedure shall be subject to approval by the Engineer.

3.6 Safety

3.6.1 General

The Contractor shall comply with all the relevant requirements of the Health and Safety in Employment Act. The Contractor shall submit a Health and Safety plan to the Engineer for approval prior to commencing any work. The site shall be left in a safe state. The Contractor shall ensure that there is no risk of injury to the public.

3.6.2 Safety Supervisor

All demolition work shall be carried out under the control of a Competent Safety Supervisor at all times. The Contractor shall advise the Engineer of the name of the Supervisor before work commences, and shall not change the Supervisor without prior notification to the Engineer.

3.6.3 Fire

The Contractor shall supply to site and maintain adequate fire fighting equipment, particularly when gas cutting. No fires shall be lit on site to burn timber or other material. No accumulation of debris shall be such as to cause a fire hazard.

3.6.4 Explosives

No explosives shall be permitted for demolition works.

3.6.5 Foundations

The contractor shall ensure all existing platform pavement, lighting columns, CCTVs and other infrastructure which are not to be demolished, are effectively shored and left safe at all times during and after completion of demolition.

Batters steeper than 1 vertical to 2 horizontal shall not be formed unless shown on the Drawings or approved by the Engineer in writing.

3.7 Nuisance

3.7.1 Dust and Mud

The Contractor shall take steps to minimise dust generation and dispersion. This shall include the use of water, screens or other approved methods. The Contractor shall wash the wheels of departing vehicles to prevent the shedding of mud on public land.

3.7.2 Noise

The Contractor shall allow for and comply with the Local Authority requirements relating to noise levels and hours of work.

3 Demolition

3.7.3 Traffic

The use of metal tracked vehicles on public land is prohibited. Fuel and oil tankers shall not be parked on the street.

3.7.4 Storage

No material shall be stored outside the site boundaries (Ontrack's designation), nor shall plant be stored or operated outside the site except in areas previously agreed with the Local Authority.

3.8 Disconnection of Services

Before commencing demolition, the Contractor shall ascertain the location of all services within the site and arrange with the relevant authorities for disconnection, sealing or diversion of all services. The Tender Documents may show or describe services on the site; however it is the Contractor's responsibility to ascertain the location of all the services on the site including electricity, telephone, gas, stormwater and sanitary sewer services. All relevant safety precautions, as detailed in the appropriate standards and statutes, shall be strictly adhered to.

3.9 Disposal of Material

3.9.1 Material Ownership

The Special Conditions of Contract or Tender Documents may list items which the Contractor shall salvage and retain for the Principal. These items shall remain the property of the Principal.

All other items not to be retained by the Principal shall be deemed the property of the Contractor. The Contractor's price shall make due allowance for the value of sound materials or items acquired from the demolition and the value of scrap.

3.9.2 Disposal

The Contractor shall be fully responsible for the demolition, loading, cartage and disposal off-site of all demolished material and items not to be retained for the Principal. The Contractor shall pay all tip fees or any other costs incurred in off-site disposal.

Foundation Excavation and Backfilling

4.1 General

This section of the Specification covers all excavation required for the construction of footings, walls and ground slabs to the dimensions shown on the Drawings, together with backfilling where required.

Bulk excavation, filling, clearing and other work related to site development, underground services, roads, paths, landscaping etc are not covered by this specification and are specified elsewhere.

4.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

NZS4202	Method of Measurement of Building Works
NZS4204P	Code of Practice for Foundations for Buildings not requiring Specific Design
NZS4205P	Code of Practice for Design of Foundations for Buildings

4.3 Site Investigation Information

Any site investigation information shown on the Drawings or included herein is provided only for the information of the Contractor. No warranty as to the correctness or completeness of the information is given and it shall be the responsibility of the Contractor to interpret the information or carry out further investigations for his own purposes.

4.4 Excavation

4.4.1 Dimensions

The Contractor shall excavate to the total building dimensions shown on the Drawings together with any additional allowance for working space for form work prescribed in Clause 3.4.1, NZS 4202. The total building dimensions shall include provision for 40mm minimum thickness of site concrete under all foundations except ground slabs and for any requirement for drainage course, hardfill or other details shown on the Drawings.

4.4.2 Unsuitable Foundations

Any unsuitable or doubtful foundation conditions shall be brought to the attention of the Engineer who will make any decisions and give any instructions required to remedy the condition.

Any unsuitable foundation conditions arising from disturbance of the soil by the Contractor or failure by the Contractor to maintain adequate drainage and any over excavation shall be good by the Contractor at his own cost.

4 Foundation Excavation and Backfilling

4.5 Classification of Materials

For the purposes of this Specification, earthworks materials will be classified as follows:

4.5.1 Rock Material

Rock material shall be that which cannot be excavated by a conventional bulldozer, tracked loader or tracked excavator having net engine power up to 300 kilowatts and which requires to be loosened for excavation by ripping or blasting.

4.5.2 Type W Material

Type W material shall be material, which because of its inherent properties of grain size, water content or organic content is excavated as a special operation requiring the attendance of plant nor otherwise required during the excavation process.

Material shall not be classified as Type W when its condition is due to the Contractor's operations or failure to provide adequate surface drainage or a reasonable time has not been allowed after rainfall to allow the material to return to its normal condition.

4.5.3 Type A Material

Type A material shall be all excavated material which does not fall within the classification for Rock or Type W material.

4.6 Disposal of Spoil

Any excavated material required for backfill or site works shall be stockpiled as directed by the (Engineer/Architect). All surplus spoil shall be removed from the site and disposed of at the total cost of the Contractor.

4.7 Existing Utilities

The attention of the Contractor is drawn to the provisions of the General Conditions of Contract regarding underground and overhead utilities. Where the Drawings show any such utilities to be affected by proximity to the foundations or other portions of the structure, the Contractor shall carry out such protective measures as are shown.

4.8 Dewatering

The Contractor shall provide adequate and continuous drainage from the foundation excavations. All seepage and surface water shall be discharged by means of temporary sumps, drains or pumps as required. Where a settlement pond is provided Site Works discharge from the foundation excavations shall be to that pond. Where no such provision is made or the pond so provided is not conveniently located the Contractor shall construct a settlement area to the approval of the (Engineer/Architect) designed to minimise the discharge of settle able solids to the receiving system.

Any foundation materials softened as a result of the Contractor's failure to provide adequate drainage shall be removed and replaced with approved compacted hardfill at the cost of the Contractor.

4 Foundation Excavation and Backfilling

4.9 Support Excavation

In addition to the general provisions in the General and Special Conditions of Contract, the Contractor shall take all specific measures required to ensure the stability of the excavation including any shoring, underpinning or face strutting. Such measures shall extend to the safety and stability of the surrounding ground and adjoining buildings and services. The Contractor shall provide the required notice to the Department of Labour, Local Authority and adjoining owners.

4.10 Backfilling

4.10.1 Bearing Areas

Backfill under footings where required as a result of over-excavation by the contractor or excavation of unsuitable foundations as instructed by the Engineer shall be carried out with approved hardfill. Such backfill shall be consolidated to not less than 92% of the maximum dry density of the soil as determined by NZS 4402, Test 4.1.3.

Where the Engineer determines that backfilling with excavated material is necessary to preclude differential settlement, such material shall be selected to the approval of the Engineer and consolidated to provide an average undrained shear strength (by hand vane) of 120 kPa in any group of 10 tests with no single test less than 100 kPa. Backfilling with excavated material shall not be carried out without the written instruction of the Engineer.

Asphalt Concrete Works

5.1 General

Asphalt concrete pavement shall be constructed on a constructed sound granular basecourse with NZTA Mix 10 – 35mm wearing course as per NZTA M/10 Specification.

Due care during construction of the asphalt wearing courses is required to ensure that all requirements of this specification and the related Standards are complied with.

5.2 Scope of Works

This section sets out the specific requirements for tack coat membrane and the asphalt concrete surfacing of platform area pavement.

5.3 Related Documents

The 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 the Standards, the requirements of this specification take precedence over the provision of the standards. All materials and workmanship shall comply with these Standards unless noted otherwise expressively in this specification.

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein.

