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**PROPOSED MINISTRY OF JUSTICE AND  
COURTS ADMINISTRATION'S (MJCA) NEW  
COURTHOUSE & JUDGES RESIDENCE AT  
SALELOLOGA, SAVAI**

**Civil &  
Structural  
Specification**

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November 2022

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## **2241 EXCAVATION**

### **1. GENERAL**

This section relates to the excavating required for the building works, removing surface soils and the disposal of excavated material.

#### **Related work**

#### **1.1 RELATED SECTIONS Refer to Structural Drawings**

#### **Documents**

#### **1.2 DOCUMENTS REFERRED TO**

Documents referred to in this section are:

<a href="#">NZS 4402</a>	Methods of testing soils for civil engineering purposes
OSH	Approved code of practice for safety in excavation and shafts for foundations

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 ARCHAEOLOGICAL DISCOVERY**

If fossils, antiquities and other items of value are found refer to the general section 1220 PROJECT for actions to be taken with archaeological discovery.

#### **Performance**

#### **1.4 ACCESS FOR MACHINES**

Determine working conditions and access for machines. Take into account the time of year, the nature of the ground and subsoil to be excavated, the ground water table and all matters influencing the carrying out of the work.

#### **1.5 SAFE WORKING CONDITIONS**

Provide safe working conditions and adequate support to excavations at all times. Cover holes and fence off trenches and banks.

#### **1.6 FOUNDATION BEARING**

Request written instructions if a natural bearing is:

- reached at a lesser depth or
- not reached at the depth shown on the drawings.

In made-up ground excavate down to a natural bearing. Remove unsuitable material that is exposed and replace with compacted backfill.

#### **1.7 INSPECTION**

Arrange for inspections and before placing any new work. If bearing becomes inadequate due to any cause then stop work and request further instructions.

#### **1.8 SITE MEASUREMENT, OTHER FORMATIONS**

If for any reason the excavations have to vary from the drawings, those affected to be solid measured and the quantity recorded and agreed to in writing as the excavation proceeds.

### **2. PRODUCTS**

## **Materials**

- 2.1 **TOPSOIL**  
Weathered soil, with organic inclusions capable of supporting the growth of vegetation.
- 2.2 **CUT MATERIAL**  
Consisting of sands, gravels, sedimentary materials, clays, scoria and similar deposits.
- 2.3 **ROCK**  
Defined as material encountered in excavations which because of its size or position can be removed only by breaking up by explosives or mechanical plant such as jack hammers or percussion drills.
- 2.4 **UNCONTROLLED FILL**  
Variable fill material placed with little or no compaction control.
- 2.5 **EXCAVATED FILL**  
Material from other formations in the excavation which may be selected and approved as suitable for filling and complying with [NZS 4402](#) by having grading and moisture content properties that will allow compaction to 95% of maximum density.

## **3. EXECUTION**

### **Conditions**

- 3.1 **REPORT**  
Report any survey pegs, bench marks, and the like on any features, leaving them undisturbed until approval is given for removal.
- 3.2 **COMPLY**  
Comply with the requirements of the OSH publication: Approved code of practice for safety in excavation and shafts for foundations.
- 3.3 **WORK BY OTHERS**  
Before taking over work done on the site by others check all levels and conditions and report any discrepancies affecting further work.
- 3.4 **EXISTING SERVICES AND FOUNDATIONS**  
Locate underground services and foundations before work is started. Any information provided regarding the location of these services and foundations is given from available records but with no guarantee of accuracy as regards alignment or depth. Furthermore no guarantee is given or implied that the information provided covers all existing services and foundations. Make good at no extra cost damage to existing services to the satisfaction of the appropriate network utility operator. Protect existing roads, footpaths, gutters, crossings etc from damage during work.
- 3.5 **KEEP FREE OF WATER**  
Keep excavations free from water and keep water from excavations clear of other construction work.
- 3.6 **TERRITORIAL AUTHORITY REQUIREMENTS**  
Obtain from the territorial authority requirements for the method of discharging water from the site.
- 3.7 **FORM SUMPS**  
Form sumps outside the line of foundations and deep enough to drain excavations. Pump from sumps without disturbing excavations or any material in place.
- 3.8 **SILT CONTROL**  
Undertake silt control measures required by territorial authorities and network utility operators in relation to design, location and discharge into the drainage system.

### **Application**

- 3.9        **STRIP TOPSOIL**  
Strip topsoil carefully over the whole site and stockpile where directed on the site, on the prepared subgrade, for re-spreading at the completion of the contract.
- 3.10       **STRIP TO SUBGRADE**  
Strip the soil over the whole site to form a subgrade generally, but at a minimum of 200mm below the original ground level. Leave the subgrade level, clear of all loose material and with no impediment for the excavation work.
- 3.11       **DIVERT DRAINS AND SERVICE LINES**  
Divert services, drains and field drains encountered in the excavations to new routes clear of the building and reconnect to the requirements of the network utility operator.
- 3.12       **BREAK OUT**  
Break out and remove old foundations, floor slabs, drains, manholes and septic tanks, seal up connections and remove contaminated soil. Grub out roots in excess of 75mm diameter to a minimum of 500mm below the bottom level of footings or paving. Backfill with selected excavated material, well rammed in layers.
- Take special care when working close to retained trees and shrubs.
- 3.13       **EXCAVATION GENERALLY**  
Excavate for pads, strip foundations and tie beams to the profiles and levels shown on the drawings. Allow clearance for working space and formwork as necessary. Trim to required profiles, falls and levels. If pouring against natural ground excavate an extra 25mm that side to provide 75mm minimum cover to reinforcement horizontally. Bench surface of sloping ground to receive filling.
- 3.14       **OVER EXCAVATION**  
Make good with well compacted backfill.
- 3.15       **EXCAVATED BACKFILL**  
Stockpile selected excavated backfill on site where directed so that it does not impede continuing works until it is required.

### **Finishing**

- 3.16       **BATTERS, TEMPORARY PROTECTION**  
Protect batters with a change of level between crest and toe of more than 1.5 metres from weather erosion with a waterproof covering of either hessian and tar, or heavy duty black polythene sheet. Seal at joints and securely fix down at crest and toe. Maintain coverings in good condition until the ground is secured by permanent construction.

### **Completion**

- 3.17       **LEAVE**  
Leave work to the standard required by following procedures.
- 3.18       **SURPLUS TOPSOIL**  
Remove unwanted stripped soil from the site continually as the work proceeds. Clean up continually any soil if dropped on footpaths or roads.
- 3.19       **SURPLUS MATERIAL**  
Remove surplus excavated material from the site continually as the excavation proceeds. Clean up continually any excavated material dropped on footpaths or roads.

## 2242 BACKFILLING

### 1. GENERAL

This section relates to the supply, placing and compaction of materials for backfill, basecourse or built-up ground, as required for the contract works.

#### Related work

#### 1.1 RELATED SECTIONS

#### Documents

#### 1.2 DOCUMENTS REFERRED TO

Documents referred to in this section are:

[NZS 3104](#) Specification for concrete production

[NZS 4402](#) Methods of testing soils for civil engineering purposes  
TNZ M/4 Specification for basecourse aggregate

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.

### 2. PRODUCTS

#### Materials

#### 2.1 EXCAVATED FILL

Material from other formations in the excavation which may be selected and approved as suitable for filling and complying with [NZS 4402](#) by having grading and moisture content properties that will allow recompaction to 95% of maximum density.

#### 2.2 COMPACTED ROP ROCK STRIPPINGS

Rotten rock or quarry strippings, free of organic material, maximum density to [NZS 4402](#), test 4.1.1 or equivalent.

#### 2.3 VOLCANIC TUFF FILL

Scoriaceous tuff of variable grading excluding excessive silt or clay material, capable of being placed and compacted as specified.

#### 2.4 ROCK FILL

Hard material comprising rock, broken stone, hard brick, concrete, run of pit scoria, or other comparable inert material, with a maximum particle size of 100mm, capable of being placed and compacted as specified.

#### 2.5 SAND FILL

Clean sand of such grading in particle size as to achieve mechanical compaction to 90% maximum density to [NZS 4402](#).

#### 2.6 BLINDING FILL

Scoria, crushed or river run rock to AP (All Passing) 7 grading.

#### 2.7 HARDFILL

Scoria, crushed or river run rock to AP (All Passing) 65 grading.

#### 2.8 GRANULAR FILL

Approved screened crushed gravel or scoria graded in size from 20mm to 7mm, clean. When tested with a standard sieve of 4.75 opening no material is to pass.

- 2.9 DRESSING COURSE  
Scoria to GAP 20 grading, or "dirty footpath scoria", or equivalent "all in" graded crushed metal aggregate.
- 2.10 FREE-DRAINING AGGREGATE  
Scoria or crushed gravel graded 50 to 14 clean.
- 2.11 SITE CONCRETE  
Prescribed mix 10.0 MPa to [NZS 3104](#).

### **3. EXECUTION**

#### **Conditions**

- 3.1 UNSUITABLE MATERIALS  
Remove from site all unsuitable filling material.
- 3.2 REMOVE SURPLUS  
Remove surplus imported filling materials from the site.
- 3.3 SPREAD SURPLUS  
Spread and level surplus imported filling materials where directed.
- 3.4 PLACE FILLING  
Place filling using approved methods, to required dimensions, levels, lines and profiles and so that surface water drains freely.
- 3.5 PROTECTION OF FORMATION  
Do not allow construction traffic on filling until the level has been raised not less than 150mm above formation level by properly compacted temporary protective filling. Remove temporary protective filling from the site before beginning permanent construction. Do not stockpile materials on newly filled areas without permission.
- 3.6 DIFFERING MATERIALS  
Where materials of widely divergent characteristics are used for filling, spread and compact in clearly defined separate layers.
- 3.7 EARTHMOVING EQUIPMENT  
Do not use earthmoving equipment for compaction.
- 3.8 COMPACTION NEAR EDGE SUPPORTS  
Ensure that edge supports are strong enough to support compaction forces without movement, cracking or other damage. Make good damage caused by compaction.
- 3.9 MOISTURE CONTENT, GENERAL FILL  
Moisture content at time of compaction to be within the range of optimum less 6% up to optimum. Do not use filling with moisture content above optimum value. If necessary:  
- adjust moisture content of filling by turning and drying  
- provide water sprinkling equipment if fill is too dry.

