

SPECIFICATIONS



034

SPECIFICATION

of work to be done and materials to be used in carrying out the works shown on the accompanying drawings

Proposed garage

(project name)

SH 12 Opononi

(project address)

M O'Hallaran

(owners name)

FAR NORTH DISTRICT COUNCIL
Approved Documents

Job Number: 201537

Date: 05 05 15

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1220 GENERAL REQUIREMENTS

1. GENERAL

1.1 THE WORKS

The works are as described in this specification and shown on the drawings.

1.2 PERSONNEL

Owner: The person defined as "owner" in the New Zealand Building Code.

Contractor: The person contracted by the owner to carry out the contract.

1.3 THE SITE

The site of the works, the site address and the legal description are listed under the sections 1210 PROJECT. Confine access and work to the area of site indicated on the drawings.

1.4 SPECIFICATION SECTIONS

Sections are for reference and convenience only and do not constitute individual trade sections or work elements. Read all sections together and read this section with all other sections.

1.5 INTERPRETATIONS

Required: Required by the documents, or by a statutory authority.

Proprietary: Identifiable by naming the manufacturer, supplier, installer, trade name, brand name, catalogue or reference number.

Approval: Approval in writing.

Direction: Direction in writing.

Notified: Notified in writing.

1.6 ABBREVIATIONS

The following abbreviations are commonly used throughout the specification:

AS	Australian Standard
AS/NZS	Joint Australian/New Zealand Standard
BCA	Building Consent Authority
BRANZ	Building Research Association of New Zealand
LBP	Licensed Building Practitioner
NZBC	New Zealand Building Code
NZS	New Zealand Standard
NZS/AS	Joint New Zealand/Australian Standard
NUO	Network Utility Operator
OSH	Occupational Safety and Health
RBW	Restricted Building Work
TA	Territorial Authority

1.7 INCONSISTENCIES

If there are any inconsistencies, errors or omissions in or between documents, the contractor must seek direction in resolving it. Figured dimensions take precedence over scaled dimensions; drawings to a larger scale take precedence over drawings to a smaller scale and drawings take precedence over specification.

1.8 SUBSTITUTIONS

A substitution may be proposed where specified products are not available, or if substitute products are brought to the attention of and are considered by the owner as equivalent or superior to those specified. Except where a specified product is not available, the owner is not bound to accept any substitutions.

Notify proposed substitution of specified products. Include sufficient information to allow the owner to confirm that the substitution is equivalent or superior to that specified.

Advise the owner whether an amendment will or may be required to the Building Consent and the expected costs of such amendment.

- 1.9 **THE WORDS "PROVIDE" OR "FIX"**
The words "provide" (or "supply") or "fix" if used separately mean "provide and fix" unless explicitly stated otherwise.
- 1.10 **MANUFACTURERS AND SUPPLIERS**
Manufacturers and suppliers requirements, instructions, specifications or details are those issued by them for their particular material, product or component and are the latest edition.
- 1.11 **REFERENCED DOCUMENTS**
Reference is made to various New Zealand Building Code (NZBC) acceptable solutions (AS) and verification methods (VM) for criteria and/or methods used to establish compliance with the Building Act 2004. Reference is also made to various Standards produced by Standards New Zealand (NZS, AS/NZS) and to listed Acts, Regulations and various industry codes of practice and practice guides. The latest edition (including amendments and provisional editions) at the date of this specification applies unless stated otherwise. Documents cited both directly and within other cited publications are part of this specification.
- 1.12 **PRECEDENCE OF REFERENCED DOCUMENTS**
This specification takes precedence in the event of it being at variance with and requiring a higher standard than, the cited documents. Resolution of any variance must be confirmed in writing and where Building Consent is affected, the change notified to the BCA for advice as to whether an amendment is required to the Building Consent Authority.
- 1.13 **BUILDING CONSENT COMPLIANCE**
It is an offence under the Building Act 2004 to carry out any work not in accordance with the Building Consent. Refer the resolution of matters concerning compliance to the owner for a direction. Where Building Consent is affected refer any change to the BCA for advice as to whether an amendment is required to the Building Consent.
- 1.14 **STATUTORY OBLIGATIONS**
Comply with all statutory obligations and regulations of regulatory bodies controlling execution of the works.
- 1.15 **BUILDING CONSENT**
Obtain the original or copies of the Building Consent form and documents from the owner and keep on site. Liaise with the BCA and/or the building certifier for all required notices and all inspections required during construction to ensure compliance. Return the consent form and documents to the owner on completion.
- 1.16 **INSPECTIONS**
Do not proceed with work noted on the Building Consent for inspection until it has been inspected and passed by the BCA inspector.
- 1.17 **KEY PERSONNEL**
Provide names and contact detail of LBP's/ key personnel. Prior to Restricted Building Work being carried out, provide names, registrations numbers (where appropriate) and contact detail of LBP's that are required for RBW by the Building Consent Authority as part of the Building Consent.
- Include the following as applicable:
- Person with the appropriate site license
 - Carpenter
 - Registered drainlayer
 - Registered plumber
 - Registered gasfitter
 - Registered electrician
 - Roofer
 - Block layer
 - Bricklayer
 - External plasterer

- External window manufacturer
- Waterproof membrane applicator

- 1.18 **PRODUCER STATEMENTS AND LBP DOCUMENTATION**
When Records of Work or producer statements verifying construction are required, for the application for the Code Compliance Certificate, provide copies to both the BCA and the owner. Provide LBP documents and producer statements in the form required by the BCA.
- 1.19 **CERTIFICATE OF COMPLIANCE**
Provide Certificates of Compliance for electrical and gas work carried out.
- 1.20 **CODE COMPLIANCE CERTIFICATE**
Provide documentation that the Owner requires in order to obtain a Code Compliance Certificate for the consented work.
- 1.21 **TRADE GUARANTEES AND WARRANTIES**
Where specific trade guarantees/warranties are offered covering materials and/or execution of proprietary products or complete installations, or are required as a condition of Building Consent, provide guarantees/warranties to the owner.
- 1.22 **SITE ACCOMMODATION**
Provide, erect and maintain scaffolding, sheds, toilets, water, power and hoardings. Allow for cartage, craneage, plant hire and storage. Arrange for temporary works and services necessary for the completion of the works.
- 1.23 **HEALTH AND SAFETY**
Make the works safe and provide and maintain a safe working environment. Ensure that all those working on or visiting the site are aware of the rules governing site safety, are properly supervised and are not unnecessarily exposed to hazards.
- 1.24 **PROTECT THE WORKS**
Protect parts of the work liable to damage until completion of the works. Take all precautions necessary to protect the works from damage by unauthorised entry or inclement weather. Brace and support all parts of the works against damage during construction.
- 1.25 **STORAGE AND PROTECTION**
Provide temporary storage areas and protective covers and screens. Fillet stack and protect all framing and structural members from moisture and contamination. Completely protect finishing materials from the weather and damage and store in accordance with the manufacturer's requirements. Protect fabricated elements from the weather and damage, and store in accordance with suppliers requirements.
- 1.26 **ANTIQUITIES AND ITEMS OF VALUE AND INTEREST**
Report immediately the finding of any fossils, antiquities, pre-1900 items, or objects of value. Ensure they remain undisturbed until approval is given for their removal.
- 1.27 **MEANS OF COMMUNICATION**
All directions and approvals in writing.
- 1.28 **WORKING HOURS**
Work on site is restricted to between 0800 to 1800, Monday to Friday, excluding statutory holidays. Work outside these hours may be permitted, with prior approval in writing by the owner.
- 1.29 **RESTRICTIONS**
Do not:
 - smoke on site
 - light rubbish fires on the site
 - bring dogs on to or near the site
 - bring radios/audio players on to the site.

- 1.30 **QUALITY ASSURANCE**
Carry out and record regular checks of material quality and accuracy. Provide all necessary materials, equipment, plant, attendances, supervision, inspections and programming to ensure required standards are met.
- 1.31 **DAMAGE AND NUISANCE**
Prevent damage and nuisance from water, fire, smoke, vehicles, dust, rubbish, noise and other causes resulting from the contract works. Comply with the requirements of the TA and relevant Acts and Standards.
- 1.32 **SET-OUT AND DATUM**
Set out the works to conform with the drawings. Establish a permanent site datum to confirm the existing ground floor level and its relationship to other existing and new building levels.
- 1.33 **EXECUTION OF THE WORK**
Conform to the requirements of this specification. Ensure work is level, plumb, and true to line and face. Employ only experienced workers familiar with the materials and techniques specified.
- 1.34 **MATERIALS AND PRODUCTS**
Use only new materials and products, unless stated otherwise, of the specified quality and complying with cited documents.
- 1.35 **COMPATIBILITY**
Ensure all parts of a construction or finish are compatible and their individual use approved by the manufacturers and suppliers of other parts of the system. Source all parts of a system from a single manufacturer or supplier.
- 1.36 **COMPLETE ALL SERVICES**
Ensure completed building services are operational, with temporary labelling removed, required labelling fixed and service instructions provided.
- 1.37 **CLEAR AWAY**
Regularly clear away trade debris, unused materials and elements from the site. On completion of the work leave the building clean and ready for occupancy, with all services operating and mechanical parts in good working order. Remove temporary markings, coverings and protective wrappings.
- 1.38 **CLEAN**
Clean and wash down external surfaces to remove dirt, debris and marking. Clean interior surfaces including floors, glass, cabinetwork, joinery, sanitary and hardware items.

1233 DOCUMENTS REFERENCED

1. GENERAL

Documents listed below are, when referred to in the text, part of this specification. However, this specification takes precedence in the event of it being at variance with and requiring a higher standard than any cited document.

1.1 ACTS AND REGULATIONS

[Building Act 2004](#)
[Gas \(Safety and Measurement\) Regulations 2010](#)
[Health and Safety in Employment Act 1992](#)
[Electricity \(Safety\) Regulations 2010](#)
[Plumbers, Gasfitters and Drainlayers Act 2006](#)

1.2 NEW ZEALAND BUILDING CODE VERIFICATION METHODS

NZBC E2/VM1 External moisture
NZBC G12/VM1 Water supplies

1.3 NEW ZEALAND BUILDING CODE ACCEPTABLE SOLUTIONS

NZBC B1/AS1 Structure - general
NZBC B2/AS1 Durability
NZBC C/AS1-AS7 Protection from fire
NZBC D1/AS1 Access routes
NZBC E1/AS1 Surface water
NZBC E2/AS1 External moisture
NZBC E2/AS3 External moisture
NZBC F2/AS1 Hazardous building materials
NZBC F7/AS1 Domestic smoke alarms
NZBC G1/AS1 Personal hygiene
NZBC G10/AS1 Piped services - Gas
NZBC G11/AS1 Gas as an energy source
NZBC G12/AS1 Water supplies
NZBC G13/AS2 Foul water - Drainage

1.4 NEW ZEALAND STANDARDS

[AS/NZS 1604.3](#) Specification for preservative treatment - Plywood
[NZS/AS 1884](#) Floor coverings - Resilient sheet and tiles - Installation practices
[AS/NZS 2269.0](#) Plywood - Structural - Specifications
[AS/NZS 2455.1](#) Textile floor coverings - Installation practice - General
[AS/NZS 2455.2](#) Textile floor coverings - installation practice - Carpet tiles
[AS/NZS 2589](#) Gypsum linings - Application and finishing
[AS/NZS 2642.2](#) Polybutylene pipe systems - Polybutylene pipe for hot and cold water applications
[AS/NZS 2699.1](#) Built-in components for masonry construction Wall ties
[AS/NZS 3000](#) Electrical installations (known as the Australian/NZ Wiring Rules)
[NZS 3101.1](#) Concrete structures standard
[NZS 3103](#) Sands for mortars and plasters
[NZS 3104](#) Specification for concrete production
[NZS 3109](#) Concrete construction
[NZS 3114](#) Concrete surface finishes
[AS/NZS 3500.2](#) Plumbing and drainage - Sanitary plumbing and drainage
[NZS 3501](#) Specification for copper tubes for water, gas and sanitation
[NZS 3602](#) Timber and wood-based products for use in building
[NZS 3603](#) Timber structures standard
[NZS 3604](#) Timber-framed buildings
[NZS 3622](#) Verification of timber properties
[NZS 3631](#) New Zealand national timber grading rules
[AS/NZS 4130](#) Polyethylene (PE) pipes for pressure applications
[NZS 4210](#) Masonry construction materials and workmanship
[NZS 4211](#) Specification for the performance of windows
[NZS 4218 2004](#) Energy efficiency - Housing and small building envelope
[NZS 4223.1](#) Glazing in buildings - Glass selection and glazing

NZS 4223.3	Glazing in buildings - Human impact safety requirements
NZS 4223.4	Glazing in buildings - Wind, dead, snow and live actions
NZS 4229	Concrete masonry buildings not requiring specific engineering design
NZS 4251.1	Solid plastering - Cement plasters for walls, ceilings and soffits
AS/NZS 4666	Insulating glass units
AS/NZS 4671	Steel reinforcing materials
AS/NZS 4858	Wet area membranes
AS/NZS 5601.1: 2010	Gas installations - general installations
NZS 6803	Acoustics - Construction noise

1.5 BUILDING RESEARCH ASSOCIATION OF NEW ZEALAND (BRANZ)

Weathertight Solutions Vol. 2: Stucco
 Good practice guide: Tiling
 Good practice guide: Membrane roofing
 Bulletin 441 - Sealed joints in external claddings - 2. Sealants
 Bulletin 519 - Fasteners selection

1.6 OTHER DOCUMENTS

Cement & Concrete Association of New Zealand

- [CCANZ CP 01](#): Code of practice for weathertight concrete and concrete masonry construction

WorkSafe New Zealand (OSH)

- [Approved code of practice for safety in excavation and shafts for foundations](#)
 - [Repainting lead based paints](#)

Waterproofing Membrane Association Inc.