NZTA M/1	Specification for Roving Bitumens
NZTA M/10	Specification for Asphaltic Concrete
NZTA M/13	Specification for Adhesion Agents
NZTA Q/2	Quality hot mix asphalt
NZS 4407	Methods for sampling and testing road aggregates.

5.4 Materials

5.4.1 Tack Coat / Membrane Seal

Sealing chips shall be Grade 5 chip complying in all respects with the requirements of NZTA M/6. The sealing binder shall be 80/100 penetration grade and shall comply in all respects to the requirements of NZTA M/1. Adhesion agents shall comply with NZTA M/13.

5.4.2 Asphaltic Concrete

Asphaltic concrete shall be in accordance with NZTA M/10. The types, grades and controlling specifications for the bituminous material shall be 60/70 Penetration grade bitumen as per NZTA M/1.

Coarse aggregate shall primarily consist of crushed stone or crushed gravel produced from hard durable rock or boulders. The source of rock from which individual components are produced shall comply as given in the table.

5 Asphalt Concrete Works

Criteria	Test Method	Requirements
Crushing Resistance	NZS 4407 Test 3.10	200kN Minimum
Weathering Resistance	NZS 4407 Test 3.11	AA or BA
Single Broken Surface	NZS 4407 Test 3.14	98% minimum
Two Broken Surface	NZS 4407 Test 3.14	60% minimum
Polished Stone Value	BS 812	Not less than 50

Mineral aggregates selected for use in asphaltic concrete shall comply with NZTA M/10. The mix design shall also comply with the requirements as per NZTA M/10 with minimum binder content of 5.8% and air voids not more than 3.5% when tested using Marshall Test.

5.5 Construction

5.5.1 Membrane Seal

The Contractor shall apply a membrane seal to all areas of granular pavement prior to constructing any surface, base and high fatigue layers. The membrane shall consist of a grade 5 chip and 80/100 penetration grade binder in accordance with NZTA P/3.

Concrete edge beam and other works adjacent to surfaces to be sealed shall be adequately protected against over-sprayed primer or vehicle damage. Any blemish or damage so caused shall be made good at the Contractor's expense and to the satisfaction of the Engineer. The seal coat shall overlap the lip of all concrete surfaces by 25mm.

The chip application rate shall be sufficient to provide a suitable surface for plant to operate while laying the asphaltic concrete, and prevent the pick-up of bitumen. The membrane seal shall be applied not more than 24 hours in advance of the asphaltic concrete.

The Contractor shall be responsible for maintaining the membrane seal and repairing any defects prior to commencing paving of the subsequent asphaltic concrete layer. The cost of any repairs required shall be borne by the Contractor.

5.5.2 Stockpiling

The requirements for stockpiling of pavement materials as set out in Section 12 shall also apply to the stockpiling of sealing chip except those requirements relating to maintenance of optimum moisture content, segregation and height.

5.5.3 Asphaltic Concrete

All asphaltic concrete shall be constructed in accordance with the layer thicknesses and mix requirements shown on the drawings and the acceptable tolerances.

Only self propelled pavers shall be used. These shall be fitted with a method of level control, which will allow transverse slope (within 0.1%), thickness, and smoothness to be achieved.

5 Asphalt Concrete Works

The paver shall be equipped with an automatic screed control system. The control system shall be automatically actuated either a reference line and or through a system of mechanical sensors, or sensor-directed mechanisms or devices. The system shall maintain the paver screed at a pre-determined transverse slope and at the proper elevation to obtain the required surface.

Prior to paving asphaltic concrete, the area to be paved will be dry and free from loose material or dirt. If swept all sweepings will be collected and removed from site. The Contractor will take all necessary steps to ensure that water does not pond on the layers if left exposed during the paving operation. The Contractor should plan the paving to minimise joints, were possible cold joints should be avoided in favour of hot or warm joints. Cartage across freshly placed asphaltic concrete is not permitted, until the pavement temperature has dropped below 65°C.

5.5.4 Weather Limitation

Asphalt concrete shall not be placed when the weather is raining or a wet surface or when the surface temperature of the underlying course is less than 8°C for base course and 10°C for thin wearing course.

5.6 Testing and Acceptance

Any test results, which show a non-conformance with any requirements of this specification, shall be reported to the Engineer within 48hrs of production.

The Contractor shall submit test results which demonstrate that the actual sealing chips which are to be incorporated into the works comply in all respects with the other requirements of NZTA M/6. The Contractor shall submit test results, which demonstrates that the lighting kerosene content of the asphaltic binder complies with the requirements of NZTA P/3 and this specification. Blending certificates shall be provided for each load of binder.

The Contractor shall provide results of calibration of the bitumen sprayer proposed for the sealing operation.

5.6.1 Adhesion Agent

The Contractor shall submit test results, which demonstrate that the nominated adhesion agent complies with the requirements of NZTA M/13.

5.6.2 Asphaltic Concrete

The Contractor shall submit test results which demonstrate that the asphalt aggregate which is to be used in this project complies in all respects with the requirements of NZTA M/10.

5.6.3 Acceptance/Rejection

In the event of non-compliance with the specified compaction requirements of NZTA P/9P, the Contractor may take additional field cores, or to determine the extent of non complying section. This will be defined as a sub lot. Acceptance of the balance of the lot will be at the Engineer's discretion.

Should a section fail to meet the requirements for thickness, density, binder content, aggregate gradation, or surface tolerances, then these sections will be removed over the full width of the paver

5 Asphalt Concrete Works

run and between saw cuts at right angles to the paver run as directed by the Engineer. Patches are not permitted. Any asphalt used for repair will be laid in compliance with this specification.

5.6.4 Surface Shape

The new pavement surface shall be free from any abrupt surface level irregularities exceeding 5mm on parallel to centreline and 5mm transverse to centreline when measured with a 3m straight edge.

Stormwater and Drainage

6.1 General

This section of the Specification applies to stormwater drainage included in the Contract Works. All pipe laying are subject to engineering approval by Auckland Council shall be carried out by a drain layer approved by the Council.

6.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

NZS 3104	Concrete Production - High Grade and Special Grade.
NZS 3107	Precast Concrete Drainage and Pressure Pipes.
NZS 3108	Concrete Production - Ordinary Grade.
NZS 3109	Concrete Construction.
NZS 4404	Code of Practice for Urban Land Subdivision
NZS 4452	Code of Practice for the Construction of Underground Pipe Sewers and Drains.
NZS 7643	Installation of uPVC Pipe Systems.
NZS 7649	Unplasticised PVC Sewer and Drain Pipe and Fittings.
AS 1646	Elastomeric Seals for Waterworks Purposes
AS 2566	Plastic Pipe laying Design.
BS 4504	Flanges and Bolting for Pipes, Valves and Fittings, Metric Series.
NZTA F/2	Pipe Subsoil Drain Construction.
NZTA F/3	Pipe Culvert Construction.
NZTA F/6	Fabric Wrapped aggregate Subsoil Drain Construction
	Local Authority's Standard Specification Stormwater and Drainage
	Local Authority's Soakage Design Manual and Construction Standards

6.3 Pipes

Pipes shall be of the type, class and internal diameter shown on the Drawings, all with rubber ring joints and complying with the provisions of NZS 4452 and the related standard specifications referred to therein.

6.4 Materials

Materials despatched to site shall be adequately protected for the whole period of transit, storage and handling against damage from all causes including damage to protective coatings and finishes. PVC pipes shall be covered to protect them from deterioration resulting from exposure to ultra-violet light, as recommended by the pipe manufacturer.

Materials for drainage construction shall comply with the following:

6 Stormwater and Drainage

6.4.1 Concrete and Cement Grout

Concrete and cement grout for all drainage structures and for concrete bedding, capping or surround where these are specified shall be Ordinary Grade concrete in accordance with NZS 3108 or High Grade in accordance with NZS 3104. It shall have a minimum compressive strength of 20 MPa at 28 days or its equivalent if tested earlier, except that for precast drainage components the minimum compressive strength shall be 27.5 MPa.

Where Low Grade concrete or cement grout is specified this shall be site mixed generally in accordance with NZS 3108 except that aggregate shall be 20mm all-in clean crushed aggregate or approved equivalent and the minimum compressive strength shall be 10 MPa at 28 days or its equivalent if tested earlier.