#### **Application**

- 3.10 SPREAD AND COMPACT GRANULAR FILL  
Spread and level in layers not more than 150mm loose depth from the approved level. Compact filling in layers as specified by at least four passes of a vibratory roller having a static linear loading of 1.8 - 2.3 kg/mm, or twelve passes of a vibratory roller having a static linear loading of 0.8 - 1.2 kg/mm. Achieve a density of not less than 95% of maximum at optimum moisture content to [NZS 4402](#).
- Alternative compaction plant may be used provided it can be shown that the density requirement can be achieved.

- 3.11      **SPREAD AND COMPACT ROCKFILL**  
Spread and compact in layers of not more than 200mm loose depth where designated on the drawings. Compact with suitable heavy plant to provide a dense, unyielding base.
- 3.12      **SPREAD AND COMPACT HARDFILL**  
Spread and level in layers of not more than 150mm loose depth where required to make up from approved subgrade to the underside of basecourse, sitework construction or to where shown on the drawings. Compact as described under SPREAD AND COMPACT GRANULAR FILL.
- 3.13      **SPREAD AND COMPACT VOLCANIC TUFF**  
Spread and level in layers of not more than 150mm loose depth where required to make up from approved subgrade to the underside of construction. Remove lumps larger than 100mm. Compact as described under SPREAD AND COMPACT GRANULAR FILL.
- 3.14      **SPREAD AND COMPACT SAND FILLING**  
Spread and level in layers of not more than 125mm loose depth for areas designated on the plan or agreed on site. Carry out vibrating compaction on a trial area to show that 90% maximum density to [NZS 4402](#) can be achieved.
- 3.15      **SAND/AP 7 BLIND SURFACE**  
Blind surface of area being covered with a concrete slab with sand or AP 7 to a thickness not more than 12mm with a fill of 25mm maximum for depressions in granular base. Roll or compact with a vibrating plate tamper ready to take damp-proofing. Finish the surface with a non-vibrating smooth wheeled roller.
- 3.16      **BACKFILL TO FOUNDATIONS**  
Backfill with approved material, compacted in 150mm layers using mechanical vibrating tampers weighing at least 65 kg, to achieve a density of not less than 90% maximum at optimum moisture content to [NZS 4402](#).
- 3.17      **BACKFILL TO RETAINING WALLS**  
Backfill the drainage space behind walls with free-draining aggregate in 200mm layers. Do not disturb subsoil drains. Follow the sequence of filling shown on the drawings so that dependent action from suspended floors is available before filling behind the wall is complete. Do not over-compact with heavy plant.
- 3.18      **SUBGRADE TO CONCRETE SLABS**  
From approved sub-subgrade spread and level granular base in 100mm maximum loose layers. Compact with a roller or a vibrating plate tamper of at least 70 kg to provide a dense unyielding base. Dress this surface with a 25mm layer of dressing course and roll to form a tight dense surface. Blind with a maximum 12mm layer of sand and compact with a roller or a vibrating plate tamper to leave ready for damp-proofing.

### **Completion**

- 3.19      **TAKE AWAY**  
Take away from the site all selected excavated material or brought-in material not used for backfilling, leaving the site clear and tidy.
- 3.20      **LEAVE**  
Leave work to the standard required by following procedures.
- 3.21      **REMOVE**  
Remove all debris and unused materials from the site.



## 3100 CONCRETE GENERAL

### 1. GENERAL

This section deals with general matters relating to all aspects of concrete work.

#### 1.1 RELATED WORK

**Refer to Structural Drawings**

#### 1.2 DOCUMENTS

Refer to the general section 1233 REFERENCED DOCUMENTS. The following documents are specifically referred to in this section:

AS 1366.3	Rigid cellular plastics for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)
AS/NZS 1554.3	Structural steel welding - Welding of reinforcing steel
AS/NZS 2269.0	Plywood - Structural - Specifications
NZS 3101.1	Concrete Structures Standard
NZS 3104	Specification for concrete production
NZS 3109	Concrete construction *
NZS 3112.1	Methods of test for concrete - Tests relating to fresh concrete
NZS 3113	Chemical admixtures for concrete
NZS 3114	Specification for concrete surface finishes
NZS 3121	Specification for water and aggregate for concrete
NZS 3122	Specification for Portland and blended cements (General and special purpose)
NZS 3125	Specification for Portland-limestone filler cement
NZS 3604	Timber-framed buildings
NZS 3603	Timber Structures Standard
NZS 3631	New Zealand timber grading rules
NZS 4229	Concrete masonry buildings not requiring specific engineering design
AS/NZS 4357	Structural laminated veneer lumber
AS/NZS 4671	Steel reinforcing materials
AS/NZS ISO 9001	Quality management systems - Requirements
Alkali aggregate reaction (Cement and Concrete Association)	

\* A copy of [NZS 3109](#) Concrete construction, must be held on site.

### Requirements

#### 1.4 QUALIFICATIONS

Workers to be experienced, competent and familiar in the fabrication and erection of formwork and with the materials and the techniques specified.

#### 1.5 INSPECTIONS

Refer to SELECTIONS for type of inspection.

#### 1.6 RECORDS

Make and keep record of mix, time, date and location of each pour and make available on request together with delivery dockets. Cross reference delivery dockets in pour records.

#### 1.7 PRODUCER STATEMENTS

Provide Producer Statements where required by the Building Consent Authority and where required by this specification.

## Performance

### 1.8 TESTING, ON SITE

Carry out sampling and concrete acceptance tests during construction to [NZS 3109](#): section 9, Concrete acceptance tests during construction, noting that concrete may be rejected for:

- Non-compliance with this specification.
- Non-compliance with [NZS 3109](#), section 9, Concrete acceptance tests during construction.
- Showing by appearance when in place that it does not comply with this specification, especially in respect of surface finish, segregation, or low density and which cannot acceptably be made good.

Conduct 7 day strength tests. After a 7 day test result of less than 60% of the specified strength, concrete placement to stop until it is shown the suspect concrete complies with the specification. Make all test records available.

### 1.9 CONFIRM STEEL REINFORCING COMPLIANCE

Provide a Producer Statement confirming that the steel reinforcing supplied complies with the grades specified on the drawings by producing test results to [AS/NZS 4671](#).

### 1.10 CONTROL TESTS

Carry out slump tests, yield tests and air content tests to [NZS 3112.1](#), sections 4, 5, and 9 respectively and evaluate to [NZS 3104](#): section 2.15, Control tests and their evaluation, keeping a record of all tests at the plant and making them available on request.

### 1.11 STRENGTH TESTS

Carry out to [NZS 3112.2](#), section 10 and evaluate to [NZS 3104](#): section 2.15, Control tests and their evaluation, keeping a record of all tests at the plant and making them available on request.

### 1.12 QUALITY ASSURANCE

Carry out the whole of this work to the requirements of [NZS 3109](#) and under the regime of a quality systems model for quality assurance in production and erection to [AS/NZS ISO 9001](#).

Quality assurance procedures to include all aspects of concrete construction including:

- Formwork quality
- Reinforcing steel placing
- Cast in items
- Concrete quality
- Concrete finishes
- Construction tolerances

Advise name of the suitably experienced and qualified representative who is responsible for quality control of the concrete work. The representative is to sign a written quality control checklist for each on site concrete pour. Provide a copy to the construction reviewer in sufficient time for a pre pour inspection.

## 2. SELECTIONS

### 2.1 INSPECTION NOTIFICATION REQUIREMENTS

Give sufficient notice of inspections.

### 2.2 INSPECTIONS BY CONSTRUCTION REVIEWER

As required by LDS and/or BCA

### 2.3 INSPECTIONS BY BUILDING CONSENT AUTHORITY

As required by BCA

### 2.4 WATERPROOFING FOR EXTERNAL OPENINGS

The waterproofing for openings system is covered in the following section:

~

To be specified by others.

2.5

WEATHERTIGHTNESS SYSTEM

The weathertightness system is covered in the following section:

~

To be specified by others.

## 3112 REINFORCEMENT FOR CONCRETE

### 1. GENERAL

This section relates to the supply, cutting, bending and fixing of steel bar and steel welded reinforcement for concrete.

#### 1.1 RELATED WORK

**Refer to Structural Drawings**

#### 1.2 DOCUMENTS REFERRED TO

Documents referred to in this section are listed in 3100 CONCRETE GENERAL.

#### Requirements

#### 1.3 SELECTIONS AND DIAGRAMMS

Provide schedules and diagrams of bars and bar bending.

### 2. PRODUCTS

#### Materials

#### 2.1 GRADE 300E STEEL

To [AS/NZS 4671](#). Round bars are shown by symbol "R" and deformed bars by symbol "D", followed by the diameter in millimetres.

#### 2.2 GRADE 500E STEEL

To [AS/NZS 4671](#). Round bars shown by symbol "HR" and deformed bars by symbol "HD" followed by diameter in millimetres.

#### 2.3 WELDED WIRE FABRIC

Hard drawn steel wire spot welded with correct gauge to [AS/NZS 4671](#), smooth or deformed and to the spacings and dimensions either specified or shown on the drawings. All wire fabric/mesh for residential slabs on ground shall be to [AS/NZS 4671](#) Class E.

#### 2.4 TYING WIRE

Mild drawn steel wire not less than 1.2mm diameter.

#### Components

#### 2.5 SPACERS AND CHAIRS

Precast concrete or purpose made moulded PVC to approval. Where concrete spacer blocks are used in exposed concrete work use blocks matching surrounding concrete.

### 3. EXECUTION

#### Conditions

#### 3.1 HANDLE AND STORE

Handle and store all reinforcing steel and accessories without damage or contamination. Store on timber fillets on hard ground in a secure area clear of any building operation. Lay steel fabric flat.

#### 3.2 DELIVER ALL BUNDLES

Deliver all bundles of steel to the site clearly marked or tagged with numbers relating them to the bending schedule and drawings.

#### 3.3 CLEANLINESS

Keep reinforcement clean so that at the time of placing concrete it is free of all loose mill scale, loose rust and any other contamination that may reduce bonding capacity.