- [WMAI CoPTM](#): Code of practice for torch-on membrane systems for roofs and decks

New Zealand Demolition and Asbestos Association (NZDAA)

- [Best Practice Guideline for Demolition in New Zealand](#).
 - [New Zealand Guidelines for the Management and Removal of Asbestos](#)

New Zealand Metal Roofing Manufacturers Inc

- [NZMRM COP](#): NZ Metal roof and wall cladding: Code of practice

Window Association of New Zealand Incorporated (WANZ)

- [WANZ PQAS](#): Powder Coating Quality Assurance System
 - [WANZ Installation Guide](#): The WANZ Guide to Window Installation as described in E2/AS1 Amendment 5.

2200 GROUNDWORKS AND PREPARATION

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Carry out work using persons competent and experienced in the trade.

1.2 SITE SAFETY

Provide proper support for excavations. Cover holes and fence off open trenches and banks.

2. PRODUCTS

2.1 FILLING MATERIALS

Volcanic tuff:	Scoriaceous tuff of variable grading excluding silt or clay material, capable of being placed and compacted as specified.
Rock fill:	Hard material comprising rock, broken stone, hard brick, concrete, run of pit scoria, or other comparable inert material capable of being placed and compacted as specified.
Sand fill:	Clean sand of such grading in particle size as to allow for mechanical compaction to 90% maximum density.
Hardcore:	Scoria or crushed rock to GAP (General All Passing) 40 grading.
Granular base:	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.
Dressing course:	Scoria to GAP 20 grading, or "dirty footpath scoria", or equivalent "all in" graded crushed metal aggregate.
Free-draining aggregate:	Scoria or crushed gravel graded 50 to 14 clean.

3. EXECUTION

3.1 EXCAVATION GUIDELINES

Carry out excavation to the guidelines set in WorkSafe NZ [Approved Code of Practice for Safety in Excavation and Shafts for Foundations](#).

3.2 PROTECT EXISTING

Protect from damage existing buildings, structures, roads, paving and services nominated on the drawings as being retained, throughout the course of the work.

3.3 SURFACE PREPARATION

To [NZS 3604](#), 3.5 **Site preparation**, remove all turf, vegetation, trees, topsoil, stumps and rubbish from the area being built on.

3.4 UNDERGROUND ELEMENTS AND SERVICES

Break out and remove underground elements and redundant services. Report for instructions when unexpected voids, made-up ground or services are encountered. Seal off the ends of drains or remove to NUO approval.

3.5 GENERAL EXCAVATION

Trim ground to required profiles, batters, falls and levels. Remove loose material. Protect cut faces from collapse. Keep excavations free from water.

3.6 EXCAVATION FOR FOUNDATIONS

Take foundation excavations to depths shown. Keep trenches plumb and straight, bottoms level and solid, stepped as detailed and clean and free of water.

3.7 INADEQUATE BEARING

If bearing is inadequate then excavate further and backfill with material as follows:

Slabs on grade:	Hardfill
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Footings:	10 MPa concrete
Service trenches:	Hardfill

If excavation exceeds the required depths, backfill and compact to the correct level with listed material.

3.8 GRANULAR BASE FOR SLABS

To [NZS 3604](#), 7.5.3 **Granular base**. Consolidate with a vibrating roller. Blind the surface with coarse sand or sand/cement and roll ready to receive a damp-proof membrane.

3.9 GENERAL BACKFILLING

Compact backfilling in 150mm layers, with the last 200mm in clean topsoil, lightly compacted and neatly finished off.

3110 CONCRETE WORK

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Carry out work using persons competent and experienced in the trade. Structural and foundation work to be carried out by or supervised by the appropriate LBP.

2. PRODUCTS

2.1 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](#) Class E. Mild drawn steel tying wire not less than 1.2mm diameter.

2.2 MESH FOR SLABS TO NZS 3604 OR NZS 4229

For slabs on ground, welded reinforcing mesh to [AS/NZS 4671](#), minimum to [NZBC B1/AS1](#) - Grade 500E, 2.27kg/m² (1.14kg/m² in each direction).

2.3 SPACERS AND CHAIRS

Precast concrete or purpose made moulded PVC. Use concrete spacer blocks only where the concrete surface is not exposed in the finished work.

2.4 CONCRETE

Strength as selected. Ready-mix normal grade, maximum aggregate size 19mm to [NZS 3104](#). Site mixed prescribed grade, using either separate batching of sand and coarse aggregate, or builder's mix, to [NZS 3104](#).

3. EXECUTION

3.1 HANDLE AND STORE REINFORCING

Handle and store reinforcing steel and accessories without damage or contamination. Ensure reinforcement is clean and remains clean and free of 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.

3.3 CUT AND BEND

Cut and bend bars using proper bending tools to avoid notching and to the requirements of [NZS 3109](#). Do not rebend bars without written approval. Bend main reinforcing bars, stirrups and ties to the former pin diameters as given in [NZS 3109](#), figure 3.1, **Standard bend, hook and stirrup**.

3.4 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 laid down in [NZS 3109](#), 3.3. **Hooks and bends**.

3.5 LAPPED SPLICES

Set length of laps, where not dimensioned on the drawings, in accordance with [NZS 3109](#): 3.7, **Splices in reinforcement**. Increase laps of plain round steel by 100%.

3.6 MESH LAPS FOR SLABS TO NZS 3604 OR NZS 4229

For slabs on ground, mesh to be lapped and tied, so the outermost wires overlap by the greater of:- the spacing of the cross wires plus 50mm or, 150mm or, manufacturer's requirements. Do not count bar extensions beyond the outermost cross wire.

- 3.7 REINFORCEMENT COVER TO NZS 3604
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 3604 requirements.
- 3.8 REINFORCEMENT COVER TO NZS 4229
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 4229 requirements.
- 3.9 REINFORCEMENT COVER TO NZS 3101.1
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.** Sub-soil cover to NZS 3101.1, to suit soil and groundwater conditions. 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 CONCRETE PLACEMENT
To comply with NZS 3109.
- 3.11 SURFACE FINISHES
To comply with NZS 3114, section 105 **Specification of finishes**, or as denoted on the drawings. Formwork linings and surface finishes as nominated for both fair face and concealed or exposed surfaces. Surface tolerances to comply with NZS 3114, section 104 **Surface tolerances** and 105.3.2.
- 3.12 DAMP-PROOF MEMBRANE
Apply 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.
- 3.13 CASTING IN
Build in grounds, bolts and fixings for wall plates and bracing elements, holding down bolts, pipes, sleeves and fixings as required. Form pockets, chases and flashing grooves as required. No grounds exceeding 100mm in length. Minimum cover on conduits 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. Wrap all pipes embedded in concrete with tape to break the bond and to allow for expansion.
- 3.14 FLOOR SLABS TO NZS 3604
Slabs on ground to NZS 3604 as modified by NZBC B1/AS1 and NZBC E2/AS3. Construct to NZS 3604, 4.5 **Concrete and concrete masonry** and NZS 3604, 7.5, **Concrete slab-on-ground floors in timber buildings** as modified by NZBC B1/AS1, 3.0 **Timber**. Lay to true and straight surfaces, screeded, floated and steel (manual or power) trowelled finish. Tolerance on flatness: maximum 3mm gradual deviation over a 3 metre straight-edge, to NZS 3114, 304, **Surface tolerances**. Allow for free joints maximum 24m centres to NZBC B1/AS1, 3.1.13 **NZS 3604 New clause**. In the Canterbury Earthquake Region comply with the changes to NZS 3604 in NZBC B1/AS1.
- 3.15 FLOOR SLABS TO NZS 4229
Slabs on ground to NZS 4229 as modified by NZBC B1/AS1 and NZBC E2/AS3. Construct to NZS 4229, 6, **Footings** and NZS 4229, 7, **Foundation walls and concrete slab-on-ground** as modified by NZBC B1/AS1, 2.0 **Masonry**. Lay to true and straight surfaces, screeded, floated and steel (manual or power) trowelled finish. Tolerance on flatness: maximum 3mm gradual deviation over a 3 metre straight-edge, to NZS 3114, 304, **Surface tolerances**. Allow for free joints maximum 18m centres to NZS 4229, 7.8.5.3 **Free joints**. In the Canterbury Earthquake Region comply with the changes to NZS 4229 in NZBC B1/AS1.

- 3.16 **SAW CUTS TO NZS 3604**
Cut slabs where indicated on the drawings as required to control shrinkage cracking. Form by saw cutting the slab (blade width approximately 5 mm) to a quarter of the depth of the slab after it has hardened (saw cutting shall take place no later than 24 hours after initial set for average ambient temperatures above 20 °C, and 48 hours for average ambient temperatures below 20 °C). If saw cuts are not indicated on the drawings, than provide saw cuts as per the requirements for shrinkage control joints in [NZS 3604](#).
- 3.17 **SAW CUTS TO NZS 4229**
Cut slabs where indicated on the drawings as required to control shrinkage cracking. Form by saw cutting the slab (blade width approximately 5 mm) to a quarter of the depth of the slab after it has hardened (saw cutting shall take place no later than 24 hours after initial set for average ambient temperatures above 20 °C, and 48 hours for average ambient temperatures below 20 °C). If saw cuts are not indicated on the drawings, than provide saw cuts as per the requirements for shrinkage control joints in [NZS 4229](#).
- 3.18 **SAW CUTS**
Cut slabs where indicated on the drawings 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.
- 3.19 **SURFACE REPAIRS**
Make good surface defects as soon as forms are stripped. Make good hollows or bony areas with 1:2 mortar, finished to the same tolerances as the parent concrete. Fill tie rod holes with 1:2 mortar.
- 3.20 **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.
- 3.21 **STRIKE FORMWORK**
Strike formwork without damaging or overloading structure.
- 3.22 **CLEAN OUT**
Clean out saw cuts. Fill with cement grout where the floor will be covered with carpet or vinyl.

3800 TIMBER FRAMING

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

Use experienced competent carpenter familiar with the materials and techniques specified. Work to be carried out by or supervised by the appropriate LBP.

2. PRODUCTS

2.1 TIMBER FRAMING GENERALLY

Species, grade and level of treatment to [NZBC B2/AS1](#), [NZS 3602](#), tables 1 to 3 **Requirements for wood-based building components...**, and moisture content to [NZS 3602](#), table 4 **Allowable moisture content.....** Structural Grade (SG) to [NZS 3604](#), [NZS 3622](#) with properties to [NZS 3603](#).

2.2 TIMBER TRUSSES

To FTMA Code of Practice. Moisture content 16% at supply.