6.4.2 Water

The Contractor shall make its own arrangements for the supply of all water used on the Contract Works and shall pay all related charges. All water must come from an approved source and shall be free from foreign matter of any sort.

6.4.3 Bedding Materials

Bedding for all public drains up to 300mm diameter shall consist of all passing 20mm graded scoria or AP20 aggregate or other approved alternative. Aggregate bedding for pipes greater than 300mm diameter and above shall be GAP40mm crushed basecourse metal.

Bedding for uPVC pipes of all diameters, other than public drains shall be approved clean non-abrasive sand.

All aggregate bedding material shall have uniform grading and be clean and free from all deleterious matter and be capable of providing a readily compacted bed giving uniform bearing throughout.

6.4.4 Drainage Hardware

Manhole frames and lids shall be heavy duty and made of cast-iron complying with requirements of AS1830. Those located within pavement areas shall be non-rock.

Manhole rungs shall be to the dimensions shown on the standard drawings and shall be of mild steel hot dip galvanised in accordance with AS 1650 with a coating of not less than 500g/sq.m.

Catchpit grates and kerb plates shall be heavy duty and made of cast-iron complying with requirements of AS1830. They shall be to the dimensions shown on the Drawings.

6.5 Pipe Laying

Pipes shall be laid true to grade and alignment between structures in accordance with the details indicated on the Drawings.

6.5.1 Excavation

When excavation is commenced the top layer, be it turf, pavement or other surfacing materials, shall be stripped first and kept separate from the remaining material. In existing sealed or concrete

6 Stormwater and Drainage

pavement areas the surface edges of the trench shall be cleanly cut in straight lines using a power saw to prevent the formation of jagged edges.

Trenches shall be excavated by open cut unless otherwise approved of by the Engineer. The trench shall be of sufficient width to permit all operations for dewatering, placing of bedding and jointing of pipes to be carried out with freedom.

The sides where necessary shall be supported by suitable timber placed so that it will not interfere with the work of pipe laying and jointing. It shall be the Contractor's responsibility to determine when timbering is necessary and to comply with all statutory requirements in this regard and the Contractor shall be deemed to have made all necessary allowances in its unit rates to cover this work.

No spoil, plant or materials shall be stacked against any fence, building or tree without the written consent of the owner.

Where rock is above the design level required for laying of pipes or constructing a manhole the Contractor shall notify the Engineer of the volume of rock to be removed. The Engineer will instruct the Contractor to break out by mechanical means (not explosives) enough material to lay the pipes and or construct the manholes to design levels.

6.5.2 Hand Excavation

Where specifically indicated on the Drawings or where directed by the Engineer excavation shall be carried out by hand to limit disturbance to a minimum. In this situation ancillary heavy plant shall also be prohibited and the Contractor's rates shall be deemed to include allowance for bringing in materials and removing surplus soil by hand or by wheelbarrow.

Where hand excavation is not specifically required but the operation of plant is limited by the proximity of trees, shrubs, buildings etc, the Contractor shall make its own assessment of any hand excavation necessary and shall be deemed to have made allowance for this in its overall rates.

6.5.3 Extra Excavation

a) Excess Trench Depth

If the pipe trench or structure excavation is excavated below the grade called for in the Drawings without specific instruction to do so, it shall be refilled to grade at the Contractor's expense with crushed rock or stabilised approved fill compacted as specified or with Low Grade concrete as may be required by the Engineer.

b) Excess Trench Width

Where the Contractor excavates any pipe trench to a greater width at the top of the pipe than is shown in the Drawings or specified the Engineer may require extra work or remedial measures to be carried out by the Contractor at the Contractor's expense. In particular if, in the opinion of the Engineer any such extra width will result in more load being placed on the pipe than it can safely carry, the Contractor will be required to provide improved concrete bedding or stronger pipes or make of the trench narrower by pouring low grade 10 MPa concrete along the sides of the trench so that the clear distance between opposite faces does not exceed the distance shown on the Drawings. The width of the trench for this purpose is between excavated surfaces, i.e. it includes the thickness of any timbering or shoring.

6 Stormwater and Drainage

Any delay, and any costs resulting from such delay that may thus result, shall be the responsibility of the Contractor.

The Engineer will, if requested, supply additional information as to allowable widths or depths in any specific case.

c) Unsatisfactory Foundation

Where any portion of the excavation reveals unstable foundations at the design depth, the trench or structure excavation shall be deepened to the approved solid ground as directed by the Engineer and the extra depth backfilled and thoroughly compacted to grade with approved hardfill. This requirement shall apply also to manhole excavations. All unsuitable excavated material shall be disposed of clear of the works.

6.5.4 Subsoil Drainage

Subsoil drains shall be of the type, size and class specified on the Drawings or scheduled of prices and shall comply with the relevant Specifications listed in NZTA F/2. Where no type or class is specified on the Drawings, pipes shall be heavy wall, high density polyethylene (Nexas Hiway or similar approved). Where no size is specified pipes shall be 150 mm diameter.

The Contractor shall provide, within its scheduled rate for excavation, for keeping the workings free from water at all times and shall provide, operate and maintain all pumping equipment, drains, sumps and other things necessary for this purpose. These operations shall at all times be carried out without damage to the work or to adjacent properties. Under no circumstances shall any water be allowed to drain into a wastewater line. Where water is pumped to a suitable outlet or allowed to drain into any existing stormwater pipe, watercourse or other system, effective settling areas shall be provided to the satisfaction of the Engineer to prevent excessive discharge of silt to the receiving system.

6.5.5 Minimum Cover over Pipes

The cover over pipes shall be as dictated by the levels shown on the Drawings but shall in no case be less than the following unless the pipes are protected by reinforced or unreinforced to the approval of the Engineer.

The minimum cover over unreinforced pipes shall be 750mm beneath berms and landscape areas, and 1 metre beneath pavements and other areas subject to wheel loads. The minimum cover over other pipes shall be 600mm for pipes up to 300mm diameter and 750mm for pipes above 300mm, unless otherwise specified.

In situations where pipes are installed beneath pavement areas and are dependent upon pavement courses being in place to achieve the minimum cover requirement, the Contractor shall be responsible for protecting those pipes against damage from construction loads until such time as pavement construction has been completed.

6.5.6 Pipe Bedding

Unless indicated otherwise on the Drawings or varied by this clause, except uPVC, pipe support shall be Type HS beneath paved areas and Type H2 elsewhere in accordance with NZS/AS 3725:

6 Stormwater and Drainage

The requirements for uPVC pipes shall be as set out in AS CA 68: Plastics Pipe laying Design and NZS 7643, Installation of Unplasticised PVC Pipe Systems.

Where the gradient of the pipe is equal to or greater than 10% sufficient cement shall be added to the granular bedding material to provide a weak concrete with a strength of not less than 7 MPa. The bedding shall be broken at the pipe joints to maintain flexibility.

Where the gradient of the pipe is equal to or greater than 20% anti-scour blocks shall be constructed in accordance with the details in the standard Drawings. Where the gradient is equal to or greater than 33% the anti-scour blocks shall extend 150mm over the crown of the pipe as shown. All anti-scour blocks shall be constructed with the faces vertical and not normal to the pipe axis.

6.5.7 Laying Practice

Any concrete bedding, haunching, capping or encasing shall be extended to the nearest pipe joints beyond the minimum encasing length given on the Drawings or as instructed by the Engineer so that each individual pipe is seated on a homogeneous material. Actual depths of cover shall be checked on the ground in each case and the capping or encasing limits adjusted if necessary.

All capping and encasing shall be effectively broken at each pipe joint with soft board or other approved means to allow for flexibility of the joints.

Whichever type of bedding is required; each pipe barrel shall be evenly supported over its whole length, without bearing on collars or joints. Pipes shall be laid true to grade and alignment between manholes.

Where specifically required by the Engineer, a 150 mm diameter heavy duty Nexas Hiway subsoils drain or as specified in the drawings shall be incorporated in the base of the trench and extended to discharge to the nearest stormwater drainage structure or to a free surface outlet. A flexible joint shall be provided on all lines within one metre of each manhole.

6.6 Construction

6.6.1 Manholes, Catchpit Manholes and Chambers

Manholes, catchpit manholes and chambers shall be constructed to the details given on the Drawings and in the locations and to the invert levels shown on the Drawings.