- 3.4 **PROJECTING REINFORCEMENT**  
Protect projecting reinforcement from the weather where rust staining of exposed concrete surfaces may occur.  
Protect and/or mark any projecting reinforcement where it provides a potential hazard to site personnel.
- Assembly**
- 3.5 **CUT AND BEND**  
Cut and bend bars using proper bending tools to avoid notching and to the requirements of [NZS 3101.1](#), 8 and [NZS 3109](#): 3.3 Hooks and bends. Minimum radii of reinforcement bends to [NZS 3101.1](#), 8 and [NZS 3109](#): table 3.1, Minimum radii of reinforcement bends. Do not rebend grade 500E bars. Where rebending is necessary for grade 300E bars, use a purpose built tool, proper preparation and preheating.
- 3.6 **ADJUSTMENTS**  
Use a purpose built tool for on site bending and to deal with minor adjustments to steel reinforcement.
- 3.7 **TOLERANCES, BENDING**  
To [NZS 3109](#): clause, 3.9 Tolerances for reinforcement.
- Application**
- 3.8 **SECURE REINFORCEMENT**  
Secure reinforcement adequately with tying wire and place accurately, supported adequately and secured against displacement when concreting. Bend tying wire back well clear of the formwork.
- 3.9 **SPACING**  
Spacing as dimensioned on the drawings but if not shown then the clear distance between parallel bars in a layer, or the distance between layers, or the spacing of other steel to the minimums laid down in [NZS 3109](#): clause 3.6, Spacing of reinforcement.
- 3.10 **TOLERANCES, SPACING**  
To [NZS 3109](#): clause 3.9, Tolerances for reinforcement.
- 3.11 **LAPPED SPLICES**  
Length of laps where not dimensioned on the drawings in accordance with [NZS 3101.1](#), 8.7 **Splices in reinforcement**, refer SELECTIONS. Increase laps for plain round steel by 100%. Provide laps only where indicated on the drawings. Tie all lapping bars to each other.
- 3.12 **WELDED SPLICES**  
No Quench and Tempered (QT) reinforcing bar shall be welded or preheated. For Microalloy reinforcing bars, carry out only if either specified on the drawings or after written approval from the Construction reviewer and then to the requirements of AS/NZS1554 and [NZS 3109](#): clause 3.7.2, Welded splices, in respect of developed strength and location. Welds shall not be permitted at bends in bars, and welding shall be carried out so that no undercutting of bar sizes occur.
- 3.13 **MECHANICAL SPLICES**  
Use only where shown on drawings. Use the appropriate sleeve size and length, swaged onto the bars using correct die and hydraulic press all to the manufacturer's requirements. Notify when ready for inspection and carry out tests if required.
- 3.14 **STEEL SPACERS**  
Fix spacers between layers of wall reinforcement at 1.0 metre centres minimum.
- 3.15 **MINIMUM COVER**  
Unless noted otherwise on the drawings, minimum cover to all reinforcing bars, stirrups, ties and spirals to [NZS 3101.1](#) **Tables 3.6 and 3.7**, and [NZS 3109](#): clause 3.8, Cover.

- 3.16 **TOLERANCES, COVER**  
Tolerances on cover relative to the values in [NZS 3109](#): clause 3.9 Tolerances for reinforcement. Tolerances shall be +5mm all positions, but in no case shall cover be less than that shown on the drawings.
- 3.17 **FIX CHAIRS**  
Fix chairs for top reinforcement in slabs at 1.0 metre centres or to ensure adequate support.
- 3.18 **CONCRETE SPACER BLOCKS**  
Where required in exposed concrete work, make from same materials and mix as the surrounding concrete.
- 3.19 **WELDED WIRE FABRIC**  
Hard drawn steel wire spot welded to [AS/NZS 4671](#), smooth or deformed and to the spacings and dimensions either specified or shown on the drawings. Laps to NZS 3101, lap one mesh square plus 50mm minimum (do not count bar extensions beyond the outermost wire).  
**Completion**
- 3.20 **REMOVE**  
Remove all debris, unused materials and elements from the site.

#### 4. **SELECTIONS**

##### 4.1 **REINFORCEMENT LAPS**

Where reinforcement laps are not shown on the drawings, lap as follows:

Bar Diameter	Grade 300E deformed	Grade 500E deformed
10mm	400mm	650mm
12mm	500mm	750mm
16mm	650mm	1000mm
20mm	800mm	1250mm
25mm	1000mm	1600mm
32mm	1200mm	2000mm

##### 4.2 **WELDED WIRE FABRIC**

Type: 665 mesh  
Wire diameter: ~mm  
Pitch: ~mm

## 3120 CONCRETE

### 1. GENERAL

This section relates to formwork, reinforcement, concrete mixes and the placing of concrete.

#### 1.1 RELATED WORK

**Refer to Structural Drawings**

#### 1.2 DOCUMENTS

Refer to the general section 1233 REFERENCED DOCUMENTS. The following documents are specifically referred to in this section:

<a href="#">NZBC B1/AS1</a>	Structure
<a href="#">NZBC E2/AS3</a>	External moisture
AS 1366.3	Rigid cellular plastics for thermal insulation - Rigid cellular polystyrene - Moulded (RC/PS - M)
<a href="#">NZS 3101.1</a>	Concrete structures standard
<a href="#">NZS 3104</a>	Specification for concrete production
<a href="#">NZS 3109</a>	Concrete construction
<a href="#">NZS 3114</a>	Specification for concrete surface
finishes <a href="#">NZS 3604</a>	Timber-framed buildings
<a href="#">AS/NZS 4671</a>	Steel reinforcing materials
<a href="#">AS/NZS 4858</a>	Wet area membranes
CCANZ CP 01	Code of practice for weathertight concrete and concrete masonry construction

### 2. PRODUCTS

#### 2.1 NORMAL CONCRETE

Normal concrete 25 MPa grade, (refer to SELECTIONS), maximum aggregate size 19mm ready-mixed to [NZS 3104](#). Provide delivery dockets listing mix and despatch details.

#### 2.2 SITE CONCRETE

Special concrete 10 MPa with minimum water for workability, all materials and batching to [NZS 3104](#), table 3.1, Prescribed mixes (P).

#### 2.3 REINFORCEMENT

Bars to [AS/NZS 4671](#). Grade 300E deformed, other than for ties, stirrups and spirals, unless shown otherwise on the drawings. Welded reinforcing mesh to [AS/NZS 4671](#). All reinforcing and mesh for residential slabs on ground shall be to [AS/NZS 4671](#) Class E.

#### 2.4 TYING WIRE

Mild drawn steel wire not less than 1.2mm diameter.

#### 2.5 SPACERS AND CHAIRS

Precast concrete or purpose made moulded PVC to approval. Where concrete spacer blocks are used in exposed concrete work use blocks matching surrounding concrete.

#### 2.6 DAMP-PROOF MEMBRANE

0.25mm minimum polyethylene to [NZS 3604](#), 7.5.4, Damp-proof membrane.

### 3. EXECUTION

#### 3.1 HANDLE AND STORE

Handle and store reinforcing steel and accessories without damage or contamination. Store on timber fillets on hard ground in a secure area clear of any building operation. Lay steel fabric flat.

Ensure reinforcement is clean and remains clean so that at the time of placing concrete it is free of all loose mill scale, loose rust and any other contamination that may reduce bonding capacity.

### 3.2 FALSEWORK AND FORMWORK

Use falsework and formwork of sufficient strength to retain and support the wet concrete to the required profiles and tolerances. Select formwork finish to produce the specified finished quality. Ensure timber or plywood used for formwork is non-staining to the set concrete.

Securely fix and brace formwork sufficiently to support loads and with joints and linings tight enough to prevent water loss. Do not use tie wires or rods unless approved in writing by the Contract Administrator. Unless detailed otherwise, provide a 19mm chamfer or fillet strip at all interior and exterior angles of beam and column forms. Mitre at intersections.

Water blast to clean formwork. Keep formwork wet before concrete is placed.

Unless detailed otherwise, set up soffit boxing for beams and slabs to provide a camber when forms are stripped, of 3mm rise for every 3 metres of total clear span.

### 3.3 INSTALL DAMP-PROOF MEMBRANE

Apply polythene membrane to prepared basecourse with 150mm laps between sheets. Tape seal laps and penetrations with 50mm wide pressure sensitive plastic tape. Refer to drawings for perimeter details.

### 3.4 CUT AND BEND REINFORCEMENT

Cut and bend bars using proper bending tools to avoid notching and to the requirements of [NZS 3109](#): 3.3 Hooks and bends. Minimum radii of reinforcement bends to [NZS 3109](#), table 3.1, Minimum radii of reinforcement bends. Do not rebend bars. Where rebending is approved, use a purpose built tool, proper preparation and preheating.

### 3.5 ADJUSTMENTS

Use a purpose built tool for on site bending and to deal with minor adjustments to steel reinforcement.

### 3.6 TOLERANCES, BENDING

To [NZS 3109](#), 3.9, Tolerances for reinforcement.

### 3.7 SECURE REINFORCEMENT

Secure reinforcement adequately with tying wire and place, support and secure against displacement when concreting. Bend tying wire back well clear of the formwork. Spacing as dimensioned, or if not shown, to the clear distance minimums in [NZS 3109](#), 3.6, Spacing of reinforcement.

### 3.8 LAPPED SPLICES

Length of laps where not dimensioned on the drawings in accordance with the SELECTIONS. Increase laps of plain round steel by 100%. Provide laps only where indicated on the drawings. Tie all lapping bars to each other.

Welded wire mesh laps to [NZS 3101](#), lap one mesh square plus 50mm minimum (do not count bar extension beyond the outermost wire).

### 3.9 REINFORCEMENT COVER

Minimum cover to all reinforcing bars, stirrups, ties and spirals, as shown on drawings. Where cover is not shown on drawings provide minimum cover to [NZS 3101](#).1, table 3.6, Minimum required cover for a specified intended life of 50 years. Fix chairs for top reinforcement in slabs at 1.0 metre centres or to ensure adequate support. Cover tolerances to [NZS 3109](#), 3.9, Tolerances for reinforcement.

### 3.10 CASTING IN

Build in all grounds, bolts and fixings for wall plates and bracing elements, holding down bolts, pipes, sleeves and fixings as required by all trades and as shown on the drawings, prior to pouring the concrete.



Do not use grounds exceeding 100mm in length. Location and form of conduits to be approved in writing by the Contract Administrator. Minimum cover 40mm. Do not encase aluminium items in concrete. Do not paint steel embedded items more than 25mm into the concrete encasement. Cut back form ties to specified cover and fill the cavities with mortar.

Form all pockets, chases and flashing grooves as required by all trades and as shown on the drawings.

Wrap all pipes embedded in concrete with tape to break the bond and to accommodate expansion. Do not embed pipes for conveying liquids exceeding a temperature of 50°C in concrete.

3.11 PRE-PLACEMENT INSPECTION

Do not place concrete until all excavations, boxing and reinforcing have been inspected and passed by the Building Consent Authority and Construction Reviewer.