2.3 ACCESSORIES

Damp-proof course:	High impact embossed polyethylene
Stud straps	Polypropylene tape run horizontal at 300mm centres over flexible wall underlay, for drained cavities with stud spacings greater than 450mm.
Nails, bolts and screws:	Steel, stainless steel, galvanized steel of pattern to suit the location and to BRANZ BU 519: Fasteners selection. To NZS 3604 , 4 Durability and NZBC E2/AS1 .
Nail plates connectors:	Stainless steel and/or galvanized steel toothed or nailed plates to the plate manufacturer's design for the particular locations as shown on the drawings and to NZS 3604 , 4 Durability . Galvanized steel and stainless steel connectors and brackets to the connector manufacturer's design for locations shown on drawings and to NZS 3604 , 4 Durability and NZBC E2/AS1
Corrosion risk	For exterior timber, timber in damp areas and timber subject to occasional wetting, use only stainless steel (or equivalent) fixings and connectors, when the timber is treated with; Copper Azole (CuAz, Preservative code 58), Alkaline Copper Quaternary (ACQ, Preservative code 90), Micronise Copper Azole (code 88) or Micronised Copper Quaternary (code 89).

3. EXECUTION

3.1 ATTENDANCE

Provide and fix blocks, nogs, openings and other items as required by others.

3.2 MOISTURE CONTENT

Maximum allowable moisture content to [NZS 3602](#), table 4 **Allowable moisture content...**, for framing supporting interior linings:

Framing at erection	24%
Framing at enclosure	20%
Framing at lining	16%

3.3 EXECUTION GENERALLY

To [NZS 3604](#) except as varied in this specification. To include those methods, practices and processes contained in the unit standards for the National Certificate in Carpentry and the National Certificate in Joinery (cabinetry, exterior joinery, stairs). Set out framing in accordance with the requirements of [NZS 3604](#) and as required to support sheet linings and claddings.

3.4 **INSTALL FLOOR, WALL AND ROOF FRAMING**

Floors and bottom plates framed and fastened to [NZS 3604](#), **7 Floors**. Frame walls to required loading and bracing complete with lintels, sills and nogs, all fabricated and fastened to [NZS 3604](#), **8 Walls**. Frame roof to required loading and bracing complete with valley boards, ridge boards and purlins to [NZS 3604](#), **10 Roof framing**. Design and fit roof trusses complete with anchorage. All fabricated and fastened to [NZS 3604](#), **9 Posts**, and [NZS 3604](#), **10 Roof framing**.

3.5 **BATTENS**

For drained cavity construction nominal 20mm H3.1 cavity battens (non-structural) to [NZBC E2/AS1](#), 9.1.8.4 **Cavity battens**. For direct fix cladding window and door openings nominal 20mm H3.1 jamb battens to [NZBC E2/AS1](#), Fig. 72A.

4220 WALL CLADDING

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Carry out work using persons competent and experienced in the trade.

2. PRODUCTS

2.1 PLYWOOD

Structural plywood to [AS/NZS 2269.0](#).

2.2 FIBRE CEMENT SOFFIT LINING

Cellulose cement autoclaved sheets.

2.3 TIMBER FASCIAS AND BARGE BOARDS

As selected, or radiata pine to [NZS 3631](#) for grading and to [NZS 3602](#), table 2 **Requirements for wood-based building components...**, for selection and treatment.

2.4 ACCESSORIES

Wall underlay:	Breather type, waterproof.
Rigid Air Barriers:	Proprietary rigid sheet pre-cladding systems.
Jointers:	To suit cladding type and thickness.
Nails, screws, fastenings:	Metal, size and pattern, to cladding manufacturer's requirements and complying with the relevant aspects of NZS 3604 , section 4: Durability and E2/AS1.

3. EXECUTION

3.1 MOISTURE CONTENT

Maximum allowable moisture content to [NZS 3602](#), table 4 **Allowable moisture content....**

3.2 EXECUTION GENERALLY

To [NZBC E2/AS1](#) except as varied in this specification. Execution to include those methods, practices and processes contained in the unit standards for the National Certificate in Carpentry and the National Certificate in Joinery (cabinetry, exterior joinery, stairs).

3.3 INSTALL WALL UNDERLAY/RIGID AIR BARRIER

Fix to the manufacturer's requirements. Refer to 1213 SELECTIONS for type

3.4 CAVITY BATTENS OR JAMB BATTENS

As specified in the section 3800 TIMBER FRAMING, to suit the selected wall cladding and construction type.

3.5 INSTALL PLYWOOD

Install plywood sheet and timber joint battens to [NZBC E2/AS1](#), 9.8 **Plywood sheet**.

3.6 INSTALL FIBRE CEMENT SOFFITS

Cut sheets dry and scribe fit to fully support all edges and joints. Nail and drill for and insert fasteners to the sheet manufacturer's requirements. Fit complete with jointers and capping moulds. Refer to the cladding manufacturer's literature for fixing details and fixings durability requirements to [NZS 3604](#), section 4 **Durability**.

3.7 INSTALL EXTERIOR TIMBER FINISHINGS

Install timber fascias, barge boards, facings, beads, trim and enclosures level, true to line and face, with all end grain sealed and joints mitred.

- 3.8 **INSTALL FLASHINGS**
Install flashings, covers and soakers as detailed on the drawings and to [NZBC E2/AS1](#),
4.0 Flashings.
- 3.9 **USE OF SEALANTS**
Selection and use of sealants to follow BRANZ BU 441: Sealed joints in external
claddings - 2. Sealants.
- 3.10 **COMPLETE**
Complete all flashings, finishings and trim so the cladding system is completely
weathertight.

4310 ROOFING

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Use experienced competent roofers familiar with the materials and techniques specified. Work to be carried out by or supervised by the appropriate LBP.

1.2 WIND AND EARTHQUAKE LOADINGS

Use fixings and methods capable of sustaining the loads appropriate to the area as set out in [NZS 3604](#), section 5 **Bracing design**, and confirmed under 1212 COMPLIANCE.

2. PRODUCTS

2.1 PROFILED METAL

Profile, metal and finish as selected. Accessories, cappings, flashings and fixings to match and to the roofing manufacturer's requirements.

2.2 ACCESSORIES

Tile battens:	Douglas fir or radiata pine, SG6, treated H1.2, size, spacing and fixing to NZS 3604 , table 10.12, Tile battens for all wind zones .
Roof underlays:	As selected.
Nails, screws, fastenings:	Metal, size and pattern, to roofing manufacturer's requirements and complying with the relevant aspects of NZS 3604 , section 4 Durability and NZBC E2/AS1 .
Flashings:	As required.

3. EXECUTION

3.1 STORAGE

Stack roofing and accessories on clean, level areas of the site. Cover and protect from damage and from weather until ready to fix in place.

3.2 SET-OUT

Set out the planned layout before fixing commences, to ensure true lines and the correct relationship to module, grid and roof features. Overlaps to face away from prevailing wind direction.

3.3 LAY ROOF UNDERLAY

Lay and fix to [NZBC E2/AS1](#), 8.1.5 **Roof Underlays**.

3.4 TAKE CARE

Take care to avoid damaging pre-finished roofing both during and after fixing. Mark only with chalk or spirit-based pen. Wear only soft-soled shoes on the finished surface. Remove metal filings daily.

3.5 INSTALL PROFILED METAL

Use cutting tools recommended by the roofing manufacturer. Fold ends and seal cut edges to the roofing manufacturer's requirements. Fix complete with matching accessories, flashed to roof features and penetrations; all in accordance with NZ metal roof and wall cladding code of practice and [NZBC E2/AS1](#): 8.4 **Profiled metal roof cladding**.

3.6 FIXINGS AND SEALANTS

Refer to the roofing manufacturer's literature for fixing details and to [NZS 3604](#) for fixings durability requirements. Select and use sealants only as recommended by the roofing manufacturer.

- 3.7 **INSTALL COVERS AND FLASHINGS**
Provide apron, verge and ridge flashings. Install and fix as detailed and to the roofing manufacturer's details and to comply with [NZBC E2/AS1, 4.0 Flashings](#), [NZBC E2/AS1: 5.0 Roof/wall junctions](#), and [NZBC E2/AS1: 6.0 Parapets](#).
- 3.8 **PENETRATIONS**
Flash and overflash penetrations through the roof. Fit proprietary boots to pipework penetrations.
- 3.9 **COMPLETE**
Ensure the work is complete with flashings, undercloaks, valleys, ridges and hips properly installed so the finished roof is completely weathertight.
- 3.10 **CLEAR**
Clear trade debris and unused materials from the roof and surrounds regularly during the work and at completion. Sweep down the completed roof and flush out spoutings, gutters and rainwater pipes.

4520

ALUMINIUM WINDOWS AND DOORS

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Fabricators/Installers to be experienced, competent trades people familiar with the materials and techniques specified.

1.2 CERTIFICATION

Provide documentation that the windows and doors comply with [NZS 4211](#) and safety glass complies with [NZS 4223.3](#) as modified by [NZBC F2/AS1](#) and [NZBC B1/AS1](#).

1.3 WIND LOADINGS

Refer to section 1212 COMPLIANCE for wind zone.

2. PRODUCTS

2.1 WINDOW AND DOOR REVEALS

As selected, manufactured to comply with [NZS 4211](#). Timber jamb liners to [NZS 3602](#).

2.2 FLASHINGS

To [NZBC E2/AS1](#), 9.1.10 **Windows and Doors** and as required.

2.3 ANODISED ALUMINIUM

To [WANZ SFA 3503-03](#). Thickness 12 microns generally, 20 microns for more corrosive areas and 25 microns for coastal areas and severe corrosive areas.

2.4 SEALANT, GLAZING TAPE AND GASKETS

To the window manufacturer's requirements.

2.5 FIXINGS

Ensure fixings and bracketing are compatible with aluminium. Do not use electroplated zinc fasteners or brass fastenings.

3. EXECUTION

3.1 OPENING PREPARATION

Confirm framing openings (including jamb battens for direct fix cladding) on site for dimension, plumb and straightness prior to fabrication or ordering of aluminium joinery. Prepare and trim to WANZ Window Installation Guide requirements. For openings over 600mm wide on cavity construction provide sill support bars.

3.2 EXECUTION GENERALLY

To [NZBC E2/VM1](#) and [NZBC E2/AS1](#). Install to WANZ Window installation Guide requirements.

3.3 HANDLING

Avoid distortion of elements during transit, handling and storage. Prevent pre-finished surfaces from rubbing together. Prevent contact with mud, plaster and cement. Do not deliver to site any elements which cannot be immediately unloaded into suitable conditions of storage.

3.4 CORROSION PROTECTION

Seal or suitably coat cut ends and holes drilled in aluminium before the frames are installed. Before fixing, apply bituminous coatings, slips or underlays between dissimilar metals in contact, or aluminium in contact with concrete.

- 3.5 **FIX FRAMES**
Fix frames rigidly in place without distortion, to the window manufacturer's requirements and to [NZBC E2/AS1, 9.1.10.8](#), **Attachments for windows and doors**, plumb, true to line and face, weathertight and with all openings operating freely.
- 3.6 **DRAINAGE**
Anti-condensation channels to sills. All sills to sashes and fixed lights to incorporate positive drainage to the exterior.
- 3.7 **GLAZING INSTALLATION**
All glass held in aluminium beads and black PVC gaskets.
- 3.8 **SAFETY GLASS INSTALLATION**
Use in doors, sidelight panels, low level windows and all other locations to comply with [NZS 4223.3](#), as modified by [NZBC F2/AS1, 1.0 Glazing](#) and [NZBC B1/AS1, 7.0 Glazing](#).
- 3.9 **INSTALL FLASHINGS**
Install flashings to heads, jambs and sills of frames as supplied and required by the window manufacturer and as detailed on the drawings. Finish on head flashings to match window finish.
- 3.10 **SEAL FRAMES ON SITE**
Seal frames to each other and to adjoining structure and finishes, all as required by the window manufacturer and to make the installation weathertight. Provide a continuous internal air seal between reveals and framing, using sealant over a backing rod.
- 3.11 **SAFETY**
Indicate the presence of transparent glasses for the remainder of the contract period, with whiting, tape or signs compatible with the glass type. Indicators other than whiting must not be applied to the glass surface. Permanent manifestations to comply with [NZS 4223.3, 303.1 Manifestations](#) (making glass visible).
- 3.12 **CLEAN GLASS AND FRAMES**
Clean off or remove glass indicators at completion of the building. Clean glass inside and out to a shining finish. Clean down both sides of window and door frames using the methods required by the window and door manufacturer.