All pipe work penetrations through manhole walls shall be sealed using "Sikaplug" or an approved equivalent type of permanent sealant.

Precast base sections are to be bedded on a 150mm depth of 17.5MPa concrete, and not directly on the excavated ground.

All joints between segments of precast manholes and chambers shall be sealed with R.B. 200 circular sealing rings visible from inside and shall be tightly clamped with approved galvanised or stainless steel couplings as supplied by the manufacturers. Inverts of the manholes shall be formed with half pipes or other approved methods, located centrally to give streamlined flow in every case. Where separate inlet and outlet invert levels are not given on the Drawings the invert level shown shall be taken at the centre of the manhole and a minimum fall of 20mm plus 5mm for each 10 degrees change in direction of flow shall be provided.

6 Stormwater and Drainage

Reinforcing steel shall be provided in all roof slabs as shown.

Cast-iron covers and frames shall be set flush with the cross-fall and grade of the surrounding finished surfaces, so that surface water cannot enter the manhole either through the cover or under the frame excluding catchpit manholes. Galvanised step rungs shall be provided in all manholes of greater depth than 1.0m in accordance with the Drawings.

Construction and backfilling of manholes shall keep pace with pipe laying.

6.6.2 Catchpits

Catchpits shall be precast field units as indicated on the Drawings. They shall be bedded on 75mm minimum depth of 17.5MPa concrete and not directly on the excavated ground. All catchpits shall have half syphon outlets as detailed on the Drawings. Catchpit outlet pipe diameters are shown on the Drawings.

Catchpit gratings shall be set in a concrete surround as shown in the Drawings, having a minimum fall of 50mm toward the grating.

On completion, catchpits shall be filled with water to the outlet invert level. Any catchpits which are found not to be watertight shall be repaired at the Contractor's cost. All catchpit silt chambers shall be cleared out on completion of the Contract Works.

6.6.3 Subsoil Drains

Subsoil drains shall be installed in accordance with NZTA F/2 and the further requirements given below.

Trenches shall be excavated to the dimensions and grades shown, and shall not be less than 300mm wide or greater than the external diameter of the pipe plus 300mm. The bottom of the trench shall fall evenly to the nearest stormwater drainage structure or free surface outlet as indicated in the drawings.

Subsoil drains shall not be used as temporary surface drainage. Any malfunctioning or deficiency of the subsoil drains shall be made good at no cost to the Principal.

The Contractor shall ensure that pipes do not become contaminated with clay or soil so that the perforations are blocked. Any such contamination shall be removed prior to the pipes being laid.

The pipe installation shall be inspected and approved by the Engineer before backfilling.

Except where otherwise directed by the Engineer, all subsoil drains shall be backfilled with graded 20mm to 7mm clean aggregate placed carefully in layers so that the pipes are not displaced.

All surplus spoil from the excavations shall be incorporated in fillings where the material meets minimum standards or disposed of off-site at no cost to the Principal.

6.7 Backfilling

Backfilling of all trenches and excavations shall be carried out on completion of preliminary testing, haunching and encasing to the approval and requirements of the Engineer. Special care shall be taken not to damage the pipes or joints during this process.

The first 300mm of backfilling shall normally consist of selected material free from stones larger than 50mm in diameter or other material liable to damage the pipes, fully compacted to the Engineer's

6 Stormwater and Drainage

approval. For pipes requiring concrete capping, the upper 150mm of this initial backfill layer shall be replaced by ordinary grade concrete as specified previously.

Except beneath road pavement areas, the balance of the backfilling shall be carried out in 225mm layers using approved excavated material thoroughly compacted layer by layer.

Where lines are within pavement areas, backfilling shall be carried out after the initial 300mm over the pipe using GAP65 subbase material carried up to subgrade level in compacted layers not exceeding 225mm. Backfilling above subgrade level shall be carried out in conjunction with pavement construction and surfacing.

Special care shall be taken not to displace any pipe from its true position and any pipes so moved shall be removed and accurately re-laid.

When backfilling has been completed all lines shall be visually inspected to see that they are straight and free from dirt or obstruction of any kind.

Backfilling around manholes and catchpits shall proceed in the same manner as outlined above, care being taken to maintain filling all rounds at the same level to eliminate unbalanced loading on the structure.

Except where drainage is constructed through areas which are to be subject to further work under this contract the final surface layers of backfill shall be equal to the adjoining surface - pavement, path, grassed surface or any other as to nature, depth and strength of materials.

6.8 As-built Details

As-built details of all stormwater reticulation shall be recorded by the Contractor and provided to the Engineer as mark-ups on approved Drawings as follows:-

- Length, diameter, type and class of pipe
- Grade of line and direction of flow
- Inlet and outlet invert levels at all manholes and junctions
- Invert levels of all connections at drop manholes
- Mt Eden 2000 or NZMS coordinate of all manholes and junctions

As-built details shall be provided not only for new reticulation, but also for modified, removed or abandoned existing reticulation.

Non-Structural Concrete

7.1 General

This section of the Specification applies to the construction of ancillary concrete works included in this Contract.

7.2 Related Documents

Work shall comply with the relevant requirements of the following standard specifications together with the further provisions herein:

NZS 3104 Concrete Production – High Grade and Special Grade

NZS 3108 Concrete Production – Ordinary Grade

NZS 3109 Concrete Construction

Local Authority Standard for Infrastructure Development

Concrete for all works specified in this Section shall be ready-mixed in accordance with NZS 3104 and shall comply also with relevant provisions of NZS 3109 and have a minimum compressive strength of 25 MPa at 28 days or its equivalent if test earlier, unless otherwise specified herein or on the Drawings.

7.3 Construction

This shall generally consist of machine laid edge beam and cast in situ channel. Dish channel, precast kerb block may be used in specific situations or to match in to existing profiles at the platform area.

The machine laid kerbing shall be laid using an approved kerbing machine fitted with an approved profile. Concrete shall have a minimum compressive strength of 25 MPa at 28 days and shall be in accordance with NZS 3104 or NZS 3108 and, where applicable, NZS 3109. The exposed surface texture shall be equivalent to that obtainable with a steel float. Control joints shall be formed through the concrete at intervals not exceeding 5m. Any sections of kerb where cracks occur between control joints shall be removed and replaced at the Contractors expense, as directed by the Engineer.

Precast kerb blocks shall be of approved manufacture. They shall be thoroughly bedded as detailed in a concrete foundation and backing and shall be laid with close joints. Recesses between blocks shall be filled with a 2:1 cement mortar mix neatly struck. For cast in-situ channel work boxing shall be dressed and securely stayed to prevent displacement and appreciable deflection. The concrete shall be in accordance with NZS 3104 or NZS 3108 and, where applicable, NZS 3109 with a minimum compressive strength of 25 MPa at 28 days and shall be properly worked to ensure maximum density and a smooth surface on all exposed faces. Concrete mixed on-site shall be mixed for a minimum period of two minutes and shall be placed in its final position within thirty minutes of leaving the mixer. Control joints shall be formed at no greater than 3m intervals.

7.4 Tolerances, Inspections and Testing

Horizontal - Face of kerb to be ± 10 mm from design position provided that the error between normal set out points (eg 10m) does not vary by more than 5mm.

Level - Top of kerb to be within zero to 5mm provided that the error between normal set out points (eg 10m) does not vary by more than 3mm.

7 Non-Structural Concrete

These levels are to be checked on the string-line by level and staff prior to kerb being constructed and are to be recorded on the "As Built" plans.

7.5 Inspections

Commencement of stages shall not proceed until after Engineer's inspection and approval of the previous stage. Engineer's inspections are as follows:

- a) After setting out and prior to commencement
- b) Completion of under-channel drainage prior to foundation preparation.
- c) Foundation inspection prior to pegging string-line.
- d) Contraction/construction joint methodology
- e) String-line inspection prior to pouring of concrete.
- f) Machine laid and kerb and channel – various dipping measurements of wet laid kerb and channel shall be carried out to verify concrete depth is as per Contract Drawings

7.6 Testing

All testing shall be carried out as required in Concrete Works Specification.

Traffic Sign and Tactile Indicators

8.1 General

This section covers the general requirements for Signs and Tactile Paving to meet the objectives of the AT standard Design Guide.