3.12 SURFACE FINISHES

To [NZS 3114](#), 105, Specification of finishes, as scheduled or as denoted on the drawings.

3.13 CONCRETE SURFACE TOLERANCES

To [NZS 3114](#), 104, Surface tolerances and [NZS 3114](#), 105, Specification of finishes, with the suggested tolerances becoming the required tolerances.

3.14 PUMPING CONCRETE

Set up and supervise pump operation, placing and compaction of the mix to [NZS 3109](#), 7.4, Handling and placing and [NZS 3109](#), 7.6, Compaction Advise the ready-mix supplier of the type of pump and the slump required, in addition to the concrete grade, strength and quantity.

3.15 COMPACTION

Use power operated vibrators on foundations, vertical constructions and beams.

3.16 SAW CUTS

Cut slabs where indicated on the drawings and to the approval of Client Representative and as required to control shrinkage cracking. Carry out cutting as soon as possible, without causing tear-out of aggregate and before shrinkage cracking has occurred, generally within 24 hours of pouring. Where saw cuts are made, cut out 100mm of every second wire of the mesh for a length of 50mm each side of the saw cut position. Saw cuts: 1/3 slab depth or 30mm minimum.

3.17 SURFACE DEFECTS

Make good surface defects immediately after forms are stripped. Make good hollows or bony areas with 1:2 mortar or plaster, finished to the same tolerances as the parent concrete. Fill any tie rod holes with 1:2 mortar.

3.18 CURING OF CONCRETE

Keep damp for not less than seven days. Ensure curing of slabs commences as soon as possible after final finishing, by the use of continuous water sprays, or ponding. Alternately, apply a curing membrane. Ensure any membrane used will not affect subsequent applied finishes.

3.19 STRIKE FORMWORK

Strike formwork without damaging or overloading structure. Do not remove formwork before the following minimum periods:

12 hours:	Sides of beams, walls and columns
4 days:	Slabs in beam and slab construction (leave props under slab spans over 2 metres)
10 days:	Props from under slab spans over 2 metres
18 days:	Beams, soffits and slab spans over 5 metres

3.20      **CLEAN OUT**  
Clean out saw cuts. Fill with cement grout where the floor will be covered with carpet or vinyl.

3.21      **REMOVE**  
Remove all unused materials and all concrete and reinforcing debris from the site.

#### **4.      SELECTIONS**

4.1      **DAMP-PROOF MEMBRANE**  
Brand/type:            to be specified by others

4.2      **REINFORCEMENT LAPS**  
Where reinforcement laps are not shown on the drawings, lap as follows:

Bar diameter	Grade 300E deformed
10mm	400mm
12mm	500mm
16mm	650mm

4.3      **CONCRETE**  
Normal concrete:  
25 MPa:                Slab  
25 MPa:                Foundations  
  
Prescribed concrete:  
10 MPa:                Site concrete, bedding concrete and for setting posts  
25 MPa:                As required by [NZS 3604](#) and for exposed concrete in sea spray zone

## **3121 CONCRETE PLACEMENT**

### **1. GENERAL**

This section relates to the handling, placing and curing of concrete.

#### **1.1 RELATED SECTIONS**

**Refer to Structural Drawings**

#### **1.2 DOCUMENTS REFERRED TO**

Documents referred to in this section are listed in 3100 CONCRETE GENERAL.

### **2. PRODUCTS**

#### **Materials**

#### **2.1 CONCRETE MIXES**

Refer to 3129 CONCRETE PRODUCTION.

#### **Equipment**

#### **2.2 VIBRATION EQUIPMENT**

Provide vibration equipment as required by [NZS 3109](#).

### **3. EXECUTION**

#### **Conditions**

#### **3.1 UNFAVOURABLE CONDITIONS**

Do not place concrete in high winds or other unfavourable conditions. Refer to [NZS 3109](#): 7.2 Unfavourable conditions, for when concrete may not be placed. Remove and make good concrete damaged by frost, dry and wet conditions.

#### **3.2 DEFECTS**

Reject concrete with structural defects. Immediately after stripping formwork, identify all defects and obtain direction. Do not carry out any repair work until directed and then only in accordance with the direction. Repair defects by cutting out, making good and replacing, or otherwise as directed.

#### **3.3 EXISTING WORK**

Protect existing work from damage and make junctions to existing work as detailed.

#### **3.4 INSPECTIONS BY BUILDING CONSENT AUTHORITY**

Notify for inspection sufficiently in advance before placing concrete and any necessary rectification of formwork, reinforcement and construction joint stops. Pour concrete only between properly positioned stops.

#### **3.5 INSPECTIONS BY CONSTRUCTION REVIEWER**

Notify for inspection sufficiently in advance before placing concrete and any necessary rectification of formwork, reinforcement and construction joint stops. Pour concrete only between properly positioned stops.

#### **3.6 PREPARATORY WORK**

Ensure at the time of placing, that surfaces to receive the concrete, are clean, free of debris and with no free water present. Thoroughly clean reinforcement to remove any release agent or other deleterious surface deposit.

#### **3.7 WETTING OF FORMWORK**

To [NZS 3109](#): clause 7.3, Preparation for concreting, subclause 7.3.2.

## **Application**

- 3.8      **PROTECT CONCRETE WORK**  
Protect formwork, reinforcement, "build in" items and fresh concrete from damage, as the pour is placed, making good any damage if it occurs.
- 3.9      **TRANSPORT CONCRETE**  
Transport concrete from agitator to final placement as quickly as possible using means that avoid segregation.
- 3.10     **PLACE CONCRETE**  
Place concrete in layers not more than 500mm deep, compacted and vibrated. Do not place fresh concrete against the preceding layer after more than 45 minutes, or such lesser time as required by the circumstances, to [NZS 3109](#): clause 7.4, Handling and placing.
- 3.11     **COMPACT CONCRETE**  
To [NZS 3109](#): clause 7.6, Compaction. Compact by vibration of the concrete to expel entrapped air and until settlement of the concrete is visibly evident over all areas of the surface. Maintain vibration until settlement ceases and coarse aggregate at the surface is embedded. Do not continue vibration beyond reaching this condition.
- 3.12     **VIBRATORS**  
Use sufficient immersion vibrators, with one spare for emergency, to ensure that vibration is achieved throughout the entire volume of each layer of concrete, and until complete compaction is reached, to [NZS 3109](#): clause 7.6, Compaction.

## **Finishing**

- 3.13     **SCREED THE SURFACE**  
Screed the concrete surface by straight edge or vibrating screed immediately after compaction and to tolerances in [NZS 3109](#): table 5.2, Tolerances for in situ construction.
- 3.14     **SAW CUTS**  
Cut slabs where indicated on the drawings and to the approval of Client Representative and as required to control shrinkage cracking. Carry out cutting as soon as possible, without causing tear-out of aggregate and before shrinkage cracking has occurred, generally within 24 hours of pouring. Where saw cuts are made, cut out 100mm of every second wire of the mesh for a length of 50mm each side of the saw cut position. Saw cuts: 1/3rd slab depth or 30mm minimum.
- Spacing of sawcuts**
- 3.15     **SURFACE FINISH**  
Refer to 3124 FINISHES TO WET CONCRETE
- 3.16     **CURING METHOD**  
Notify the Engineer of the curing method to be used for this work.
- 3.17     **CURING PERIOD**  
Cure all concrete of normal cement type and mixing proportions for a minimum of 7 days. Keep time between placing of concrete and the start of curing to an absolute minimum. Ensure curing is continuous.
- 3.18     **PONDING**  
Build a temporary retaining lip around the concrete slab and pond with water, keeping the depth constant over the curing period.
- 3.19     **SPRINKLING**  
Apply a fine spray of water continuously over the curing period through a system of nozzles placed to cover the whole of the concrete work being cured.

- 3.20      **WET COVERINGS**  
Cover the whole of the concrete work being cured, including edges with hessian, or similar, and keep continuously moist so that a film of water remains on the concrete surface throughout the curing period.
- 3.21      **PLASTIC SHEETS**  
Cover the whole of the concrete being cured with polyethylene or other waterproof sheet material for the whole of the curing period. Fit closely, carry down over edges and tape as necessary to contain moisture.
- 3.22      **KEEP FORMWORK MOIST**  
Keep formwork left in place continuously moist by sprinkling with water over the curing period. Continue sprinkling the exposed surface if the formwork is removed before the end of the curing period.
- 3.23      **SECURE COVERINGS**  
When covering with sheet materials, ensure that edges are well secured throughout the specified curing period, to prevent draughts passing over the surfaces of the concrete.
- 3.24      **COLD WEATHER**  
Do not use coverings employing water at times of freezing weather.
- 3.25      **PROTECT PLASTIC CONCRETE**  
Protect plastic concrete from indentation and surface marking.
- 3.26      **PROTECT HARDENED CONCRETE**  
Protect surfaces of stripped concrete from damage especially at arrises.
- 3.27      **PROTECT EXPOSED SURFACES**  
Protect from rust marks and other surface disfigurements.

### **Completion**

- 3.28      **CLEAN AND DRESS**  
Clean and dress all surfaces, leaving them to the standard of finish specified for the work to follow.
- 3.29      **CLEAN UP**  
Clean up surrounding areas. Dispose of surplus concrete away from the site.
- 3.30      **REMOVE**  
Remove all debris, unused materials and elements from the site.

## 3321 CONCRETE MASONRY - ENGINEERED

### 1. GENERAL

This section relates to the supply and installation of hollow concrete masonry to [NZS 4230](#) including;

- concrete masonry, mortar, reinforcement and grouting
- self insulating concrete masonry

#### 1.1 RELATED WORK

**Refer to Structural Drawings**

#### 1.2 DOCUMENTS

Refer to the general section 1233 REFERENCED DOCUMENTS. The following documents are specifically referred to in this section:

<a href="#">NZBC B1/VM1</a>	Structure
<a href="#">AS/NZS 2699</a>	Built-in components for masonry
<a href="#">NZS 3101.1</a>	Concrete structures standard - The design of concrete structures
<a href="#">NZS 3103</a>	Specification for sands for mortars and plasters
<a href="#">NZS 3104</a>	Specification for concrete production
<a href="#">NZS 3109</a>	Concrete construction
<a href="#">NZS 3112.1</a>	Methods of test for concrete - Tests relating to fresh concrete
<a href="#">NZS 3121</a>	Specification for water and aggregate for concrete
<a href="#">NZS 3604</a>	Timber-framed buildings
<a href="#">NZS 4210</a>	Masonry construction: Materials and workmanship
<a href="#">NZS 4230</a>	Design of reinforced concrete masonry structures
<a href="#">AS/NZS 4455.1</a>	Masonry units, pavers, flags, and segmental retaining wall units - Masonry units
<a href="#">AS/NZS 4671</a>	Steel reinforcing materials
<a href="#">AS/NZS 4858</a>	Wet Area membranes
<a href="#">CCANZ CP 01</a>	Code of practice for weathertight concrete and concrete masonry construction

### Requirements

#### 1.4 QUALIFICATIONS

Carry out all masonry work with people competent and experienced in this type of work, under the supervision of a registered mason or a suitably qualified tradesperson as required in [NZS 4210](#). ~~Blocklayers are to hold a current NZ Masonry Trades Association Certificate.~~

#### 1.5 CONSTRUCTION CONTROL

Supervise masonry construction to [NZS 4230](#), table 3.1, Observation Type A, admissible use and nominal strengths. Keep records of materials to [NZS 4210](#), 2.4.2. and to the test requirements listed in this section.