6700 PAINTING

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Carry out work using competent and experienced painters.

1.2 HEALTH AND SAFETY

Refer to the requirements of the [Health and Safety in Employment Act 1992](#) and if elimination or isolation is not possible, then minimise the hazards in this work. Refer to WorkSafe NZ publication, [Repainting lead based paints](#), for the required procedures and precautions when treating or removing lead based paint, burning or sanding off paint, or using solvent based paint removers.

1.3 SELECTIONS

Confirm all selections, colours and finishes with the owner.

2. PRODUCTS

2.1 PAINT

As selected and to the paint manufacturer's standards for exterior and/or interior primers, undercoats, sealers, stains, clear coatings, solvent-borne and water-borne paints.

2.2 GAP FILLERS

Linseed oil, putty, plastic wood, wood filler or plastic filler, to suit and to match the surface being prepared.

3. EXECUTION

3.1 INSPECT SURFACES

Inspect surfaces being painted and report to the owner any that will not, after the preparatory work laid down by the paint manufacturer, allow work of the required standard. Confirm that all areas have adequate lighting and are sufficiently free of other construction activities to enable painting work to proceed.

3.2 PROTECT

Cover up adjoining surfaces and areas liable to damage or over-painting.

3.3 REMOVE HARDWARE

Remove hardware and door/window furniture and replace on completion. Do not paint over permanently attached hinges, or any hardware items which cannot be removed.

3.4 PRIMING AND SEALING

Ensure that priming and sealing work needed before or during construction is carried out when required.

3.5 ENVIRONMENTAL CONDITIONS

Carry out work within acceptable temperature and humidity limits, with timber dry, all to the requirements of the paint manufacturer.

3.6 SHARP EDGES, CRACKS AND HOLES

Repair as required by the paint manufacturer.

3.7 PREPARE SURFACES

Prepare surfaces as required by the paint manufacturer. Make good all damage and defects.

3.8 PAINT APPLICATION

Apply paint by brush and/or roller to suit the location of the coating and to the paint manufacturer's requirements. Do not spray on site without express permission.

- 3.9 **MANUFACTURER'S MANUALS**
Refer to the paint manufacturers' manuals and follow their preparation, sequence and application requirements applying to each system. Ensure all paint coats in any system are supplied by the same manufacturer.
- 3.10 **SCUFF BETWEEN COATS**
Scuff between all coats to remove any dust pick-up, protruding fibres and coarse particles.
- 3.11 **FINISHED PAINT SURFACES**
Finished paint surfaces to show uniformity of gloss and colour, with the correct thickness for each coat, and freedom from painting defects. Ensure finished work is clean and free of any disfigurement.
- 3.12 **CLEAN**
Clean adjoining surfaces, glass and fittings of any paint contamination.
- 3.13 **REFIT HARDWARE**
Refit hardware without damage to the hardware or the adjoining surfaces.

7410 RAINWATER SPOUTING SYSTEM

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 LIAISON

Ensure liaison with associated installations to ensure material selections are compatible and required flashing work is completed.

1.2 ELECTROLYTIC ACTION

Avoid electrolytic action by eliminating contact or continuity of water between dissimilar metals.

2. PRODUCTS

2.1 PVC-U SPOUTING

Profile, jointing, brackets and fittings brand matched and complete to the spouting manufacturer's specifications.

2.2 PVC-U DOWNPIPES

Tubes, stand-off brackets and fittings brand matched and complete to the manufacturers specifications.

2.3 RAINWATER HEADS, DROPPERS, OVERFLOWS

Fabricate and install as detailed.

3. EXECUTION

3.1 INSTALL PVC-U SPOUTING AND DOWNPIPES

Fit and screw fix brackets, set to falls to outlets. Ensure solvent welded or rubber ring jointed spouting sections are complete with all fittings to the spouting manufacturer's requirements. Screw fix stand-off brackets, set pipes plumb and clear of the wall, solvent welded. Discharge into stormwater bends.

3.2 ENSURE

Ensure rainwater services are operational, flashings complete and the building weathertight.

7430 DRAINAGE SYSTEMS

1. GENERAL

Refer to 1213 SELECTIONS/drawings for specific product, material, accessories and finish selections.

1.1 QUALIFICATIONS

Carry out work by or under the direct supervision of a person registered under the Plumbers, Gasfitters and Drainlayers Act 2006.

1.2 AS-BUILT DRAWINGS

Supply a 1:100 as-built drawing to the BCA and the owner on completion.

2. PRODUCTS

2.1 MATERIALS

Concrete:	17.5 MPa prescribed grade.
Reinforcement:	Grade 300 deformed bars.
PVC-U pipes:	PVC-U pipes bends, junctions, fittings and joints.
Field drains:	Plastic pipes for field drains perforated and coiled with filter fabric over.
Drainage/filling materials	
Granular fill:	Clean gravel or crushed stone or a blend of these. Particle size from minimum 7mm to maximum 20mm.
Selected fill:	Fine grain soil or granular material suitable for bedding, excluding topsoil.
Ordinary fill:	Top soil or other excavated materials.

2.2 FITTINGS

Gully traps:	To NZBC G13/AS2, 3.3 Gully traps , complete with grating.
Strip drain channel:	Proprietary, modular, variable invert, PVC-U or precast concrete drainage channel sections and drainage sump, embedded in site concrete and fitted with selected metal gratings.

3. EXECUTION

3.1 EXCAVATE

Excavate for drains to a firm even base with correct gradients set in straight runs.

3.2 MANUFACTURER'S REQUIREMENTS

All drainage installations to the pipe and fitting manufacturer's requirements.

3.3 EXECUTION GENERALLY

Carry out drainage work as applicable to:
- NZBC G13/AS2 and NZBC E1/AS1.

3.4 LAY STORMWATER DRAINS

Confirm the required location of downpipes and finished ground levels before commencing pipework. Set downpipe bends in concrete brought up to protect the top of the bend from damage. Lay drains in straight runs to correct gradients to discharge into the NUO's stormwater system.

3.5 INSTALL STRIP DRAIN CHANNEL

Excavate trench and form site concrete base to fall. Set interlocking channel sections, sumps and accessories in place, all in accordance with the channel manufacturer's requirements. Check falls and install gratings and covers.

3.6 INSTALL SURFACE WATER SUMP

To NZBC E1/AS1, 3.6 Surface water inlets to drains. Ceramic half-siphon pipe. Cast iron frame with a lift out grating.

3.7

CONCRETE ENCASEMENT

Concrete encase shallow drains and drains under driveways, on a 100mm deep 17.5 MPa concrete bed reinforced with three 10mm mild steel bars. Surround pipes with a polythene membrane to allow movement and encase in 100mm 17.5 MPa concrete.

3.8

FIELD TEST

Field test drains for watertightness to the satisfaction of the BCA inspector.

3.9

BACKFILL

Backfill drain lines in 150mm layers, well tamped but without disturbing the drains. Finish off garden areas with 150mm of topsoil, slightly mounded above the finished ground line. Public roads and footpaths to be made good to the controlling authority requirements.

shadowclad®

SHADOWCLAD®
Natural
GROOVE

SHADOWCLAD®
Natural
TEXTURE

SHADOWCLAD®
Ultra
GROOVE

SHADOWCLAD®
Ultra
TEXTURE

SHADOWCLAD®
FLASHING

SHADOWCLAD® SPECIFICATION & INSTALLATION GUIDE

JUNE 2014

 **Carter Holt Harvey**
Woodproducts New Zealand

Information contained within is specific to Shadowclad® branded structural plywood and must not be used with any other plywood brands no matter how similar they may appear.

shadowclad®

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1.0 SHADOWCLAD[®] PRODUCT RANGE

Manufactured by Carter Holt Harvey[®] Woodproducts, Shadowclad is suitable for use as an exterior wall cladding when using H3 treated panels or as an internal wall and ceiling lining when using untreated panels.

Shadowclad is manufactured under a third party audited quality control programme to monitor compliance with AS/NZS 2269 Plywood Structural. All Shadowclad products carry Engineered Wood Products Association of Australasia (EWPAA) Joint Accreditation System – Australia and New Zealand (EWPAA/JAS-ANZ) certification.

Shadowclad has been BRANZ appraised as a cladding material for both direct and cavity fixed construction. To view the appraisals visit www.chhwoodproducts.co.nz.

For information relating to Ecoply[®] structural plywood and applications other than exterior cladding, refer to the Ecoply Specification & Installation Guide. Or for specific information on plywood as a rigid air barrier, refer to the Ecoply Barrier Specification and Installation Guide.

The Shadowclad BRANZ appraisals do not cover:

- Shadowclad used as an interior lining
- Downgrade plywood products

Shadowclad must be completely installed in accordance with good building practice and sound design principles to satisfy the requirements of the Building Act 2004 and the New Zealand Building Code. This is the responsibility of building owners and the design professionals and builders that they engage. This document contains information, limitations, and cautions regarding the storage, handling, installation, usage, and the maintenance of Shadowclad. However, Carter Holt Harvey assumes no legal liability to you in relation to this information.

1.1 TECHNICAL INFORMATION AND CAD DETAILS

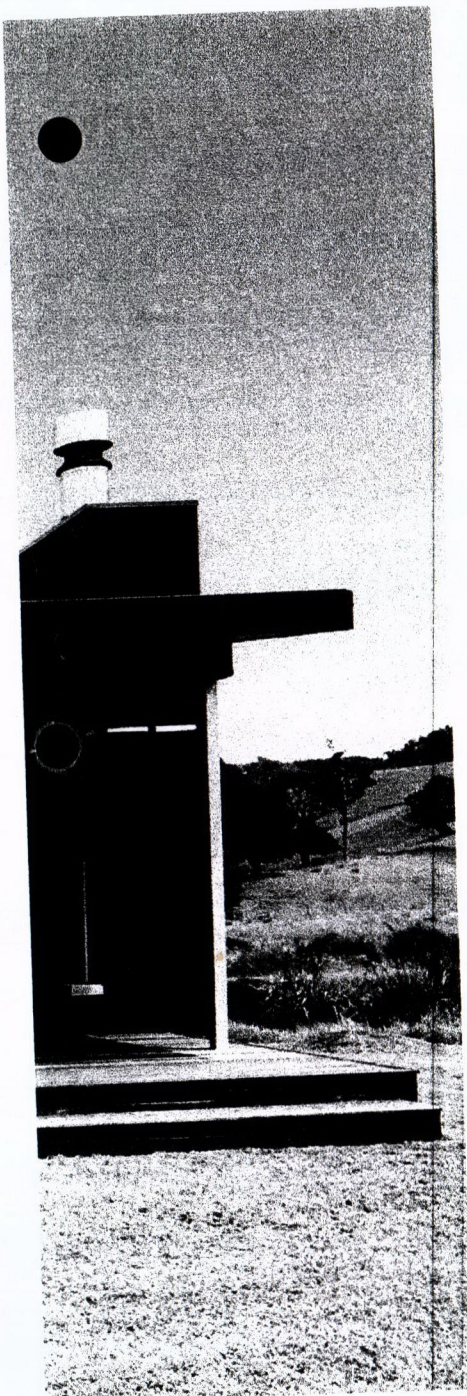
When specifying or installing any Shadowclad product visit www.chhwoodproducts.co.nz or call 0800 326 759 to ensure you have current specification material.

Having trouble installing Shadowclad visit www.chhwoodproducts.co.nz to view the installation of common Shadowclad junctions.

The information contained in this document is current as at June 2014. It is your responsibility to ensure you have the most up to date information available.

The information contained in this manual relates specifically to Shadowclad branded structural plywood manufactured by Carter Holt Harvey Woodproducts and cannot be used with any other plywood manufacturers product however similar they may appear.

Alternative plywood products can differ in a number of ways which may not be immediately obvious and substituting them for products is not appropriate and could in extreme cases lead to premature failure and/or buildings which do not meet the requirements of the New Zealand Building Code.