8.2 Scope of Works

The Works involve, but are not limited to, the removal of, and the supply of labour, materials, plant and equipment for the construction and installation of the directional / hazard indicators on platform and access to stairs.

8.3 Related Documents

Work shall comply with the relevant requirements of the following standards together with the further provisions herein:

RTS14	Guidelines for facilities for blind and vision-impaired pedestrians (Land Transport Safety Authority - 2003)
AS/NZS 1428.4: 2002	Design for Access and Mobility 'Part 4: Tactile Indicators'
AS/NZS 3661.1:1993	Slip resistance of pedestrian surfaces - Requirements.
NZS4121:2001	Design for Access and Mobility – Buildings and Associated Facilities
AUSTROADS (1995)	Guide to Traffic Engineering Practice, 'Part 13 - Pedestrians', Sydney.
NZTA/LTSA	Manual of Traffic signs and Marking: Part II: Markings
ARTA	Public Transport Signs – by Lexicon or approved supplier

Markings shall be in accordance with The Land Transport Rule "Traffic Control Devices 2004" Rule 54002 and Land Transport New Zealand's "Manual of Traffic Signs and Markings: Part II: Markings" except when shown otherwise on the Drawings.

8.4 Tactile Indicators & Sign

The indicator shall be durable and shall have a high luminance contrast with minimum of 45% as required by AS1428.4: 2002. In addition, the indicators shall provide a slip rating of R10 and R11 when tested as per AS/NZS 4856:1999 for directional indicator and hazard indicator respectively. The tactile indicators shall be resistant to most common acids, alkalis and greases.

New AT standard 3M signs shall be installed as per the drawings or Engineer's instruction.

8.5 Construction

The tactile indicators shall be installed with drill hole and epoxy-adhesive fixed installation to manufacturer's specifications - colour yellow.

ELECTRICAL SPECIFICATIONS

Table of Contents

1	Introduction	1
1.1	General.....	1
1.2	Scope of Work.....	1
1.2.1	Stations without Existing Power and Control Cabinet	2
1.2.2	New Power - Application and Supply	2
1.2.3	Metering	2
1.3	New Telecom Connection	2
1.3.1	Application.....	2
1.3.2	Supply	2
1.4	Work By Others.....	2
1.4.1	Stations with Existing Power and Control Cabinet	2
1.4.2	Existing Power - Application and Supply.....	3
1.4.3	Security/Data Equipment System	3
1.4.4	Underground Conduits.....	3
1.5	Demolition	3
1.6	Consents and Fees	3
1.7	Use of Labour	3
1.8	Co-ordination	3
1.9	Electrical Codes and Standards	4
1.10	Information and Drawings for Approval	5
2	Incoming Services	6
2.1	Single Phase Power Configurations	6
2.1.1	Supply Modifications.....	6
2.2	Three Phase Power Configurations	6
2.2.1	Application and Supply	6
2.2.2	Supply Modifications.....	6
2.2.3	Metering	6
3	Switchboards.....	7
3.1	Control Cabinet	7
3.1.1	Existing/New Cabinet	7
3.1.2	Distribution Board	7
3.1.3	Miniature Circuit Breakers	7

3.1.4	Shrouding/Distribution Board Enclosure.....	7
3.1.5	Relays and Contactors	8
3.1.6	Terminations	8
3.1.7	Identification.....	8
3.2	Testing and Commissioning.....	8
4	Cabling and Wiring	9
4.1	Earth Bonding	9
4.2	Equipotential Bonding Network	9
4.3	Sub-circuit Wiring	9
4.4	Cable Penetrations	9
4.5	Conduit and Segregation	10
4.6	Glanding	10
5	Electrical Equipment.....	11
5.1	Permanent Connection Units.....	11
5.2	Luminaries.....	11
5.3	Fixings	11
5.4	Corrosion Protection	12
6	Masts/Poles	13
6.1	Masts.....	13
6.2	Relocated Lighting Poles	13
7	Marking and Labelling	14
7.1	Traffolyte Lables	14
7.2	Ferrules.....	14
8	Testing and Commissioning	15
8.1	Requirements	15
8.2	Failure to Complete Preliminary Tests	15
8.3	Test Instruments	15
8.4	Maintenance	16
8.5	Certificate of Compliance and Fees	16
9	Control Cabinet Physical Layout.....	17

Introduction

1.1 General

The work described in this section of the Specification relates to the supply, installation and commissioning of the electrical services included in the Contract Works. The electrical works described are for the systems within, and associated with, the Signature Stations. Except where specifically stated otherwise, the work described will apply to all sites.

1.2 Scope of Work

The contract includes for the supply, except where specifically stated otherwise, of all labour, materials, equipment, tools, plant and scaffolding for the proper delivery, installation, connection, testing, commissioning, maintenance, and guarantee of complete installations.

This is further detailed on the Electrical Drawings and on the associated Architectural, Civil and Structural Drawings, which comprise provision of the following at each site:

- a) Disconnection and removal of existing nominated electrical equipment from the defined platform area and the associated rail corridor.
- b) Where required, cabling from a new Telecom supply point to the control cabinet including full coordination with Telecom, payment of all Telecom costs and phone cable terminations.
- c) Any modification, as necessary, to the new control cabinet and to cater for a three phase supply (if required by a particular station).
- d) Extra miniature circuit breakers and associated control contactors, etc. to be installed into the existing control cabinet, for the new equipment supplied under this scope.
- e) Any modification, as necessary, to the new control cabinet plinth to cater for the new cable runs (if necessary).
- f) Where required, the supply and installation of a new control cabinet, mounting collar plinth and all associated controls.
- g) All new luminaires and electrical equipment.
- h) Cabling to and connections of all new lighting and power equipment.
- i) All above ground conduits, bends, joints etc.
- j) Testing and commissioning.
- k) Operation and Maintenance Manuals.
- l) Training of Operation and Maintenance personnel.
- m) Provision of guarantees.
- n) Coordination and cooperation with other wire services Contractors.
- o) Removal of existing luminaires and poles as necessary.
- p) Provide either a suitable (approval by the engineer required) foundation cage or use the propriety foundation cage to anchor any bollard luminaires that are used in some stations.
- q) Cable (sub-circuit) runs over 60m shall be protected at the board by type B MCB's.

All parts of the works which are essential to the operation of the electrical services in the manner described, which are not specified or specifically excluded, shall be supplied, installed and paid for by the Contractor as part of this contract.

1 Introduction

1.2.1 Stations without Existing Power and Control Cabinet

The supply and installation of the following items is included in this scope where a new power connection is required, or the existing single phase connection needs to be upgraded to a three phase connection.

- a) Incoming mains cabling to the new control cabinet including full coordination with Vector and payment of all Vector Limited's costs associated with the initial power supply installation.
- b) Provision of electrical tariff metering from Metrix Limited, including full coordination with Metrix and payment of all Metrix costs associated with the initial power supply installation.
- c) Supply and installation of the stainless steel control cabinet, including the three phase distribution board chassis, limited power and lighting control equipment and circuit terminations from existing electrical equipment.
- d) The incoming supply and connection is generally rated at 60A. three or single phase (as required).

1.2.2 New Power - Application and Supply

The application for supply to the Vector Limited is within this scope.

1.2.3 Metering

The metering arrangements are within this scope.

1.3 New Telecom Connection

The supply and installation of the following items is only included in this scope where a new Telecom connection is required.

1.3.1 Application

Request and coordinate a new Telecom supply point.

Ensure early application is made to Telecom for this incoming connection.

1.3.2 Supply

Supply and install cabling from the Telecom supply point up to a demarcation frame within the Control cabinet.

Allow to install the demarcation frame.

This shall include full coordination with Telecom and payment of any Telecom costs.

1.4 Work By Others

1.4.1 Stations with Existing Power and Control Cabinet

Supply and installation of the following items is not included in this section.

1 Introduction

- a) Incoming mains cabling to the new control cabinet including full coordination with Vector and payment of all Vector Limited's costs associated with the initial power supply installation.
- b) Provision of electrical tariff metering from Metrix Limited, including full coordination with Metrix and payment of all Metrix costs associated with the initial power supply installation.
- c) Supply and installation of the stainless steel control cabinet, including the three phase distribution board chassis, limited power and lighting control equipment and circuit terminations from existing electrical equipment.