#### 1.6 CONSTRUCTION OBSERVATION BY ENGINEER

Inspections shall confirm compliance with the design and the required standards of construction.  
Obtain from the engineer Producer Statement (PS4) required relating to the masonry construction.  
Advise the engineer when inspections are required.

#### 1.7 QUALITY RECORDS

Keep accurate records relating to strength and quality of materials used in the construction, and make the information available to the Building Consent Authority inspector on request.

Do not place grout until all blockwork and reinforcing have been inspected and passed by the Engineer and the Building Consent Authority.

## 1.8 SELECTED MASONRY

Refer to the drawings for areas of masonry, which require select quality blocks to both sides, self-insulating masonry or for weatherproof construction.

## 1.9 DURABILITY

To [NZS 4230](#), Table 4.1 - **Masonry durability requirements**, and mortar to [NZS 4210](#), Table 2.E1. Refer to SELECTIONS.

<b>Exposure NZS 3604 zones</b> Figure 4.2	<b>Exposure NZS 3101 Classification</b> Table 3.1	<b>Durability Mortar from NZS 4210</b> (Note 1)	<b>Durability Built in Components</b> (Note 2)	<b>Durability Minimum Cover Reinforcement</b> (Note 3)
Zone D	B2	M4	R4	60 (30)mm
Zone C	B1	M4	R3	50 (20)mm
Zone B	A2	M3	R3	45 (15)mm
Closed interiors	A1	M2	R1	35 (5)mm
Walls against earth	B2	M4	R4 (from <a href="#">NZS 4210</a> )	60 (30)mm (from <a href="#">NZS 4210</a> )
Geothermal hotspots	U	M4	R5	Special study
Zone E (NZBC E2/AS1)	C	M4	R4	60(30)mm

Notes:

1. Mortar mixes to [NZS 4210](#), 2.2.2.1.
2. Classifications to the three parts of [AS/NZS 2699](#), R1 is light to heavy galvanized, R3 is heavy hot-dip galvanized, R4 is 316 stainless steel, R5 specific performance.
3. Cover is measured from the outside face of the block, assuming 30mm shell thickness (or in brackets to the inside face of the block cell)

### Performance - tests

## 1.10 TESTS

Carry out all required tests to [NZS 4210](#), appendix 2A, **Compressive strength tests for mortar and grout**.

## 1.11 TESTING PROCEDURES

Provide advance notice of all or any cell filling work. Maintain on site all equipment necessary for taking and preparing samples for test. Retain records of all test results and supply on request.

## 1.12 SPREAD OF GROUT

If requested, carry out tests to NZS 3112, part 1, to the requirements of [NZS 4210](#).

## 1.13 COMPRESSIVE STRENGTH OF GROUT

If requested, carry out tests to [NZS 4210](#), appendix 2.A, **Compressive strength tests for mortar and grout**, with 3 specimens per test.

## 1.14 COMPRESSIVE STRENGTH OF MORTAR

If requested, carry out tests to [NZS 4210](#), appendix 2.A, **Compressive strength tests for mortar and grout**, with 3 specimens per test.

## 1.15 MASONRY TO MORTAR BOND TEST

If requested, carry out tests to [NZS 4210](#), appendix 2.B, **Masonry to mortar bond strength test**, with 6 specimens per test.

- 1.16 EXPANSION OF GROUT  
If requested, carry out tests to [NZS 4210](#), appendix 2.C, **Test for expansion of grout**.
- 1.17 RECORDS OF TESTS  
To [NZS 4210](#) and kept on site:  
- spread of grout tests  
- grout supplier's test certificates.
- 2. PRODUCTS**
- Materials**
- 2.1 MASONRY  
To [AS/NZS 4455.1](#) with true and unblemished surfaces and arises and from a single manufacturer. Knock-in bond beam masonry not to be used. Use appropriate masonry for intermittently filled construction where vertical reinforcement is placed prior to laying of masonry.
- Components**
- 2.2 REINFORCEMENT  
To [AS/NZS 4671](#), deformed mild steel except for ties in plain round mild steel and as detailed.
- 2.3 SAND FOR MORTAR  
Sand to comply with [NZS 3103](#). Chloride levels not exceeding 0.04% by dry weight of sand.
- 2.4 MORTAR  
To [NZS 4210](#), 2.2 **Mortar**.  
Mix: M2, M3 or M4, refer to DURABILITY in SELECTIONS  
Strength: 12.5 MPa  
Bond strength: 200 kPa  
Pigment: to [NZS 3117](#)  
Do not rework if not used within 1.5 hours of adding cement.  
A plasticizer may be used instead of lime.
- 2.5 COARSE AGGREGATE GROUT  
To [NZS 4210](#), 2.3 **Grout**.  
Mix: 3:8:4 - cement: concreting sand: coarse aggregate  
Strength: 20 MPa at 28 days (normal grout)  
Aggregate: 4.75mm to 13.2mm maximum  
Spread value: 450mm to 530mm  
Ready mix: To [NZS 3104](#) with a copy of the mix design information
- 2.6 FINE AGGREGATE GROUT  
To [NZS 4210](#), 2.3 **Grout**.  
Mix: 2:7 - cement: concreting sand  
Strength: 20 MPa at 28 days (normal grout)  
Aggregate: 4.75mm to 6mm maximum  
Spread value: 450mm to 530mm  
Ready mix: To [NZS 3104](#) with a copy of the mix design information
- 2.7 EXPANSIVE AGENT  
Proprietary admixture providing controlled expansion prior to initial set. Use in strict accordance with the manufacturers requirements. Add the required measured dose of agent to the agitator truck on site, immediately prior to grouting. Ensure thorough mixing for 3 to 5 minutes before discharge.
- 2.8 WATER  
To [NZS 3121](#). Water from a territorial authority/NUO water supply is acceptable.



### 3. EXECUTION

#### Conditions

- 3.1 MASONRY CONSTRUCTION GENERALLY  
To [NZS 4210](#), [NZS 4230](#) and [NZBC B1/VM1](#).

3.2 STORAGE

Store masonry units clear of the ground, under cover and well ventilated until placed in the work.

Handle and store reinforcing steel and accessories without damage or contamination. Store on timber fillets on hard ground in a secure area clear of any building operation. Lay steel fabric flat.

Ensure reinforcement is clean and remains clean so that at the time of placing concrete it is free of all loose mill scale, loose rust and any other contamination that may reduce bonding capacity.

3.3 MOISTURE CONTENT

Ensure that blocks are air-dry prior to laying. If necessary to reduce excess absorption of water from the mortar, some dampening of the surface is permissible but no surface water may be present at the time of placing mortar.

3.4 CHECK BASE

Ensure the base concrete is true to line and level, requiring a base mortar bed of 10mm (minimum) to 20mm (maximum). Ensure that all laitance, loose aggregate, or anything preventing bond is removed prior to laying masonry units.

If more than 20mm thickness of mortar bed is needed to correct inaccuracies obtain written direction on remedial action.

3.5 STARTER POSITIONS

Before commencing laying masonry units, check the location of starter reinforcement by measure or by a dry trial lay up of the first course. Do not correct misplacement by cranking bars. Where misplacement exceeds the location tolerance, obtain written direction before proceeding.

3.6 TOLERANCES

Construct within the tolerances set out in [NZS 4210](#), 2.6.5, **Tolerances** and clause 2.7, **Laying the units**, unless specified otherwise on the drawings or in this specification. Lay blocks with jointing of consistent thickness throughout.

Lay masonry to an even, plane surface with no deviation exceeding 3mm in 3 metres on any surface in view in the finished work.

3.7 CONSTRUCTION JOINTS

Ensure the structural integration of all masonry with adjacent concrete work by providing well roughened, retarded construction joints at all junctions.

All construction joints between grout and concrete and between grout and grout similar to Type B as described in [NZS 3109](#), 5.6.3, prepared using an approved retarder, except that the roughness at fine grout surfaces may be  $\pm 1.5\text{mm}$  above and below the average level. Use a "double strength" retarder if necessary to suit the high cement content of the grout.

Vertical joints between masonry and concrete to achieve full structural integration across the joints. Allow to construct concrete work first with prepared vertical construction joints at block junctions the same as for horizontal construction joints. Lay masonry so that all courses have open ends abutting the existing concrete work.

3.8 COVER

Cover to [NZS 4230](#), Table 4.1 - **Masonry durability requirements**, refer to DURABILITY clause in SELECTIONS. Maintain reinforcing bars for retaining walls and bond beams, a minimum of 15mm, and for other masonry a minimum of 9mm, from the masonry work face, with the space filled with grout.