1.2 PRODUCT DESCRIPTION AND RANGE

Shadowclad® is a structural plywood panel manufactured from radiata pine wood veneers. The veneers are placed at right angles to each other for maximum strength and stability then bonded together with synthetic phenolic (PF) resin to form a strong and permanent Type A bond.

Shadowclad is available in panel sizes 2440 / 2745 x 1216 mm (to provide 1200 mm cover) and features a unique textured appearance which also helps to defuse UV rays for increased aesthetic performance when exposed to weather.

Shadowclad is available in either Textured or Texture Groove profiles and in either Natural or Pre Primed finishes.

Shadowclad Natural

Shadowclad Natural is an uncoated panel suitable for use with penetrating stains, film forming stains and paint systems.

Shadowclad Ultra

Shadowclad Ultra features a factory applied exterior grade primer suitable for use with most paint and film forming stain systems. Using a unique powder coating process on the panel face and edges means Ultra panels can be immediately top coated on site, eliminating (in most cases) the need for expensive and time consuming wet primers.

Shadowclad Ultra features:

- High 70 microns film build, can be up to 2-3 times thicker than traditional wet primers
- Continuous powder coated surface forms an effective moisture barrier for a dryer more consistent painting surface
- Saves time and money as traditional wet primers are not normally required
- Panel surface and edges factory primed for increased panel durability
- Once installed Shadowclad Ultra can be exposed to weather for up to 3 months prior to top coat application
- Low volatile organic compound (VOC) primer coating

Shadowclad Ultra is available H3 treated for use as an exterior cladding. It is available H3.1 LOSP treated for residential and commercial applications or H3.2 CCA if required.

H3.2 CCA treatment is only available in the Ultra finish and is not available with Natural finish products.

Shadowclad Ultra is not suitable for use with penetrating stains. For advice on specific coating systems and their suitability for use with Shadowclad Ultra always refer to the coating manufacturer.

TABLE 1: SURFACE FINISHES

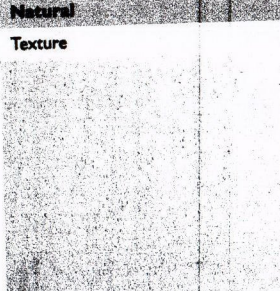
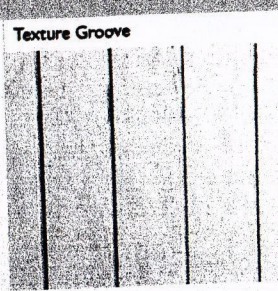
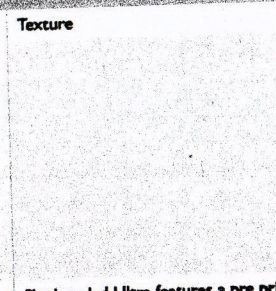
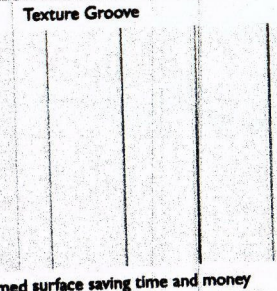
Natural		Ultra	
Texture	Texture Groove	Texture	Texture Groove
			
Shadowclad Natural is an uncoated panel suitable for staining and painting. Panels can also be clear coated when used in internal dry applications.		Shadowclad Ultra features a pre primed surface saving time and money when using paints and film forming stains and is suitable for use in exterior applications only.	

TABLE 2: SHADOWCLAD PRODUCT RANGE

Profile	Texture	Texture Groove
Finish	Natural or Ultra	Natural or Ultra
Sheet Length	2440 & 2745 mm	2440 & 2745 mm
Width (overall)	1216 mm	1216 mm
Width (effective)	1200 mm	1200 mm
Cover / Width Tolerance	+/- 1 mm	+/- 1 mm
Nominal Thickness	12 mm	12 mm
Weight (kg/m ²)	6.6	6.6
R-value (m ² .C/W)	0.104	0.104
Groove Profile	N/A	9 mm wide, 5 mm deep at 150 mm centres
Edge Profile	Shiplap with weather groove	Shiplap with weather groove
Treatment Available	<ul style="list-style-type: none"> • H3.1 LOSP (Azole) • H3.2 CCA (Ultra finish only) • Untreated – internal dry applications (Natural finish only) 	<ul style="list-style-type: none"> • H3.1 LOSP (Azole) • H3.2 CCA (Ultra finish only) • Untreated – internal dry applications (Natural finish only)

Shadowclad® Exterior Flashing Range

Manufactured from extruded aluminium, the Shadowclad flashings range is purpose designed to complement Shadowclad panels used in exterior applications.

Independently tested for weather tightness and compliant with Table 20 of E2/AS1, Shadowclad flashings achieve 50 year durability in all NZS 3604 exposure zones including zone D (sea spray)

The range includes internal and external angles, horizontal and inter-storey 'Z' flashings and a cavity base closure.

Horizontally installed flashings come in 3600 mm lengths and vertically installed angles are available in standard Shadowclad panel lengths.

Flashings not supplied by CHH Woodproducts must comply with E2/AS1 specifications and be compatible for use with H3.1 LOSP or H3.2 CCA treated plywood.

Flashing Finishes

Shadowclad flashings are available in either natural anodised finish (silver colour) for immediate installation or mill finished allowing customers to powder coat flashings to any desired colour finish.

Visit www.duluxpowdercoatings.co.nz to find a powder coater in your area or refer to your local yellow pages directory.

Exterior Flashings & H3.2 CCA Treated Shadowclad®

Exposure Zone B & C

H3.2 CCA treated Shadowclad in exposure zones B and C (where flashings are exposed to weather) must use mill finished flashings which must be powder coated to the desired colour or use stainless steel flashings.

H3.2 CCA treatment contains copper. As such, some form of isolation between aluminium flashings and H3.2 CCA treated panels such as powder coating of the flashings is required. Refer to Table 21 "Compatibility of Materials in Contact" in E2/AS1 for more information.

Exposure Zone D (Sea Spray)

In exposure zone D (sea spray) flashings exposed to weather must be stainless steel for H3.2 CCA treated Shadowclad.

Stainless steel flashings are not supplied by CHH Woodproducts and must meet requirements of E2/AS1.

H3.2 CCA Treated Shadowclad

Uncoated aluminium flashings are not permitted to be in direct contact in any zone with H3.2 CCA treated Shadowclad under any circumstances.

For further information relating to H3.2 CCA treated Shadowclad contact CHH Woodproducts on 0800 746 399

TABLE 3: SHADOWCLAD® FLASHING RANGE

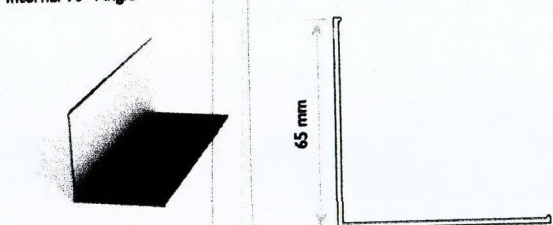
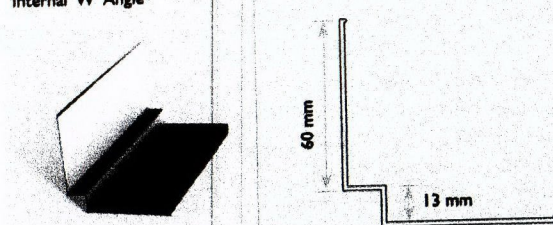
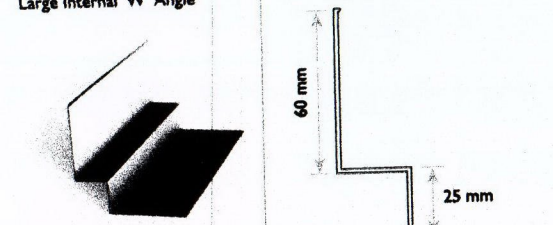
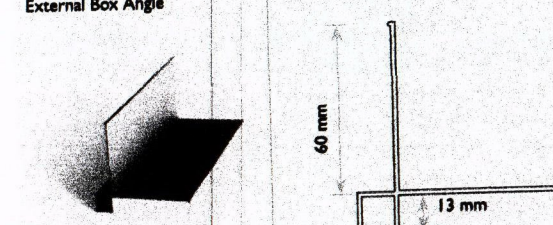
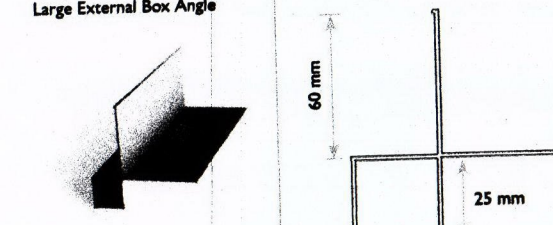
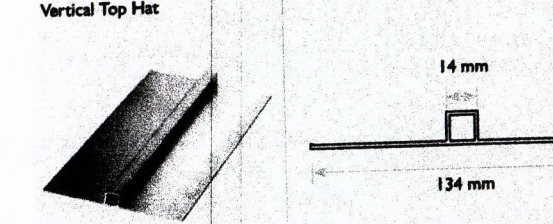

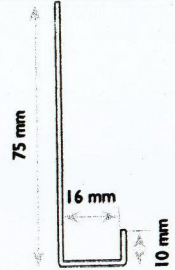
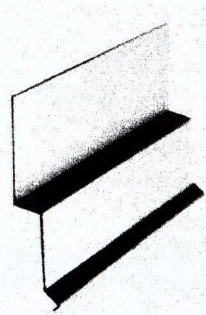
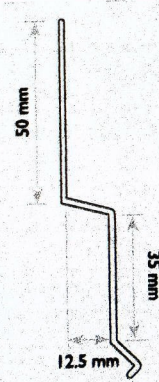
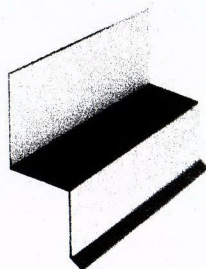
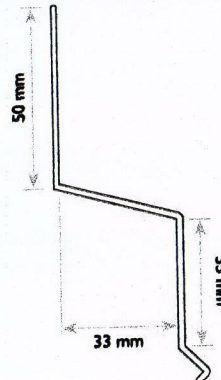
Flashing	Line Drawing	Description	Finish Available	Length (mm)
Internal 90° Angle		Back flashing for internal corners	Natural Anodised	2440 2745
Internal 'W' Angle		'W' back flashing for internal corners providing a flush finish with panels (13 mm x 13 mm)	Natural Anodised	2440 2745
Large Internal 'W' Angle		'W' back flashing for internal corners (25 mm x 25 mm) Design Tip: Use a Large 'W' where a flush junction between the Horizontal 'Z' flashing and corner flashing is desired	Natural Anodised Mill	2440 2745
External Box Angle		Box corner for external corners providing a flush finish with panels	Natural Anodised Mill	2440 2745
Large External Box Angle		Box corner for external corners (25 mm x 25 mm) Design Tip: Use Large External Box where a flush junction between the Horizontal 'Z' flashing and corner flashing is desired	Natural Anodised Mill	2440 2745
Vertical Top Hat		Vertical sheet joint flashing	Natural Anodised Mill	2440 2745

TABLE 3: SHADOWCLAD® FLASHING RANGE CONTINUED

Flashing	Line Drawing	Description	Finish Available	Length (mm)
<p>Cavity Base Closure</p> 		Restricts vermin from accessing the cavity space	Natural Anodised	3600
<p>Horizontal 'Z' Flashing</p> 		Horizontal Z flashing for horizontal joints between panels	Natural Anodised Mill	3600
<p>Inter-Storey 'Z' Flashing</p> 		Horizontal Z flashing for horizontal joints between panels when limiting continuous cavities to a height of two storeys or 7 meters	Natural Anodised Mill	3600

SHADOWCLAD® PRODUCT RANGE

1.3 BUILDING MATERIALS FOR USE WITH SHADOWCLAD (EXTERIOR CLADDING)

TABLE 4: MATERIALS AVAILABLE FROM CHH WOODPRODUCTS

Description	Treatment	Length
Sill Tape	-	150 mm x 20 m
Ecoply® Barrier ²	H3.2 CCA	2440 mm / 2745 mm x 1200 mm

¹ Batten dimensions are nominal
² Refer to the Ecoply Barrier Specification and Installation Guide for more information

Building Materials Supplied by Other Manufacturers

- Fasteners (i.e. nails or screws) in accordance with Table 8: Fastener Lengths for Shadowclad fixing
- Building underlay compliant with Table 23 of E2/AS1
- Window/door head flashings supplied by window joinery company
- Window sill flashings (direct fixed only) supplied by window joinery company

1.4 PRESERVATIVE TREATMENT

Shadowclad® is available either H3 treated for use as an exterior cladding or untreated (Natural finish products only) for interior wall and ceiling linings. H3 treated Shadowclad is treated in accordance with AS/NZS 1604.3 with the standard treatment for Shadowclad panels being H3.1 LOSP (Azole). H3.2 CCA treatment is available for Shadowclad Ultra panels if required.