1.4.2 Existing Power - Application and Supply

Where there is existing power, the application for supply to the Vector Limited has been undertaken under a previous contract.

1.4.3 Security/Data Equipment System

A separate Security/Data Contractor will undertake this work, including the supply, installation and commissioning of the system and installation of the security equipment into the control cabinet.

1.4.4 Underground Conduits

All underground conduits, bends, draw pits, etc. are supplied and installed under the Civil works section.

1.5 Demolition

This shall be done in a coordinated program by the Contractor to ensure that all existing electrical services to and within the Stations are maintained until a changeover can be achieved with no disruption to station operation.

Allow to make any wiring electrically safe, as requested, during the construction period.

1.6 Consents and Fees

The Contractor shall obtain all consents and pay all Power Line Company (Vector Limited), Metering (Metrix Limited) and Telecom fees for the completion of work specific to the Signature Station upgrade.

1.7 Use of Labour

The Contractor shall utilise experienced tradesmen, skilled in their particular class of work and registered or certified as required. Apprentices shall not be employed at more than two to each tradesman and unskilled personnel only where permitted under law not more than one to each tradesman. Such personnel shall not be left working unsupervised.

1.8 Co-ordination

The Contractor shall provide liaison and co-ordination of the installation and commissioning with the relevant Subcontractors and Separate Contractors working on site.

1 Introduction

In particular, the Contractor shall ensure that:

- a) No conflict occurs between cables and other buried services and between cables and structural footings and piles.
- b) All Security/Data ducts in the duct system remain unused and available for use by others at all times.
- c) All the building and structural penetrations, including those associated with the masts are coordinated. Allow coordination for the vertical conduits supplied by others within the masts and the flexible cable entries within the mast footings. In particular, ensure that all conduit entry and exit locations within the masts are all clear and useable.

1.9 Electrical Codes and Standards

All work and materials shall comply with the current issue of the following codes and standards, which are specifically referred to in the Specification.

In the absence of a specific standard reference, the work and materials shall comply with the latest issue of relevant New Zealand Standards, British Standards and International Electrotechnical Commission standards with New Zealand / Australian Standards taking precedence.

The Contractor shall comply fully with New Zealand Electricity Regulations and AS/NZS 3000:2003 and any relevant New Zealand Building Code requirements.

AS/NZS 3000	New Zealand standard wiring rules
AS 3439	LV Switchgear and control gear assemblies
AS 34947	Low Voltage Switchgear and Control gear.
AS/NZS 3008	Electrical installation selection of cables
AS/NZS 2053	Conduits and fittings for electrical installations
AS/NZS 3147	Approval and Test Specification for thermoplastic insulated cables up to 0.6/1kV.
NZS 3198	Approval and Test Specification - XLPE insulated cables up to 0.6/1kV.
NZS 3134	Approval and test specification - ac supplied electronic ballasts for tubular fluorescent lamps.
NZS 4203	General structural design and design loadings for buildings
NZS 4219	Specification for seismic resistance of engineering systems in buildings.
NZS 4051	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment.
NZS 2293	Emergency evacuation lighting for buildings.
NZS 3112	Approval and test specification - plugs and socket outlets.
NZCEP 54	Code of Practice for the installation of Recessed Luminaires and auxiliary equipment.

1 Introduction

1.10 Information and Drawings for Approval

Prior to manufacture, provide three copies of the fully detailed, dimensional drawings and technical specifications of:

- a) Control cabinet and all new equipment contained within.
- b) Site testing and commissioning procedures, schedules, and methods.
- c) At other times, miscellaneous details where requested by the Engineer.

Incoming Services

2.1 Single Phase Power Configurations

2.1.1 Supply Modifications

It may be necessary to allow for a single phase incoming supply, in which case the incoming cables to the DB shall be looped across all phases and which can be removed if a 3-phase supply becomes available.

2.2 Three Phase Power Configurations

2.2.1 Application and Supply

Make the Applications for Supply to Vector Limited, on behalf of the client, to change the power incomer supply to three phase in lieu of the existing single phase and carry out full coordination.

2.2.2 Supply Modifications

Modify the incomer wiring at the main switch to allow for a three phase configuration.

Supply and install the cabling from the point nominated by Vector Limited.

2.2.3 Metering

Request supply of three phase metering from Metrix Limited or other approved metering company.

Co-ordinate on all metering requirements and equipment to be installed in the control cabinet.

Pay all associated costs.

Switchboards

3.1 Control Cabinet

3.1.1 Existing/New Cabinet

Physical details of the control cabinet have been included in the back of this specification.

Where the cabinet has been supplied and installed under a previous contract, a cast concrete (continuous) slab has generally been used with four (4 No.) PVC flexible ducts, 50mm. diameter cast in for the future power.

The following equipment has been provided in the previous supply;

- Surge suppressor.
- Three phase distribution board chassis and main switch, including miniature circuit breakers for the existing circuits only.
- Programmable time clock.
- Control contactors for the existing circuits only.

Where a new cabinet is required, supply and install the standard cabinet, complete with all electrical equipment needed on a cast 300mm thick 'collar' type plinth.

3.1.2 Distribution Board

Equipment sub assemblies should be mounted on removable gear plates or rack supports within the cabinet. They shall be arranged for easy access, separate disconnection and removal without disturbing adjacent assemblies. Adequate space shall be provided for neatly forming and terminating all cabling and wiring connections to the sub assemblies for testing and servicing.

All live metalwork shall be fully shrouded or protected so that adjustments, settings and testing within the cabinet can be deemed to be non - prescribed electrical work and can be carried out by non registered people.

All exposed live busbar metalwork and connections shall be covered by removable insulating barriers.

3.1.3 Miniature Circuit Breakers

All protective devices shall be selected to provide full overload and short circuit discrimination with downstream protective devices to meet AS/NZS 3000.

MCB's shall have a minimum rated symmetrical breaking capacity of 6kA and generally shall be C characteristic in accordance with VDE 0641.IEC 898 or equal approved.

Triple pole MCB's shall be used for three phase circuits.

Any spare ways shall be provided with blanking plates and all live metal shrouded.

3.1.4 Shrouding/Distribution Board Enclosure

Full height covers plate and shrouds shall be modified and so mounted that only the circuit breaker toggles project. They shall completely cover all terminations, busbars and wiring. The cover plates shall be supported around the perimeter and of sufficient gauge to prevent excessive movement and finished to give a neat appearance. They shall be removable for servicing.

3 Switchboards

3.1.5 Relays and Contactors

Relays shall be of heavy-duty pattern enclosed in clear plastic dust tight covers with front wired screw terminals. They shall be fully rated for inductive circuits.

Contactors may be DIN rail mounted type rated for the appropriate utilisation category and Duty Class 1 in accordance with BS 5424. Any contactor considered noisy shall be replaced as directed by the Engineer. All control wiring shall be flexible multi-stranded PVC insulated copper of minimum 1.5mm² (30/25 mm) size. All wiring shall be neatly loomed and constrained within defined cableways.

3.1.6 Terminations

All terminals shall be numbered with clip-in engraved plastic numbers.

All control and contactor wiring within the panel terminals shall be identified with full circle type ferrule wire numbers.

3.1.7 Identification

All individual equipment such as contactors, relays, etc. shall be identified by means of laminated plastic names plates engraved with black letters on a white background with the inscriptions and letter size to the approval of the Engineer. Circuit breakers shall be identified by means of a similar plastic nameplate and engraved with the circuit numbers shown in the schedules. A plastic covered circuit index mounted in a pocket behind the panel door shall be provided bearing the circuit numbers and circuit identification called up on the drawings.

Nameplates shall be screwed to the panels with self-tapping screws. Glued fixings will not be accepted.

3.2 Testing and Commissioning

Tests and commissioning will include the testing and recording of:

- a) Power and control cable megger continuity, and polarity/rotation
- b) Tightness/torquing and sealing of all connections
- c) Functional and control tests in all operation and alarm modes
- d) Distribution boards connections, earthing

All tests shall be fully documented and signed by the switchboard manufacturer and or electrical contractor.

The Contractor shall give adequate notice of completion to allow this inspection to be made.