- 3.9            **PROTECTION**  
Keep fair face block walls clean of mortar droppings, grout splashes, or stains of any kind as the work proceeds and before any droppings set.
- 3.10          **WEATHER PRECAUTIONS**  
When extreme temperatures prevail, either below 4°C or above 27°C, make adjustments to construction as listed in [NZS 4210](#), 2.18, **Cold weather construction**, and clause 2.19, **Hot weather construction**. Do not use expansive grout for filling in temperatures below 5°C.
- Application**
- 3.11          **SELECTION**  
For fair face walls select blocks for consistent colour, texture and lack of imperfections.
- 3.12          **BONDING PATTERN**  
Unless specifically shown or described otherwise, lay masonry in running bond with full masonry bonding at intersections.
- 3.13          **OPEN-ENDED DEPRESSED WEB MASONRY**  
Use open-ended depressed web masonry throughout all courses in fully grouted walls.
- 3.14          **CUTTING**  
Always use a masonry saw to provide clean, accurate cuts, without chips.
- 3.15          **BEDDING FOR INTERMITTENTLY FILLED WALLS**  
Lay blocks on shell bedding, with full bedding of the cross webs at positions of filled cells of intermittently filled walls. Ensure tightly filled perpend.
- 3.16          **SHELL BEDDING**  
Lay masonry on full mortar beds under face shells only where fully grouted.
- 3.17          **BOTTOM COURSE**  
For fully grouted walls use inverted open-end depressed web bond beam masonry for the first course, to permit clean-out of grout space at the base.
- 3.18          **CLEAN OUT HOLES**  
Use special clean-out masonry or saw off a 100mm x 200mm high section of face shell at the base of all cells containing reinforcement, to form clean out and inspection holes.
- 3.19          **GROUT SPACE**  
Ensure that grouting cells at reinforcement locations are continuously clear by removal of projecting mortar. Ensure tightly filled perpend and beds.
- 3.20          **REINFORCEMENT**  
Cut and bend bars using proper bending tools to avoid notching and to the requirements of [NZS 3109](#). Do not rebend bars. Where rebending is approved, use a purpose built tool, proper preparation and preheating.
- 3.21          **TIE REINFORCING STEEL**  
Tie vertical reinforcing steel to starter bars prior to laying blocks. Lay and tie horizontal bars as the work proceeds.
- 3.22          **REINFORCEMENT LAPS**  
Minimum reinforcing laps schedule (except as noted otherwise on the drawings)

BAR TYPE	LAPS
Deformed grade 300E bars	40 diameters
Deformed grade 500E bars	70 diameters
Plain round (with hooks)	60 diameters

Plain round (no hooks)	100 diameters
Bars larger than 25mm dia.	welded

- 3.23 **BRACING**  
Provide temporary lateral bracing where necessary to ensure stability and until final supporting construction is in place.
- 3.24 **FLUSH JOINTS**  
Finish joints which are not visible in the completed work, or in walls to be plastered, by striking off flush with the trowel.
- 3.25 **TOOLED JOINTS**  
Finish joints on exposed masonry by tooling to produce a neat joint. Refer to SELECTIONS for joint type.
- 3.26 **WEATHERPROOF JOINTS**  
Where weatherproof construction is specified, take extra care to ensure that all joints are tightly filled and tooled to provide an impervious panel between control joints.
- 3.27 **CONTROL JOINTS**  
To [NZS 4210](#), [NZS 4230](#) and [NZBC B1/VM1](#).  
To [NZS 4230](#), 3.5.2.6, **Shrinkage and shrinkage/thermal control joints**, and to [NZS 4230](#), Figure 3.1, **Shrinkage control joints**, locate as shown on drawings and not more than 7.8 metres apart.  
[NZS 4230](#), Figure 3.1a should only be used for block walls directly supported on grade.  
[NZS 4230](#), Figure 3.1b should be used for block walls supported on beams or on grade.  
Rake out and prime adhesion faces of vertical control joints between masonry and between masonry and concrete as required by the sealant manufacturer. Use masking tape to avoid over-run of sealant onto the block face. Install a backing strip to limit sealant depth to 10mm, and insert sealant, all to the manufacturer's requirements.  
Discontinue grouting of bond beams at control joint locations unless specifically noted otherwise.
- 3.28 **CONTROL JOINTS - HORIZONTAL REINFORCEMENT**  
To [NZS 4230](#), Figure 3.1, **Shrinkage control joints**, single or two walls as shown on drawings.  
  
[NZS 4230](#), Fig 1a for block walls on grade only - Two wall, discontinuous reinforcement: Horizontal reinforcement other than as noted above shall be discontinuous at control joints. Debond reinforcement passing through control joints with bond break tape for 300mm minimum or as specified. Cells within the masonry units either side of the control joints shall be vertically reinforced and grouted.  
  
[NZS 4230](#), Fig 1b for block walls on beams or grade - Single wall, continuous reinforcement: Reinforcement required in lintels and in top course bond beams connecting to floors and roofs shall be continuous through control joints. Debond reinforcement passing through control joints with bond break tape for 150mm minimum either side of the joint or as specified.
- Application - grouting**
- 3.29 **INSPECTION**  
Inspect clean-out holes prior to grouting. Ensure that cells are clean and reinforcement is correctly placed. Mortar back the clean-out hole shell after verifying the adequacy of grout filling. If holes are covered in the completed work, boxing across the face may replace the shell infill. Brace hole infills to prevent blowouts during grouting.  
  
Notify when work is ready for inspection.

- 3.30      **GROUTING OF CELLS**  
Only grout all masonry cells, below finished grades, in retaining walls, where fixing devices occur and all other cells containing reinforcing.
- 3.31      **GROUT CELLS**  
Grout all masonry unit cells.
- 3.32      **GROUTING, HIGH LIFT WITH EXPANSIVE**  
Fill masonry walls using the "high lift with expansive admixture method" to [NZS 4210](#), 2.12 up to a maximum height of 3600mm in a semi-continuous operation. Consolidate by immersion vibrator or rodding. Wait for expansion to take place and locally re-compact the top of the wall by trowelling, or place a weighted board on top of the wall to contain the expansion.
- 3.33      **LIMIT RATE**  
Limit rate of pour to avoid hydrostatic blowouts.

**Application - ancillary work**

- 3.34      **HOLES AND CUT MASONRY**  
Provide all necessary holes, pockets and chases. Cut blocks when non-standard shapes are required. When cut masonry units are used, ensure vertical joints in adjacent courses are no closer than 100mm. Subsequent cutting away of masonry to form holes is not permitted.
- 3.35      **BUILT IN ELEMENTS**  
As the work proceeds, mortar in place elements such as sills, copings, lintels, and steps.
- 3.36      **BUILT IN FIXINGS**  
Build in all necessary plugs, bolts, ties, metal flashings, dowels, fastenings and fixings required by this and other work sections. Co-operate with others to meet this requirement. Fixings only permitted into filled cells.
- 3.37      **ELECTRICAL WORK**  
Ensure that provision for and fitting of boxes, conduit and pre-wiring are made and done as the work proceeds under the direction of the electrician.

**Completion**

- 3.38      **PROGRESSIVE CLEANING**  
Clean off mortar splashes and grout spills as they occur.
- 3.39      **FINAL CLEANING**  
At completion, clean down block work, remove efflorescence and remove waste materials from adjoining surfaces and floors.
- 3.40      **REPLACE**  
Replace damaged, cracked or marked elements.
- 3.41      **LEAVE**  
Leave work to the standard required by following procedures.
- 3.42      **REMOVE**  
Remove debris, unused materials and elements from the site.

**4. SELECTIONS**

- 4.1      **INSPECTION NOTIFICATION REQUIREMENTS**  
Give sufficient notice of inspections.
- 4.2      **INSPECTIONS BY CONSTRUCTION REVIEWER**  
As required by LDS and BCA

- 4.3 INSPECTIONS BY BUILDING CONSENT AUTHORITY  
As required by BCA
- 4.4 DURABILITY - PROJECT REQUIREMENTS  
Refer to clause DURABILITY.
- Refer to Structural General Notes & NZS 4229
- 4.5 MASONRY UNITS  
Brand: To be approved by Client Representative  
Width: 190mm  
Bond: Stretcher
- 4.6 MORTAR JOINTS  
Location: To be approved by Client Representative  
Joint profile: Concave  
Mortar colour: None
- 4.7 COARSE AGGREGATE GROUT Design  
strength: 20 MPa at 28 days  
Aggregate size: 13.2mm maximum  
Grout expansion: ~ % prior to initial set  
Note; if expansive agents are used the minimum strength must be 20 MPa or the design strength whichever is greater.
- 4.8 FINE AGGREGATE GROUT  
Design strength: 20 MPa at 28 days  
Aggregate size: 6mm maximum  
Grout expansion: ~ % prior to initial set  
Note; if expansive agents are used the minimum strength must be 20 MPa or the design strength whichever is greater.
- 4.10 WEATHERTIGHTNESS SYSTEM  
The weathertightness system is covered in the following section:  
~
- To be specified by others.

## 3410 STRUCTURAL STEELWORK - BASIC

### 1. GENERAL

This section relates to the fabrication, erection and specialist coating of structural steelwork of a general nature.

#### 1.1 DOCUMENTS

Refer to the general section 1233 REFERENCED DOCUMENTS. The following documents are specifically referred to in this section:

<a href="#">NZBC F5/AS1</a>	Construction and demolition hazards
<a href="#">AS/NZS 1252</a>	High-strength steel bolts with associated nuts and washers for structural engineering
<a href="#">AS/NZS 1554.1</a>	Structural steel welding - Welding of steel structures
<a href="#">AS 1627.4</a>	Metal finishing - Preparation and pretreatment of surfaces - Abrasive blast cleaning
<a href="#">AS 1627.9</a>	Metal finishing - Preparation and pretreatment of surfaces - Pictorial surface preparation standards for painting steel surfaces
<a href="#">AS/NZS 2312</a>	Guide to the protection of iron and steel against atmospheric corrosion by the use of protective coatings
<a href="#">NZS 3404.1:1997</a>	Steel Structures Standard
<a href="#">AS 3828</a>	Guidelines for the erection of building steelwork
<a href="#">AS/NZS 4680</a>	Hot-dip galvanized(zinc) coatings on fabricated ferrous articles
<a href="#">HERA R4-99</a>	Specification for the fabrication, erection and surface treatment of structural steelwork

#### 1.3 QUALIFICATIONS

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

#### 1.4 SHOP DRAWINGS

Supply 1 set of shop and erection drawings to the owner for review prior to fabrication.

#### 1.5 SHOP DRAWINGS REVIEW

Shop drawings review indicates the design concept has been reviewed without the need for further modification. This does not relieve the contractor of any responsibility for the correctness of the shop drawings, site dimensions, or for ensuring the work is performed in compliance with the drawings and specifications.

#### 1.6 VERIFY DETAILS AND DIMENSIONS

Refer to drawings to ensure all required details and fixings are provided for in the structural steelwork. Verify dimensions against site measurements prior to fabrication.

#### 1.7 TEST WELDING

Non-destructive weld examination with method, extent and standards of acceptance to [AS/NZS 1554.1](#), Section 7 and [NZS 3404.1](#), Appendix D.

### 2. PRODUCTS

#### 2.1 STRUCTURAL STEEL

All steel Grade 300, except RHS sections Grade 350, unless noted otherwise on the drawings. Test and stress relieve for brittle fracture when required by [NZS 3404.1](#), section 17, Testing of structures or elements.