Shadowclad is envelope preservative treated. Where sheets are cut, cuts must be coated with a brush on timber preservative. Holdfast Metalex Clear is recommended. Failure to do so may affect the long term durability of the panel.

H3.1 LOSP Treatment

H3.1 LOSP treatment is the standard treatment for Shadowclad panels as it does not discolour the panel surface and does not use water in the treatment process allowing panels to remain at uniform dimensions.

When coating H3.1 LOSP treated plywood some residual solvent may be present on the sheet surface from the treatment process. Sheets feeling greasy to touch should be placed in a well ventilated area and allowed to flash off to ensure proper adhesion of paints and stains to the sheet surface.

Mechanical fasteners are recommended to fix H3.1 LOSP treated Shadowclad to framing.

H3.2 CCA Treatment

H3.2 CCA uses water during the treatment process and may leave panel surfaces with a slight green colour. For this reason H3.2 CCA treatment is available only in a pre primed finish (Shadowclad Ultra).

TABLE 5: PRESERVATIVE TREATMENT

	Untreated	H3.1 LOSP (Azole)	H3.2 CCA
Preservative carrier	N/A	Light organic oil (white spirits)	Water
Colour	Natural	Natural	Green
Fungicide	Heat treated dry wood	Propiconazole and Tebuconazole	Copper
Insecticide	Heat treated dry wood	Permethrin	Arsenate
Other chemicals	N/A	Buryl Oxitol (co-solvent to assist active stability)	Chrome (to fix preservative in water)
Mouldicide	N/A	IPBC	Copper (limited efficiency)
Notes	Plywood for dry interior use, supplied ex mill at <15% moisture content	Solvent does not affect dimensions. Solvent smell disappears when exposed to air flow	Dried after treatment to average 18% moisture solvent
Applications (Refer NZ3602)	Interior dry protected	Exterior (service performance subject to detailing & coatings used)	Exterior (service performance subject to detailing & coatings used)

1.5 SUSTAINABILITY

Shadowclad is manufactured from radiata pine. It is grown on tree farms which are tended and harvested to provide wood for plywood manufacture. The crop is managed on a sustainable basis to yield millable trees.

New Zealand plantations are managed in compliance with the New Zealand Forest Accord.

Shadowclad is manufactured in New Zealand at CHH Woodproducts Tokoroa plywood mill.

Shadowclad is available Forestry Stewardship Council (FSC) (SCS-COC-001316) certified upon request.

1.6 PRODUCT IDENTIFICATION

In accordance with AS/NZS 2269, every sheet of Shadowclad plywood has the following information marked on the back:

- Brand name: e.g. SHADOWCLAD
- Glue bond: e.g. A BOND
- Intended application: e.g. STRUCTURAL
- Australasian Standard: e.g. AS/NZS 2269:2012
- Date and time of manufacture: e.g. 01/01/12 19:45:45
- Formaldehyde emission class: E₀
- The Engineered Wood Products Association of Australasia

(EWPA) brand and mill number: e.g. 911 (Tokoroa mill)

For example:

SHADOWCLAD A BOND STRUCTURAL
AS/NZS 2269:2012 PAT 01/01/12 19:45:45 E0



If the plywood is treated it will also be marked in accordance with the treatment standard AS/NZS 1604.3

2.0 DESIGN CONSIDERATIONS

2.1 DESIGN RESPONSIBILITY

The specifier for the project must ensure that the details in the specification are appropriate for the intended application and that additional detailing is provided for specific design or any areas that fall outside the scope and specifications of this literature.

Good detailing which avoids moisture or dust accumulation on the sheet surface can help increase durability and aesthetics.

Roof overhangs contribute to performance as they offer shade and will protect walls from rain and dust. Trims should be bevelled to shed moisture and flashings should be detailed with gaps that do not trap water at the panel edges.

2.2 LITERATURE SCOPE

Shadowclad® can be used for those structures which fall within the scope of Acceptable Solution E2/AS1 "External Moisture". There are two methods of installing Shadowclad depending on the risk assessment for each wall face to be clad:

- Direct-fixed, where the cladding is fixed directly to the timber frame. This method of installation is only permitted in low risk buildings
- Drained and ventilated cavity, where the cladding is fixed onto timber battens fixed over the timber frame

Details in this publication reference cavity fixed applications only. Direct fix details can be downloaded from www.chhwoodproducts.co.nz/shadowclad-plywood-cladding

To determine which fixing method is required by the Acceptable Solution, assess each wall face using the building envelope risk matrix in 'E2/AS1 – External Moisture' (latest edition). For each wall with a risk score of 0 – 6, Shadowclad can be either direct-fixed or fixed over a drained, ventilated cavity. Where the risk score is 7 – 20, Shadowclad must be fixed over a drained and ventilated cavity.

2.3 CODE COMPLIANCE

Shadowclad is tested in accordance with E2/VM1 and AS/NZS 4284 "Testing of Building Facades" for compliance with NZ Building code requirements.

2.4 SITE & FOUNDATIONS

The site on which the building is situated must comply with the Acceptable Solution E1/AS1 of the Approved Document

for the NZBC (New Zealand Building Code) Clause E1 "Surface Water".

2.5 GROUND CLEARANCES

The bottom edge of the Shadowclad sheet must be a minimum of 100 mm above decks or paved ground and a minimum of 175 mm above unprotected ground.

Shadowclad must overhang the bottom plate on a concrete slab by a minimum of 50 mm as required by NZS 3604.

For garage door openings, refer Paragraph 9 "Openings to garages" in Acceptable Solution E2/AS1.

2.6 MOISTURE MANAGEMENT

It is the responsibility of the specifier to identify moisture related risks associated with any particular building design.

Wall construction design must effectively manage moisture, accounting for both the interior and exterior environments of the building. This is particularly important in buildings that have a higher risk of wind driven rain penetration or that are artificially heated or cooled.

Where a deck is attached to the building and the Shadowclad® extends below the deck to cover the framing, keep decking clear of

the Shadowclad surface and detail to avoid moisture entrapment.

All wall openings, penetrations, junctions, connections, window sills, heads and jambs must incorporate appropriate flashing and waterproofing. Materials, components and the installation used to manage moisture in framed wall construction must, at a minimum, comply with the requirements of relevant Sections and Clauses of the NZ Building Code.

2.7 WIND LOADING

Shadowclad is suitable for use in all wind zones up to and including extra high (55 m/s) as defined by NZS 3604 and

specific design wind pressures up to design differential ultimate limit state (ULS) of 2.5 kPa.

2.8 DURABILITY

The durability level applicable to Shadowclad is dependent upon the application and coating applied. Detailing, treatment and installation methods need careful consideration to satisfy the requirements of the NZ Building Code.

Internal Linings – 50 year Durability

Untreated Shadowclad used in dry, interior situations will meet the requirements for 50 year minimum durability left coated or uncoated.

Exterior Cladding – 15 year Durability

NZ Building Code Clause B2 requires claddings which do not form part of the bracing to achieve a minimum structural durability level of 15 years.

Shadowclad coated with stains or paints (regardless of colour choice) will meet this requirement. If using dark colours (colours with an LRV of less than 40%) homeowners should expect an increased level of coating maintenance over the life of the cladding than would normally be expected where lighter colours are used.

Using dark colours with an LRV of less than 40% and failure to adequately maintain the surface coating of the cladding increases the risk of aesthetic related issues such as face checking.

Exterior Cladding Providing Wall Bracing – 50 year Durability

To meet the requirements for a 50 year minimum durability level, when used as an exterior cladding used as bracing (Refer NZS 3602 Table I, Ref 1B.4). Shadowclad panels must be:

- H3 preservative treated
- Coated with a 3 coat acrylic coating system such as a good quality paint or film forming stain system. (Penetrating stains do not meet this requirement)
- Coating colours must have a light reflectance value (LRV) of 40% or more
- Minimum total coating system film build of 90 microns
- Coating must be regularly maintained as part of a normal building maintenance program throughout the life of the building

Advice and assurances from the coating manufacturer must be sought and details submitted for approval with any building consent application to ensure the applicable requirements for 50 year durability are achieved.

For further information on Shadowclad used as both cladding and bracing refer to section: 3.0 Bracing Specifications.

CHH® Woodproducts does not recommend Shadowclad is left uncoated when used as an exterior cladding.

For further advice on coating selections refer to section 6.0: Coating and Application – Exterior Cladding.

2.9 TEXTURED VS. SMOOTH FINISHED PLYWOOD AS EXTERIOR CLADDING

Structurally, some smooth faced plywood products may meet the requirements of E2/AS1 however in CHH Woodproducts opinion smooth faced plywood does not retain a high level of appearance when directly exposed to weathering.

Where a high level of appearance is desired (such as exterior cladding) CHH Woodproducts recommends the use of Shadowclad over smooth faced plywood. Shadowclad features a

textured (bandsawn) face which reduces the visibility of natural surface checking which can occur in any wood based product which has been exposed to weather for a prolonged period.

Surface checks are not considered a manufacturing fault as they are part of a natural process and are merely an indication that it is time to re-apply the surface coating on the product.

2.10 HEALTH & SAFETY

Shadowclad® should be installed and used as per the Material Safety Data Sheet (MSDS) downloadable from www.chhwoodproducts.co.nz.

Always wear safety glasses or non-fogging goggles when cutting Shadowclad panels and aluminium flashings.

If wood dust exposures are not controlled when machining (sawing, routing, planing, drilling etc) a class P1 or P2 replaceable filter or disposable face piece respirator should be worn.

Wear comfortable work gloves to avoid skin irritation and the risk of splinters. Wash hands with mild soap and water after handling panels.

2.11 STORAGE & HANDLING

Shadowclad panels:

- Keep Shadowclad panels dry
- Store under cover
- Handle and stack with care to avoid damage.
- Stack flat; clear of ground, on at least three evenly spaced bearers
- Store in well-ventilated areas away from sources of heat, flames or sparks

Shadowclad flashings:

- Keep dry. Should a shipment of Shadowclad flashings arrive in a wet condition, they should be immediately dried before storing
- When storing aluminium avoid contact with other metals which may cause scratches or marks. The use of shelving or racks faced with dry wood is recommended
- Keep away from caustics, nitrates and acids

2.12 LIMITATIONS

The information contained in this document is current as at June 2014 and is based on data available to CHH® Woodproducts at the time of going to print.

All photographic images are intended to provide a general impression only and should not be relied upon as an accurate example of Shadowclad installed in accordance with this document or NZ Building Code compliance documents.

This publication replaces all previous CHH Woodproducts design information and literature relating to Shadowclad panel installation and flashings. CHH Woodproducts reserves

the right to change the information contained in this document without prior notice. It is important that you visit www.chhwoodproducts.co.nz or call 0800 326 759 to confirm that you have the most up to date information available.

CHH Woodproducts has used all reasonable endeavours to ensure the accuracy and reliability of the information contained in this document and, to the extent permitted by law, will not be liable for any inaccuracies, omissions or errors in this information nor for any actions taken in reliance on this information.

3.0 BRACING SPECIFICATIONS

The Shadowclad® bracing system provides bracing resistance for walls and subfloor foundations for light timber framed buildings under wind and earthquake loading, to meet the requirements of the NZ Building Code – B1 Structure, and NZS 3604 *Timber Framed Buildings*.

Any Shadowclad structural panel may be used for bracing provided the Shadowclad bracing specifications outlined in this publication are followed.