Cabling and Wiring

4.1 Earth Bonding

Earth continuity and connections shall be provided for the control cabinet and all submain and circuit cables in accordance with AS/NZS 3000:2003.

Provide all earthing and bonding requirements.

The earth continuity conductors and the sheaths of neutral screen cables shall be securely bonded to the earth continuity bar.

Where conduit wires are enclosed in non-metallic conduit, a separate fully insulated earth conductor shall be included.

The metalwork of all light fittings and appliances shall be earthed through a separate earth terminal in the fitting.

All metal conduits, catenary wires, outlet boxes and exposed metal shall be earthed at an earthing terminal in the outlet box etc. or by an earthing bush.

Provide earthing bond connections for all metallic water and waste pipes associated with the platform, ductwork and the metal frame of the building and structures.

4.2 Equipotential Bonding Network

Ontrack have issued guidelines to earthing and bonding as part of the traction engineering specification for the Auckland rail electrification works. The equipotential bonding required by these guidelines for railway electrification is outside the scope of this contract, except that any additional conduits required for bonding of any metalwork shall be provided as detailed in the drawings.

4.3 Sub-circuit Wiring

All subcircuit wiring shall be concealed from view. Cables shall be run within the buried duct system through the cable pit system or through the building framework and masts.

Full protection and removal of all internal pipe/steel sections, rough surfaces and burrs and additional insulation shall be provided for wiring within the building structure, framework and ceilings in accordance with the requirements of AS/NZS 3000:2003.

The installation associated with any recessed downlight luminaires shall comply with NZECP 54.

All wiring in which kinks or abrasions occur will be condemned and shall be replaced by the Contractor at his own expense.

4.4 Cable Penetrations

The Contractor shall fully coordinate with the Architect and Structural Engineer for all builders work entries and penetrations, which should be carried out to avoid the risk of damage to cables or to weaken the strength of the framing and shall be coordinated with other trades.

The Contractor shall not cut away or drill any material without the prior permission of the Structural Engineer.

4 Cabling and Wiring

All penetrations through fire walls and floors shall be sealed with expanding foam type putty to attain the same fire rating as the wall/floor.

The size of penetrations shall be kept to the minimum necessary.

4.5 Conduit and Segregation

Conduit shall be rigid PVC conduit to NZS 2053.1.

Flexible conduit shall be used for cabling between the cable draw pits and the rising structural elements and/or mast bases.

Flexible conduit shall be "Liquitite", Kopex or equivalent with proprietary conduit glands.

Rigid PVC conduits shall be installed between the cable draw pits and mast/building entry structural bases.

Cabling shall be installed such that each of the following groups of cables are physically segregated.

- a) 230/400V AC.
- b) Low voltage control.
- c) Telephone - The phone section of the control cabinet must be physically and electrically separated and segregated from the power section by a rigid insulated panel.
- d) Future Security/Data cabling.

4.6 Glanding

Glands plates shall be provided and installed for the termination of all cables. Appropriate cable glands shall be provided for all cables. All outdoor cabling shall be terminated with weatherproof glands at the bottom of enclosures.

Electrical Equipment

5.1 Permanent Connection Units

Full cooperation with the Architect is required to locate and install or make provision for power connection units in the building area for electrical equipment connections.

5.2 Luminaries

The Contractor shall supply and install all light fittings/luminaries shown on the schedule in the Station Specific section of the specification.

Alternatives shall not be used unless specified as "or Equal Approved" and submitted at tender time and approved in writing by the Engineer/Architect.

All fluorescent and discharge fittings shall:

- Comply with the appropriate standards including NZS 3137, AS/NZS 60598.1 Luminaires - General requirements and tests and comply with all (MEPS) recommendations and standards in relation to ballasts and efficiency.
- Comply with AS/NZS 61558.2.4 Isolating transformers
- Have high efficiency low loss ballast as a minimum.
- Have power factor correction capacitors mounted in each fitting and separate from any other component, or minimum 250 volts (RMS) working, to give a corrected power factor of not less than 0.95 lag.
- Have ceramic type interference suppression capacitors fitted that comply with the recommendations of AS/NZS CISPR 15.
- Be rejected if during operation the noise level emitted by the fitting causes an increase in the ambient noise level.
- Have internal wiring secured with approved clips and prevented from coming in contact with the ballast.
- Self-tapping screws or rivets shall not be used for fixing electrical components.
- All discharge fittings shall have screw lampholders. Remote ballast units shall have metal enclosures.

5.3 Fixings

All equipment installed under this contract shall be fixed to foundations slabs, structural concrete and masonry, structural steelwork or timber supports on stud partitions.

Equipment shall be fixed at a minimum of four points unless specifically designed for fewer fixing points.

All fixings shall be designed for static loads, live loads and all dynamic and other transient loads, i.e. tension and shear, with an appropriate factor of safety against failure. The factor of safety (FOS) shall be not less than 4.0 against the average ultimate failure load in the case of proprietary concrete anchors. Seismic design conditions stated under service conditions shall be complied with.

All fixings shall comply with manufacturer's instructions for supports of equipment.

All fixings to the building structure shall be as follows:

- a) Steelwork Engineer's stainless steel screws or hexagon-round bolts, nuts and washers.

5 Electrical Equipment

5.4 Corrosion Protection

All mounting brackets, supports and fixings shall be stainless steel (Grade 316) to Architect's approval

All proprietary equipment specified in this specification or selected by the Contractor must be supplied in a suitable marine form.

Masts/Poles

6.1 Masts

All wiring to masts shall be brought into the base through the concrete footing using flexible PVC conduit from the cable draw pits.

Physical segregation shall be maintained between the power cabling and Security/Data cabling.

Physical segregation within the building structure entry risers shall be provided by a group of rising conduits separated by a partition from the down pipe assembly.

Install HRC fuses at the base of each pole to allow reduced wiring to each luminaire point.

Allow to pre-wire the mast at the point of manufacture.

6.2 Relocated Lighting Poles

Relocate any nominated existing lighting poles and luminaires as directed on the drawings.

Reconnect the luminaires as shown on the Electrical Services drawings.

Marking and Labelling

7.1 Traffolyte Lables

All distribution boards, control panels, switch-sockets, light switches, switches, circuit-breakers, isolation switches, relays, contactors, connection boxes shall be clearly labelled.

Label text sizes required are:

20 mm Switchboards, danger labels.

10 mm Power switches on DB.

5 mm Sockets, switch-sockets, light switches, switches, emergency luminaries, circuit-breakers, fuses, relays, contactors, starters, connection boxes, etc.

Labelling shall be black lettering on white background.

7.2 Ferrules

All cables and control wires shall be identified by a white glassy plastic ferrule with black lettering. The ferrules shall not be affected by damp or oil.

Lighting and small power sub-circuit cables shall be marked at the distribution board only.

Internal and external control wiring including security cabling shall be marked at both ends.

Identification numbering and lettering shall read from the terminal outwards on all wires.

Power cabling shall be marked at both ends on entry and exit from switchboards/tap off boxes.

Testing and Commissioning

8.1 Requirements

Arrange for progressive inspection, testing, approval and partial commissioning of completed work and have any aspects of the work which could be disputed cleared at an early stage.

The complete electrical system is to be comprehensively tested and commissioned prior to completion at no expense to the Client.

Test and commissioning schedules shall be prepared by the Contractor and shall be completed prior to witnessing of any tests by the Engineer. All testing must include the mandatory tests identified in Section 6 of AS/NZS 3000:2003 and all associated documentation provided.

Tests and commissioning will include the testing and recording of:

- Power and control cable megger continuity, and polarity/rotation
- Tightness/torquing and sealing of all connections
- Functional and control tests in all operational modes
- Distribution boards connections, earthing
- Small power and lighting circuit megger and polarity tests, checking DB schedules are correct
- Lighting controls
- Earth continuity and loop tests
- Earthing resistance measurements of each system component and overall resistances
- Continuity of all circuits
- Voltage checking and recording of cabling

Checking that all wiring conforms to wiring diagrams and all ferrules/cable terminal numbers

The Engineer reserves the right to witness all testing and reasonable notice shall be given for this purpose.

Any work which does not comply with the documents shall be made good.

In addition to the tests mentioned above allow at no extra cost for any additional tests requested by the Engineer or as recommended equipment makers instructions to ensure satisfactory operation.