- 2.2        **WELDING**  
Electrodes to comply with and be selected for the grade of steel being welded as required by [AS/NZS 1554.1](#). Welding wire as required by the wire manufacturer for the materials to be joined and the welding position. Welding flux: dry and used from sealed containers. Material for arc stud welding to comply with [AS/NZS 1554.1](#).
- 2.3        **BOLTS, NUTS AND WASHERS**  
To [AS/NZS 1252](#) and to the requirements of [NZS 3404.1](#), section 2.3 **Fasteners**. Hot-dip galvanize all bolts, nuts and washers forming a permanent part of any structure subject to a protective coating, to [AS/NZS 4680](#).
- 3.        EXECUTION**
- 3.1        **SURFACE FINISH**  
Grind off all burrs and sharp edges.
- 3.2        **TOLERANCES**  
Discard material showing visual defects affecting its structural integrity. Structural elements to comply with [NZS 3404.1](#), section 14.4, Tolerances (straightness, full contact splices, length and struts not prepared for full contact). Comply with the required tolerances laid down for holding down bolts, columns, beams and other members in HERA R4-99.
- 3.3        **CUTTING**  
To [NZS 3404.1](#), and for existing steel HERA R4-99. Hand cut only where machine cutting is not possible.
- 3.4        **CONSTRUCT**  
Construct the steel structure as detailed and to [NZS 3404.1.1](#), section 14, Fabrication and section 15, Erection.
- 3.5        **WELDING**  
To [NZS 3404.1](#), clause 14.3.4 Welding and [AS/NZS 1554.1](#). Comply with [AS/NZS 1554.1](#) for guidance on welding inspection and quality control.
- 3.6        **WELDING NEAR TOUCHING STEELWORK**  
Shop weld together touching or near-touching steelwork all round with 5mm (one pass) continuous fillet welds unless denoted otherwise on the drawings.
- 3.7        **HOLING**  
To [NZS 3404.1](#), clause 14.3.5 Holing, for sizes, alignment, finishing and punching of holes.
- 3.8        **BOLTING**  
Bolting to comply with [NZS 3404](#), clause 14.3.6, Bolting.
- 3.9        **THREADS EXCLUDED FROM SHEAR PLANE**  
Select length of bolts such that the threaded portion does not occur within the shear plane between joined parts.

- 3.10 **START ERECTION**  
Start erection only when the holding down bolts and anchorages have achieved sufficient strength. Carry out the erection of the structural steel to the requirements of AS 3828. Comply with [NZBCF5](#) and [NZS3404.1](#), section 15, Erection. Provide temporary bracing as required to achieve stability during erection.
- 3.11 **BASE PLATES**  
Enlargement or site cutting of holes not permitted. Bending or displacement of holding down bolts not permitted.
- 3.12 **COLUMNS**  
Plumb columns using sawn steel packs and wedges not larger than necessary for the purpose. The column base must not be raised by more than 25mm. Fill space beneath the base plate with cement-sand grout, containing a non-shrink additive, the grout having a minimum compressive strength of 30MPa at 28 days. Alternately use a dry pack of 1:2 cement with the sand mortar hammered in tight to ensure complete filling of space.
- 3.13 **INSPECTION**  
Inspect all stages of fabrication and construction of the structure to [NZS 3404.1](#), sections 14, Fabrication and 15 Erection.
- 3.14 **ENCASED STEELWORK**  
Clean the steelwork to be encased in concrete to remove all loose mill scale, rust, dirt and other matter affecting bond with concrete. Achieve this by wire brushing and the use of suitable solvents.
- 3.15 **BRUSHING AND POWER TOOL CLEANING**  
Remove oil and grease by the use of solvents. Scrape and power wire brush to a minimum St2 finish to AS 1627.9. Clean to bright metal, but avoid producing a polished surface. Check that no burrs or sharp edges remain which may prevent the full coating thickness being attained.
- 3.16 **ABRASIVE BLASTING**  
Remove oil and grease by the use of solvents. Abrasive blast clean to a Sa2 1/2 finish to AS 1627.4. Clean to bright metal, but avoid producing a polished surface. Select grit type and equipment such that the cleaned surface profile between peaks and valleys does not exceed one third of the dry film thickness. Check that no burrs or sharp edges remain which may prevent the full coating thickness being attained.
- 3.17 **PRIMING GENERALLY**  
Coat steelwork, unless specifically noted otherwise, with the specified priming paint, including patch priming on site after erection.
- 3.18 **UNPAINTED SURFACES**  
Do not paint:  
  - faying face of high strength friction grip bolted joints
  - areas for site welding, keeping 75mm clear all round
  - surfaces being embedded in concrete.

Where steel is only partly encased the next end priming 25mm maximum in to the concrete encasement area.
- 3.19 **PATCH PRIMING**  
Clean areas of damaged priming and areas left clear for site jointing to a standard comparable with that specified for shop cleaning. Wash off chemical deposits from welding fumes. Apply priming coats to the same standard as shop primers, ensuring thorough coating of bolts, nuts and connection areas. Reprime if more than 4 weeks elapse before the final coating system is applied.



3.20 COATING SYSTEMS

Apply all coatings in accordance with the coating manufacturer's requirements. Apply coatings to steel within 4 hours of cleaning and before condensation or light rusting can occur. Ensure steel is dry and atmospheric conditions warm and dry, with an air temperature of greater than 12°C and relative humidity less than 85%.

3.21 TOUCH-UP

Touch up primer. Apply protective coatings as specified.

# ROAD WORKS

## 4.0 General

Roadworks shall consist of furnishing, placing and compacting base and subbase material and shaping and preparing a formation for basecourse on the subbase and on the existing road pavement all in accordance with this Specification and alignments, levels, grades, dimensions and cross-sections shown on the Drawings and as required by the Superintendent.

## 4.1 Granular Pavements

### 4.1.1 Subbase Course

Subbase course material shall be from an approved source of borrow, or material taken from existing roads and shall be free of vegetable matter and balls of clay. The method of selection and processing shall be approved by the Superintendent before full scale production commences. The sub-basecourse material shall comply with the following requirements:

- Subbase course material shall have a C.B.R. value after 4 days soaking of not less than 45 when compacted to at least 95% maximum dry density as determined by AS 1289 Test No. E1.1; and
- Subbase course grading shall conform to the requirements for either Type A or Type B material given in Table Error! No text of specified style in document.-1.
- Additional material properties for subbase course materials are nominated inTable Error! No text of specified style in document.-2.

#### 1 Subbase Course Particle Grading Requirements

Sieve Size (mm)	Percentage by Weight Passing	
	Type A (38mm)	Type B (75mm)
75	–	100
37.5	100	60 – 100
19	60 – 100	40 – 80
9.5	40 – 80	30 – 60
4.75	30 – 60	20 – 45
2.36	20 – 45	15 – 35
0.425	15 – 30	8 – 22
0.075	3 – 15	3 – 15

#### 2 Pavement Material Properties – Subbase Course

Item	Subbase	Test Method
Coarse Component: 10% Fines Value(wet) (min)	50kN	AS 1141-22
Flakiness Index (max)	N/A	AS 1141-18
Los Angeles Abrasion (max)	N/A	AS 1141-23
Fine Component: Liquid Limit (max)	30	AS 1141
Plasticity Index (PI) C3.3.1 (max)	10	AS 1289
PI X % passing 0.425 sieve (max)	360	-
Linear Shrinkage (LS) C4.1 (max)	6.5	AS 1289
LS X % passing 0.425 sieve (max)	195	-
California Bearing Ratio (min)	45	AS 1249

#### 4.1.2 Basecourse

Basecourse material shall be selected from an approved source and processed to conform to the specified requirements. Pits and quarries from which the stone is obtained shall be stripped of earth and vegetable matter before any material is approved for use. Processing shall include where necessary crushing, screening, separation, blending and any other operation necessary to produce a material conforming to the requirements of this Specification. The method of selection and processing shall be reviewed by the Superintendent. Full scale production shall not commence until the Superintendent has given consent in writing to the Contractor's proposals. The base course material shall comply with the following requirements:

- The fraction passing the 75 um sieve shall not be greater than two thirds of the fraction passing the 425 um sieve.
- The fraction retained on the 2.36 mm sieve shall consist of hard durable particles or fragments of stone, gravel or sand and shall not include any material that breaks up when alternately wetted and dried. The coarse aggregate shall have a percentage of wear as determined by AS 1141 974 (Los Angeles machine) of not more than 35.
- The fraction passing the 425 um sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 6 when used as a base for a sealed road and shall have a plastic limit not greater than 30.
- The material shall have a C.B.R. value of not less than 80 after 4 days soaking when compacted to at least 100% standard maximum dry density as determined by AS 1289. and a plasticity index not greater than 10 and not less than 5 when used as a base for a sealed road.
- Base course particle grading shall conform to the requirements for either Type A or Type B material given in the Table Error! No text of specified style in document.-3.
- Additional material properties for subbase course materials are nominated in Table Error! No text of specified style in document.-4

#### 3 Base Course Particle Grading Requirements

Sieve Size (mm)	Percentage by Weight Passing	
	Type A (38mm)	Type B (75mm)
75	–	–
37.5	–	100
19	100	60 – 100
9.5	90 – 100	40 – 80
4.75	40 – 80	30 – 60
2.36	30 – 60	20 – 45
0.425	15 – 30	15 – 30
0.075	3 – 15	3 – 15

#### 4 Pavement Material Properties – Base Course

Item	Basecourse	Test Method
Coarse Component:		
10% Fines Value(wet) (min)	100kN	AS 1141-22
Flakiness Index (max)	35%	AS 1141-18
Los Angeles Abrasion (max)	35%	AS 1141-23
Fine Component: (max)		
Liquid Limit	25	AS 1141
Plasticity Index (PI) C3.3.1 (max)	6	AS 1289
PI X % passing 0.425 sieve (max)	150	-
Linear Shrinkage (LS) C4.1 (max)	3.3.5	AS 1289

LS X % passing 0.425 sieve (max)	85	-
Item	Basecourse	Test Method
California Bearing Ratio (min)	80	AS 1249

## 4.2 Granular Pavement Construction

### 4.2.1 Subbase Course

Where basecourse is required to be laid on a prepared formation of either the subbase or the existing pavement, this formation shall be completed for at least 100 metres ahead of the placing of basecourse material. Notwithstanding any earlier approval of prepared formation, any damage to or deterioration in this formation shall be made good before basecourse is placed.