Shadowclad panels may be used as a dual cladding and structural bracing system either direct fixed (where permitted, please see the matrix in E2/AS1) or over a ventilated cavity.

Where Shadowclad is to be used as both cladding and structural bracing the following is required:

- H3 preservative treated
- Panels must be coated with a three coat acrylic coating system such as a good quality paint or film forming stain. (Penetrating stains do not meet this requirement)
- Coating colours must have light reflectance value (LRV) of 40% or more
- Minimum total coating system film build of 90 microns
- The coating must be regularly maintained as part of a normal building maintenance program throughout the life of the building

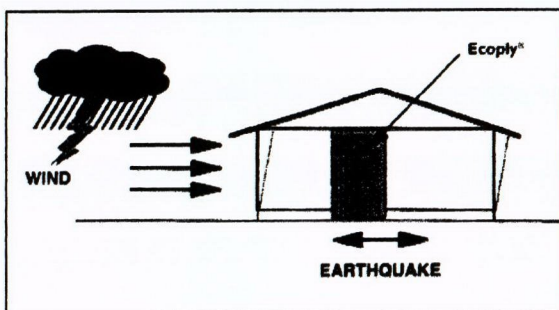
3.1 DESIGN TO COMPLY WITH THE NEW ZEALAND BUILDING CODE

Structure

Timber framed buildings to NZS 3604

NZS 3604 *Timber Framed Buildings* is listed as an Acceptable Solution under clause 3.0 Timber in Acceptable Solution B1/AS1 Structure.

CHH® Woodproducts have developed a range of wall bracing elements tested using P21 testing methods referenced in NZS 3604:2011.



Specific design

Because Shadowclad is structural plywood manufactured to AS/NZS 2269, it is suitable for design and use in earthquake and wind bracing systems constructed in accordance with NZS 3603 and AS/NZS 1170.

Structural plywood to AS/NZS 2269 is the only sheet brace material with properties defined in a published New Zealand engineering design code, NZS 3603 *Timber Structures*, and so

can be designed in compliance with Verification method B1/VM1 under clause 6.0 Timber for use in buildings over three storeys in height.

Demand is calculated by following Section 5, Bracing Design of NZS 3604 or using the GIB EzyBrace® software, downloadable from www.gib.co.nz.

Timber Floors

When carrying out a bracing design for buildings with timber floor structures, the maximum bracing rating that can be accounted for when summing up the bracing units is 120 BUs/m. This does not exclude the installation of bracing elements that are rated higher than 120 BUs/m, however the extra bracing capacity can not be accounted for in the bracing design.

Specific design of floor and sub-floor framing is required for elements rated higher than 120 BUs/m if the full element rating is to be accounted for.

Durability

Shadowclad plywood is manufactured to meet the requirements of NZS 3602 Timber and Wood based products for use in Buildings. If the product is used, handled and installed in accordance with CHH Woodproducts product literature it will meet the durability clauses of the NZ Building Code.

Table 6 summarises the applications in which Shadowclad can be used as structural bracing together with the preservative treatment and fastener material required.

TABLE 6: SHADOWCLAD® SUITABILITY FOR BRACING APPLICATIONS INCLUDING TREATMENT TYPE AND FASTENER MATERIAL

Application	Plywood Treatment	Fastener Material
Shadowclad® bracing exposed to exterior weather conditions and dampness but not in contact with ground in exposure zones¹ B & C: E.g. Shadowclad used as both cladding and bracing (direct fixed to framing or over a drained ventilated cavity system)	Shadowclad H3.1 LOSP	Hot dipped galvanised or better
	Shadowclad H3.2 CCA	Stainless steel
Shadowclad bracing exposed to exterior weather conditions and dampness but not in contact with ground in exposure zones¹ D (sea spray): E.g. Shadowclad used as both cladding and bracing (direct fixed to framing or over a 20 mm drained ventilated cavity system)	Shadowclad H3.1 LOSP	Stainless steel
	Shadowclad H3.2 CCA	Stainless steel

¹ Exposure zones as per section 4 of NZS 3604

Subfloor sheet bracing

H3 treated Shadowclad can be used as sheet bracing where dampness does not allow the use of untreated plywood or other sheet materials (section 5 of NZS 3604). Where Shadowclad subfloor sheet bracing is exposed to both rain and sun, it must be coated with a three coat, maintained acrylic exterior coating system with a light reflectance value of 40% or greater.

Adjustments for wall height

Use section 5 of NZS 3604 to calculate bracing values:

"Adjustment of bracing capacity of walls of different heights and walls with sloping top plates shall be obtained by the following method:

- (a) For wall bracing elements of heights other than 2.4 m, the bracing rating determined should be multiplied by $2.4 \div$ element height in metres, except that elements less than 2.4 m high shall be rated as if they are 2.4 m high.
- (b) Walls of varying heights, should have their bracing capacity adjusted in accordance with section 5 of NZS 3604 using the average height."

Joining panels for walls higher than maximum sheet length

Shadowclad bracing panels must be fixed from top plate to bottom plate. For wall heights over 2.45 m, Shadowclad is available in 2.745 m sheet lengths. Alternatively, a part sheet can be stacked above a full sheet, butt joined on a single row of nogs with each sheet/part sheet independently nailed off as per the nail spacing in the Shadowclad bracing specifications.

Cladding as bracing

Shadowclad is recommended as a cladding which can be used for bracing as well.

12 mm Ecoply® (CD face grade or better) can be H3 treated to meet the requirements of Acceptable Solution E2/AS1 and will perform as a structural, durable and weather tight cladding and bracing element when installed in accordance with the specifications in this Guide.

However smooth faced plywood such as Ecoply may be prone to appearance related issues such as face checking which occurs naturally and is not considered by CHH Woodproducts to be a manufacturing or product fault.

For exterior cladding applications where a high visual appearance is desired, CHH Woodproducts strongly recommends the use of Shadowclad as an exterior cladding.

Soil

Shadowclad must not be allowed to come in contact with soil or the ground. The bottom edge of the plywood sheet must be a minimum of 100 mm above decks or paved ground and a minimum of 175 mm above unprotected ground.

Service penetrations in bracing elements

Small openings (e.g. power outlets) of 90 x 90 mm or less may be placed no closer than 90 mm to the edge of the braced element, or waste pipe outlets of max. 150 mm diameter placed at no closer than 150 mm to the edge of the braced element.

3.2 SHADOWCLAD® BRACING SPECIFICATION – SCI

SINGLE SIDED SHADOWCLAD BRACE

Specification No.	Minimum Wall Length	Lining Requirements	BU/m Wind	BU/m Earthquake
SCI	0.6 m	Shadowclad one side	105	120

Framing

Wall framing must comply with:

NZBC B1 – Structure: AS1 Clause 3 Timber (NZS 3604:2011)
 NZBC B2 – Durability: AS1 Clause 3.2 Timber and Wood Based Building Products (NZS 3602)

Framing dimensions and height are as determined by the NZS 3604 stud and top plate tables for load bearing and non load bearing walls. Kiln dried verified structural grade timber must be used. Machine stress graded timber, such as Laserframe® minimum SGB, is recommended.

Bottom plate fixing

Use GIB Handibrac® hold-down connections at each end of the bracing element. Refer to manufacturer installation instructions, supplied with the connectors, for correct installation instructions and bolt types to be used for either concrete or timber floors. Within the length of the bracing element, bottom plates are fixed in accordance with the requirements of NZS 3604.

Lining

One layer of Shadowclad fixed directly to framing or over cavity battens. If part sheets are used, ensure nailing at required centres is carried out around the perimeter of each sheet or part sheet.

Fastening the Shadowclad**Fasteners**

Fasten with 60 x 3.15 mm galvanised or stainless steel flat head nails for direct fix or over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Shadowclad

Use stainless steel fastener annular grooved nails where fasteners are in contact with H3.2 CCA treated timber or plywood permanently exposed to weather.

Refer to table 8 of the Shadowclad Specification and Installation Guide for further fastener selection advice.

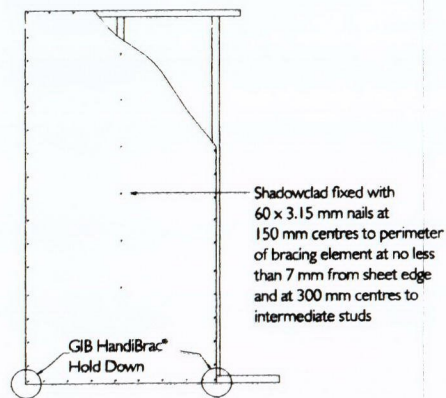
Fastening centres

Fasteners are placed at 150 mm centres around the perimeter of each sheet and 300 mm centres to intermediate studs. Where more than one sheet forms the brace element each sheet must be nailed off independently.

Fastening to cavity battens

The brace element may be fixed over cavity battens

The cavity battens must be a minimum of 40 x 20 mm nailed in staggered formation at 150 mm centres to studs around the perimeter of the brace element; and nailed to the intermediate studs within the element at 300 mm centres. 60 mm x 3.15 mm flat head galvanised or annular grooved stainless steel nails should be used.



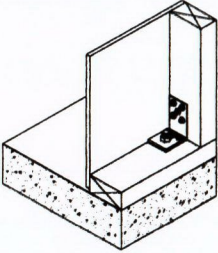
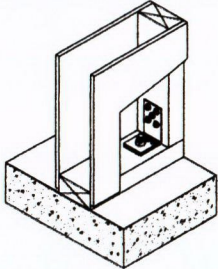
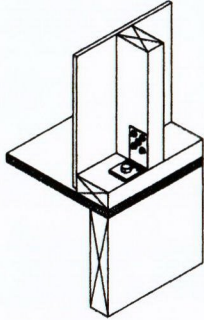
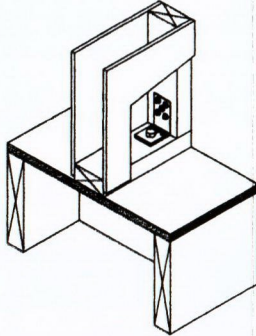
3.3 GIB HANDIBRAC® – RECOMMENDED INSTALLATION METHOD

Developed in conjunction with MiTek™ NZ, GIB HandiBrac® has been tested for use as a hold-down in all Shadowclad (SCI) bracing elements.

- The GIB HandiBrac registered design provides for quick and easy installation
- GIB HandiBrac provides a flush surface for the wall linings

because it is fitted inside the framing. There is no need to check in the framing as recommended with conventional straps

- The GIB HandiBrac is suitable for both new and retrofit construction
- The design also allows for installation and inspection at any stage prior to fitting internal linings

Concrete Floor		Timber Floor	
External walls	Internal walls	External walls	Internal walls
			
<p>Position GIB HandiBrac as close as practicable to the internal edge of the bottom plate</p>		<p>Position GIB HandiBrac in the centre of the stud/plate junction</p>	
<p>Position GIB HandiBrac in the centre of the perimeter joist or bearer</p>		<p>Position GIB HandiBrac in the centre of the floor joist or full depth solid block</p>	
<p>Hold-down fastener requirements</p> <p>A mechanical fastening with a minimum characteristic uplift capacity of 15 kN or screw bolt supplied with the bracket</p>		<p>12 x 150 mm galvanised coach screw or screw bolt supplied with the bracket</p>	

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4.0 INSTALLATION – INTERNAL LININGS

The use of untreated Shadowclad® is recommended for internal wall and ceiling linings where NZS 3602 allows the use of untreated plywood.

For detailed installation advice for plywood used as an internal lining refer to section 4.0 of the Ecoply® Specification and Installation Guide

5.0 INSTALLATION – EXTERIOR CLADDING

5.1 FRAMING – DURABILITY

Refer to NZ Building Code Acceptable Solution B2/AS1 "Durability". External timber framing must be treated to a minimum H1.2 treatment. For timber treatment and allowable

moisture content, refer to NZS 3602 as well as framing manufacturer's literature (e.g. Laserframe®).

5.2 FRAMING – CONSTRUCTION

Use kiln dried framing such as Laserframe in accordance with timber framing manufacturer's specifications and treated in accordance with NZS 3602.

Timber frame sizes and set out must comply with NZS 3604 (or specifically designed to NZS 3603) and with stud and nog centres and timber width required by this specification.

All Shadowclad sheet edges must be fully supported by framing.