Any work, which does not comply with the documents, shall be made good at no extra cost such that the installation is completed in accordance with the detail and intent of this Specification and drawings, and left in full working order.

8.2 Failure to Complete Preliminary Tests

Should the Engineer's testing or inspection be unduly prolonged due to the failure of the Contractor to undertake his own preliminary testing or preparation, the Contractor shall be notified of the deficiency and all additional time, travel, accommodation and costs spent by the Engineer will be charged to the Contractor at the Engineer's normal charge out rates. These charges will be deducted from the Contractor's next progress payment.

8.3 Test Instruments

All test instruments and other testing facilities shall be provided by the subcontractor within his tender price. Should the Engineer have any doubt as to accuracy of a measuring device, he reserves the

8 Testing and Commissioning

right to instruct the Contractor to have the instrument recalibrated at no extra cost. Nevertheless, if the recalibration was in fact not necessary, the cost will be borne by the Client.

8.4 Maintenance

The Contractor shall maintain the installation in full working order in accordance with, and for the period stated in the contract.

The maintenance service shall include regular examinations of the installation during regular working hours and not less frequently than at monthly intervals, such examination being carried out by competent employees and shall include all necessary adjustments, and repairs required to keep the installation in full working order to expiry of the maintenance period.

Replacement for lamps shall be included for a minimum period of 2 months after the issue of the Certificate of Practical Completion.

An emergency call back service shall be provided during both regular working hours and after normal working hours.

If any portion of the work is replaced or renewed, the provisions of this clause shall apply to the portion of the works so replaced or renewed until the expiration of 3 months from the date of such replacement or renewal.

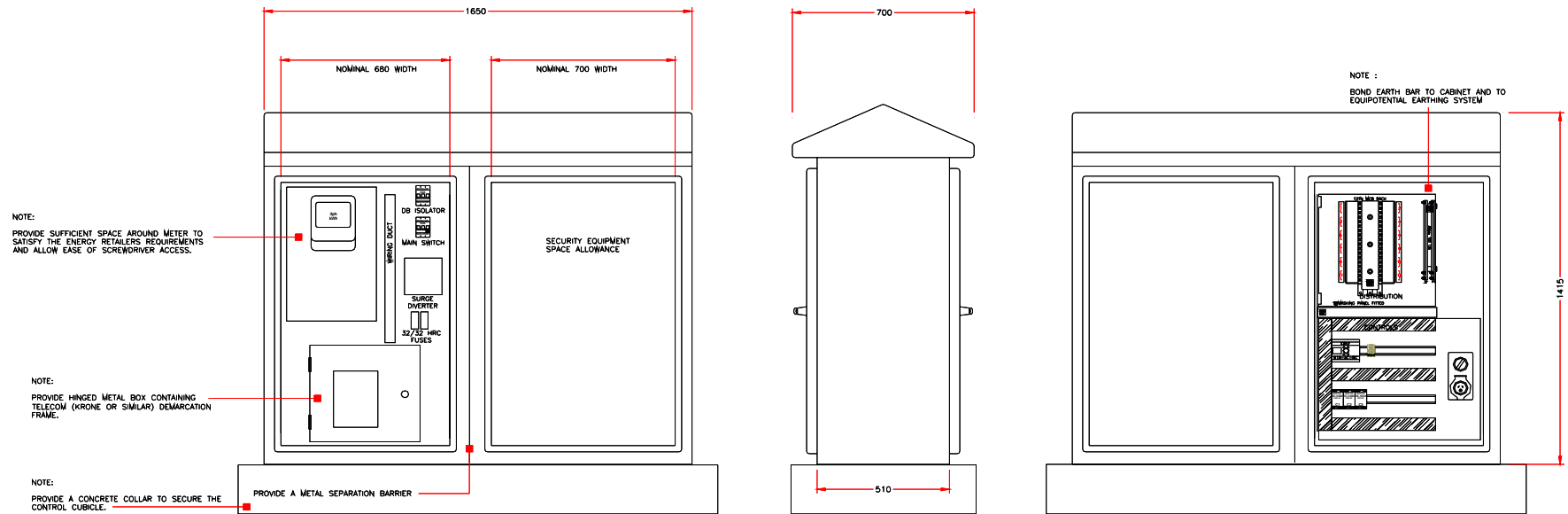
8.5 Certificate of Compliance and Fees

The Contractor shall obtain a Certificate of Compliance for the total installation and provide it to the Engineer prior to issue of the Certificate of Practical Completion and pay all associated fees.

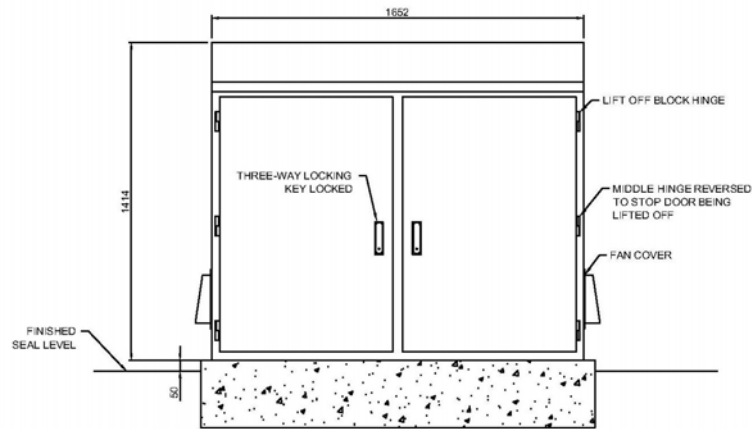
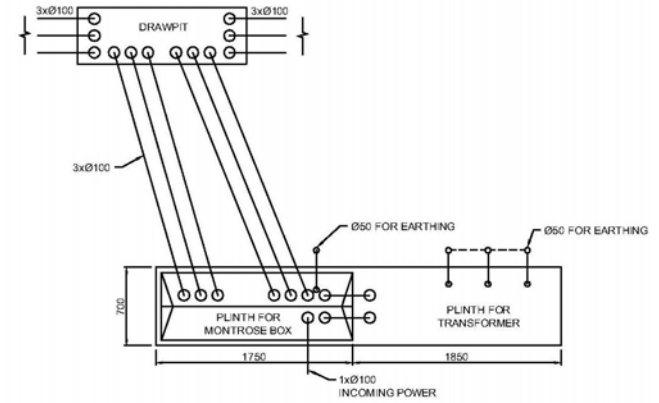
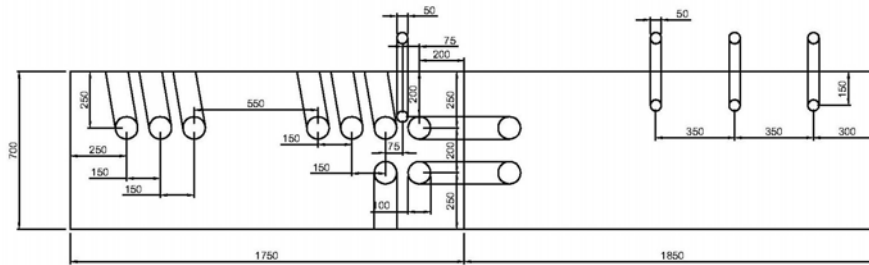
9 Control Cabinet Physical Layout

9

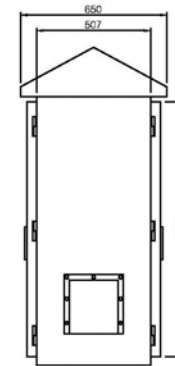
Control Cabinet Physical Layout



9 Control Cabinet Physical Layout



FRONT VIEW OF 2 DOOR CABINET
SCALE: 1:10



SIDE VIEW
SCALE: 1:10

Limitations

URS New Zealand Ltd (URS) and JASMAX have prepared these specifications in accordance with the usual care and thoroughness of the consulting profession for the use of Auckland Transport.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the contents of these specifications.

These specifications should be read in full. No responsibility is accepted for use of any part of this document in any other context or for any other purpose or by third parties.

Except as required by law, no third party may use or rely on the contents of these specifications unless otherwise agreed by URS in writing.

To the extent permitted by law, URS expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in these specifications. URS does not admit that any action, liability or claim may exist or be available to any third party.