Subbase shall be evenly spread at the appropriate moisture content in layers of compacted thickness not greater than 200 mm. For multi-layers, the layers shall be of equal thickness. All areas of segregated material shall be removed and replaced with well-graded material, or remixed using rotary hoe or other suitable equipment.

Each layer shall be compacted to at least 100% of the standard maximum dry density as determined by AS 1289. The of normal crossfall, rolling shall be carried out parallel to the road centre line beginning at the outer edge and progressing toward the crown. On super elevated sections, rolling shall begin on the low side and proceed towards the high side except in construction for widening where rolling shall always progress from the outer edge towards the existing pavement.

Materials shall not be mixed to produce a specified grading unless prior approval has been given. Inconsistent mixes shall be liable to rejection. Place materials of different gradings or from different sources in separate layers or separate sections of the work.

### 4.2.2 Base Course

Basecourse shall be evenly spread over the full width of the road bed in layers with compacted thickness not exceeding 200 millimetres subject to the approval of the Superintendent. The layers, if more than one, shall be as nearly equal in thickness as possible. The material may be spread and shaped by any method, provided this does not cause the segregation of the coarse and fine particles. Any areas of segregated coarse or fine material shall be corrected or removed and replaced with well graded material.

Where base course material is required to be added to an existing pavement, the surface of the existing pavement shall be scarified and shaped as necessary and recompacted with the addition of the base material. The total depth of scarified and added material shall not exceed the permissible depth of loose layer.

Rolling shall be carried out parallel to the road centre line beginning at the outer edge and progressing towards the crown on sections of normal crossfall and beginning on the low side and progressing towards the high side on superelevated sections. Each layer shall be compacted to at least 100% of the maximum dry density as determined by testing to AS 1289. The field density tests shall be made at locations selected by the Superintendent with at least one test per 500 sq. m per layer. The contractor shall ensure that the subbase adjacent to manholes and gully pits is compacted to this standard.

The basecourse shall be finished to give a hard, tight, dense, stone mosaic surface free of segregated material, cakes of excessive fines, roller marks and other surface irregularities and shall conform to the following tolerances:

- The base course thickness shall be within  $\pm 10$  mm of the design thickness;
- The base course width, measured perpendicular from the centre line, shall not be less than the dimension shown on the Engineering Drawings;
- At any location along the road, the deviation from a straight edge 3 metres long laid parallel to the centre line or at right angles to the centre line on a cross fall, shall not exceed 10 millimetres. Base course, which does not conform to these requirements, shall be reworked and watered as necessary, and recompacted to conform.

## **4.3 Bitumen Surfacing**

### **4.3.1 General**

The work shall consist of spraying of tar or bitumen, cut or fluxed if required, in one or more separate applications to the prepared surface of a pavement, which may or may not have been previously surface treated, and the incorporation of suitable aggregate.

The work shall comprise the following processes:

- a) Application of primer, with or without cover material followed by binder and aggregate as in sub- clause (b) and (c) of this Clause.
- b) Single application of binder with single application of coarse aggregate (1st coat seal).
- c) Single application of binder with single application of fine aggregate.

No surfacing work shall be carried out during rainy periods when the road temperature is less than 18 degrees Celsius unless authorized by the Superintendent.

### **4.3.2 Materials**

Unless otherwise specified in the contract, the Contractor shall supply all materials and plant necessary for the satisfactory performance of the work.

### **4.3.3 Bituminous Prime Coat**

Where nominated, a bituminous prime coat shall be applied as soon as practical after but not before the levels, surface compaction, quality and finish of the base course have been approved by the Superintendent. Should the pavement, due to any reason or cause, lose the required quality, stability, density or finish before surfacing is complete it shall be made good at the sole expense of the Contractor. After applying the prime coat, it must cure for a minimum of 48-72 hours before asphalt is placed, with no rain in the forecast. Where traffic cannot be diverted for sufficient time to ensure that the primer will not adhere to passing vehicles, cover material shall be applied and evenly distributed over the primed surface by an approved mechanical spreader or other approved means, before opening to traffic.

### **4.3.4 Binder**

Bitumen shall conform to the current AS 2008 "Residual Bitumen and Fluid Native Asphalt". The grade shall be C170. In all cases the rate(s) of application scheduled are for uncut binder at 15 degrees Celsius.

### **4.3.5 Cutting Oil**

Cutting oil shall only be used when specifically approved by the Superintendent. Normally cutting oil will not be used, except for priming.

### **4.3.6 Cover Aggregate**

Cover aggregate shall be produced from clean, hard gravel, or crushed rock and shall be uniform in quality, free from moisture, dust, dirt, clay or other foreign matter. Aggregate shall meet the test requirements of AS 2758.2 – Part 2 Aggregate for Sprayed Bituminous Surfacing. The Contractor may be required to supply at any time, free of charge adequate samples of a material to be used in the work. Testing required under this Specification, including determining the average least dimension of the aggregates, shall be carried out at a laboratory approved by the Superintendent and at the Contractor's expense.

### **4.3.7 Preparation of Pavement**

The pavement shall be swept free of loose stone, dust, dirt and foreign matter so as to uncover, but not dislodge the stones of the pavement. Immediately before applying the first coat, sweeping shall extend 300mm clear of the pavement. A mechanically operated rotary broom may be used for the sweeping provided surface stones are not disturbed. If directed by the Superintendent, manual sweeping shall augment mechanical sweeping. Adherent particles of foreign material shall be removed from the surface in a manner, which does not damage the finished pavement. Where the priming coat is included in the Contract, it shall be the Contractor's responsibility to maintain the conditions until the surface coat is applied. For re-surfacing before the binder is sprayed, all dust and loose and foreign material shall be removed from and at least 300mm clear of the pavement by brooming or other approved means. No spraying shall be undertaken until the pavement has been prepared to the satisfaction of the Superintendent.

#### 4.3.8 Sprayer Performance and Operation

The sprayer shall have a tank of not less than 1000 litre capacity, shall be fitted with pneumatic types and shall be capable of moving at a steady speed, when fully loaded, whether on the level or on grades up to 10 percent. Where the sprayer is mounted on a trailer or semi-trailer, the Superintendent may order the Contractor to discontinue the use of the sprayer if, in the Superintendent's opinion, it cannot be operated to apply the spray in the contract position on the pavement. Sprayers shall be fitted with the following apparatus:

- a) A calibrated dipstick or other approved device for accurately measuring the contents.
- b) An approved speedometer with intervals between graduations not exceeding 7.5m per minute, and recording distances travelled in metres.
- c) A thermometer of the dial type mounted where it can be readily seen from the roadway.
- d) A direct-reading speed indicator fitted to the pump shaft.
- e) A pressure gauge fitted between the pump and the manifold and a by-pass valve to enable the pressure to be adjusted at the manifold.
- f) An auxiliary hand-nozzle attachment for spraying small areas.
- g) An adjustable sighting arrangement to enable the driver to follow accurately any desired line.

The pumping engine shall have sufficient power to drive the pump and any auxiliaries, at the minimum speed required, when at more than three-quarter throttle and shall be fitted with a reliable governor to control the pump-shaft speed within the limits of plus or minus five revolutions per minute. The pumping equipment shall be capable of maintaining a constant spraying pressure of not less than 70 kPa at the jets. The pumping and spraying equipment shall be capable of spraying at the rate of application specified with a road speed of not more than 25 km per hour, not less than 4 km per hour. The pump shall be fitted with the necessary valves and piping for circulating the bitumen while it is not being sprayed. The piping and its inlets and outlets shall be so arranged that the bitumen is thoroughly mixed in the circulating process.

The tank shall be lagged and/or fitted with heating apparatus to ensure that the temperature-drop of the heated contents does not exceed 10 degrees Celsius per hour in still air of temperature not exceeding 15 degrees Celsius.

The manifold spray bar shall be of such dimensions as to give a uniform pressure throughout its length. It shall be of sufficient length to spray over a width of 3.7 m and shall be adjustable for other widths.

The size and arrangement of jets shall be such as to apply the material in a coating of uniform thickness throughout and to give the specified quantity per metre square the jets shall be spaced uniformly and when spraying shall be not more than 250mm above the pavement surface and shall be maintained at or above a fixed uniform height above it. The jets, if of the slotted type, shall be placed so that the discharge fans make a uniform angle with the centre line of the manifold and at such centres that any point on the road surface, except along the edges, is sprayed by at least two jets. Special arrangements shall be provided to ensure accurate alignment of the edges of the area sprayed and to give uniformity of application along the edges.

The manifold or spray-bar shall be fitted with an approved means to give a sharp cut-off on terminating the spraying of each section. Alternatively, spraying shall end on a strip of stout paper or other suitable material at least 1 m wide laid across the pavement beforehand. Before commencing spraying, also, the surface of the pavement shall be protected in a similar manner for a sufficient length to ensure that the application has attained its normal force when the untreated surface is reached. The Contractor shall destroy all such paper after use, or any other material used in its stead.

The use of compressed air type of sprayer will be permitted provided that the machine on being tested shows to the satisfaction for the Superintendent that it is capable of applying the material uniformly at the specified rates per metre square required by the specification.

Spraying equipment shall be maintained in first class mechanical order, and shall be operated by workmen who are competent and efficient in their respective duties.

#### 4.3.9 Control of Work

The Superintendent will approve the width, length and section of roadway to be sprayed at any time. The area to be sprayed at any time shall be limited to that which can be covered with aggregate at the specified rate within fifteen minutes of spraying. The sprayer shall be so guided that the edge of the spray conforms at all times to the line ordered. Any strips of pavement not adequately covered by binder shall be sprayed later by hand attachment and any binder sprayed outside the line ordered shall be removed by the Contractor if so desired by the Superintendent.

The Contractor shall take all necessary precautions to prevent binder, aggregate or other materials used on the work from entering or adhering to gratings, hydrant or valve boxes, manhole covers, bridge or culvert decks and similar road fixtures. Immediately after aggregate has been sprayed over the binder the Contractor shall take steps to clean off any material and leave such fixtures in a satisfactory condition.

#### **4.3.10 Defective Work or Material**

The Contractor shall remove from the work and shall bear the cost of replacing any binder, which has been overheated, or has deteriorated, or become contaminated in any way, prior to its application to the road. The Contractor shall make good at his own expense any work, which in the opinion of the Superintendent, is not in accordance with this specification, whether caused by bad workmanship, or defective materials supplied by the Contractor, or by materials made defective by the Contractor's operations.