- Studs must not exceed 600 mm centres
- Nogs must be provided at a maximum of 800 mm centres

When direct fixing, position the framing to allow a 6 mm capillary gap behind panels where they overlap the edge of

concrete floor, brick veneer or lower storey cladding.

- An extra stud is required at internal corners for ventilated cavities
- Refer to NZS 3602 for moisture content requirements. As a guide, frame and cavity batten moisture content should be no greater than 20%
- Framing must be kept as dry as possible at all times
- Single spans of Shadowclad should not exceed 600 mm (e.g. Below windows or balustrades)

Where used as bracing framing should be a minimum structural grade SGB.

5.3 PREPARATION – BUILDING UNDERLAY & RIGID AIR BARRIER

The use of building underlay compliant with E2/AS1 or an alternative solution rigid air barrier must be provided over framing prior to cladding installation

- Barriers to air flow are required regardless of direct or cavity construction
- For more information on rigid air barriers refer to the Ecoply Barrier Specification and Installation Guide
- Rigid air barriers are required in extra high wind zones and above

5.4 PREPARATION – DIRECT FIX CONSTRUCTION

Building Code clause E2/AS1 allows direct fix construction in some circumstances. Please use the risk matrix in E2/AS1 (latest edition) to determine the risk score of your building envelope, and apply in accordance with Table 3, E2/AS1.

This publication shows suggested details for cavity construction only.

Direct fix details can be downloaded from www.chhwoodproducts.co.nz or obtained by calling CHH Woodproducts on 0800 746 399.

5.5 PREPARATION – CAVITY CONSTRUCTION

Cavity Construction

A Shadowclad® cavity base closure must be installed at the bottom of all walls and above window heads.

This provides vermin proofing to ventilation openings. The holes in the cavity base closure must be kept clear to enable ongoing drainage and ventilation of the cavity.

Cavity Battens

Cavity battens provide an air space between the frame and the sheet and are considered a “packer” when installed in accordance with Acceptable Solution E2/AS1.

The battens must be fixed over the building underlay or a rigid air barrier.

All timber battens must: be nominal 20 mm thick (between limits of 18 mm and 25 mm in thickness); at least the same width as the stud; and minimum H3.1 LOSP treated in accordance with NZS 3640.

DO NOT use polystyrene battens which may melt in contact with solvents from H3.1 LOSP treated Shadowclad.

Battens must be fixed over the building underlay/rigid air barrier to all studs, as follows.

If studs are at 600 mm centres:

- Battens must be fixed vertically at 300 mm centres (i.e. a batten on studs and one in between the two studs fixed to top and bottom plates and nogs)
- Battens fixed between studs are to restrain the building underlay and insulation from bulging into the drained cavity
- The Shadowclad must not be fixed to these cavity battens where there is no framing behind them

If studs are at 400 mm centres battens may be fixed on studs only.

Horizontal battens should be used at the top of the wall to block the top of the cavity from venting into the roof space.

Cavity spacers (i.e. short pieces of cavity batten) may be used to support the bottom sheet edge (or provide intermediate support where required eg above window openings) but must allow water drainage to the outside. The cavity spacers must be fixed at a 5° minimum slope with a 50 mm minimum air gap at either side.



MiTek New Zealand Limited

Correspondence from : **AUCKLAND**
40 Neales Road, East Tamaki 2013
PO Box 58-014, Botany 2183
Phone: 09 274 7109
Fax: 09 274 7100

CHRISTCHURCH
14 Pilkington Way, Wigram 8042
PO Box 8387, Riccarton 8440
Phone: 03 348 8691
Fax: 03 348 0314

www.mitek.nz.co.nz

Printed: 11:25:52 03 Aug 2015

MiTek 20/20 Engineering 4.6.6.285

PRODUCER STATEMENT for MiTek 20/20[®] TRUSS DESIGN - Version 4.6

ISSUED BY: MiTek New Zealand Limited
TO: Hans Mitt
IN RESPECT OF: MiTek[®] Truss Designs

This producer statement covers the MiTek 20/20[®] truss design and the structural performance of the GANG-NAIL[®] connector plate for the job reference **24246** and may be used by a Building Consent Authority to assist in determining compliance with the New Zealand Building Code.

The MiTek 20/20[®] truss design program has been developed by MiTek New Zealand Limited for the design of MiTek[®] timber roof, floor and attic trusses in New Zealand. The truss designs computed by MiTek 20/20[®] are prepared using sound and widely accepted engineering principles, and in accordance with compliance documents of the New Zealand Building Code and Verification Method B1/VM1; and internationally accepted standard ANSI/TPI 1 - 2002 as an alternative solution to satisfy the requirements of Clause B1 of the New Zealand Building Code.

On behalf of MiTek New Zealand Limited, and subject to:

- i) All proprietary products meeting their performance specification requirements
- ii) The provision of adequate roof bracing and overall building stability
- iii) Correct selection and placement of GANG-NAIL connector plates
- iv) Correct input of Truss Design Data as shown in the Truss Design Statement for this job
- v) The design being undertaken by the accredited fabricator under the terms of the software licence

I believe on reasonable grounds that the trusses, if constructed in accordance with the MiTek 20/20[®] truss design and shop drawings, will comply with the relevant provisions of the New Zealand Building Code.

MiTek New Zealand Limited holds a current policy of Professional Indemnity Insurance no less than \$500,000.

On behalf of MiTek New Zealand Limited,

Date: Monday, 3 August 2015

In Ling Ng, BE (Hons), CPEng, IntPE, MIPENZ (ID: 146585)
TECHNICAL SERVICES MANAGER, MiTek New Zealand Limited

FAR NORTH DISTRICT COUNCIL
Approved Documents

Job: 24246

Client: Hans Mitt
Phone:

Site: O'Halloran Truss Design
3 State Hwy 12,
Opunohi
Northland

Phone:

Description:
Building Consent No.:
MITek 2020 Engineering 4.6.8.288

MITek New Zealand Limited

Printed: 11:28:52 02 Aug 2018

TRUSS DESIGN STATEMENT

This statement is issued by MITek New Zealand Limited. to the client listed above and may be used by the Building Consent Authority to assist in determining compliance with the New Zealand Building Code.

MITek 20/20° TRUSS DESIGN DATA

The MITek 20/20° computer design for this job is based on the following design parameters entered into the program. The Fabricator shall ensure that these job details are current and relevant to the project for the design of the MITek° trusses.

<u>Job Details</u>		Importance Level :	1	Design Working Life :	50 years
<u>Roof Truss</u>		Pitch:	15.000 deg	Nominal Overhang:	400 mm
Timber Group:	Master Inventory	Ceiling		Wind	
Roof		Material:	None	Area:	Very High (46.0 m/s)
Material:	Galv Iron .5mm	Dead Load:	0.050 kPa	Pressure Coeff:	Cpe = varies; Cpi = -0.30, 0.20
Dead Load:	0.210 kPa	Restraints:	3000 mm centres		
Restraints:	800 mm centres	Live Load:	Qc = 1.400 kN		
Live Load:	Q _r = 0.250 kPa Q _c = 1.100 kN				

The timber for these MITek° trusses shall be treated to the requirements of NZS 3602:2003 and shall be graded to the requirements of NZS 3603:1993. Unless otherwise noted, this design assumes that the steel fixings and timber connectors proposed are located in a "closed environment", as defined by NZS3604:2011 Section 4.

MITek° Truss List

Legend: * = detail only, ? = input only, Fxx = failed design, Ø = non certified, Unmarked trusses = designed successfully, LB = lateral bracing required
GB = gable brace required

Truss	Qty	Span (m)	Pitch (deg)	Spacing (mm)
T01	1D	6000	15.000	3900

Total quantity : 1

24246
Pg 1

Kaipara Trusses

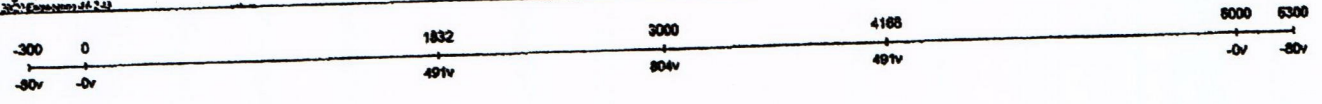
Shop Drawing - EX1: Page 1
Job: HELL

tree: EX Qty: 6 of 6 Ply: 1 Bundle: None
Job: HELL
Description:
Billing Contract No.:
1st 2024 Proposed at 2.2.24

Client: 001
Phone:

Site:

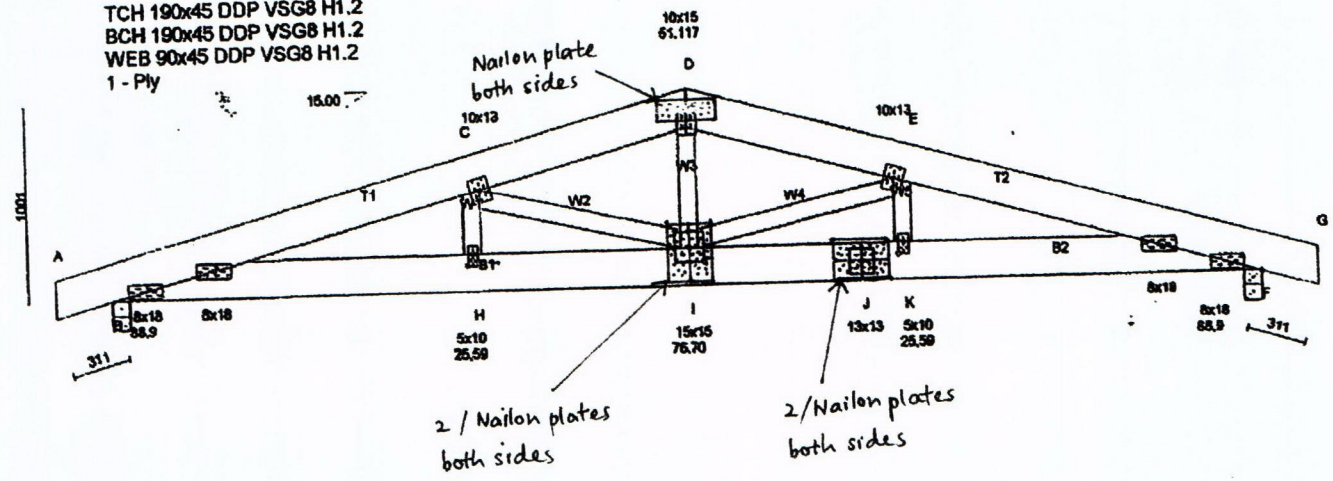
Phone: Project 01.41.06.24.12.2024



Existing Truss

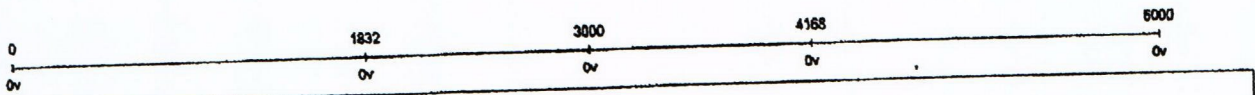
- All nailon plates to be 110x280x1mm, fully nailed, on both sides of truss
- Use Paslode hardened tip 44x3.15 dia. nails to penetrate existing GMA plates

TCH 190x45 DDP VSG8 H1.2
BCH 190x45 DDP VSG8 H1.2
WEB 90x45 DDP VSG8 H1.2
1 - Ply



2 / Nailon plates both sides

2 / Nailon plates both sides



Designed

MITek® Truss: T01

MITek New Zealand Ltd.

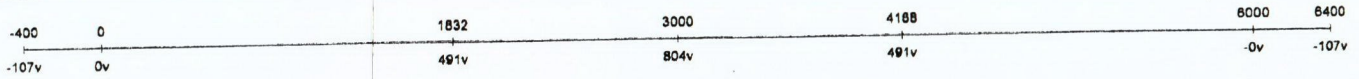
Shop Drawing - T01 : Page 1
Job: 24246

Qty: 1 of 1 Ply: 2 Bundle: None
Job: 24246
Description:
Building Consent No.:
MITek 2020 Engineering 4.8.4.289

Client: Hans Mitt
Phone:

Site: O'Halloran Truss Design
3 State Hwy 12,
Opononi
Northland

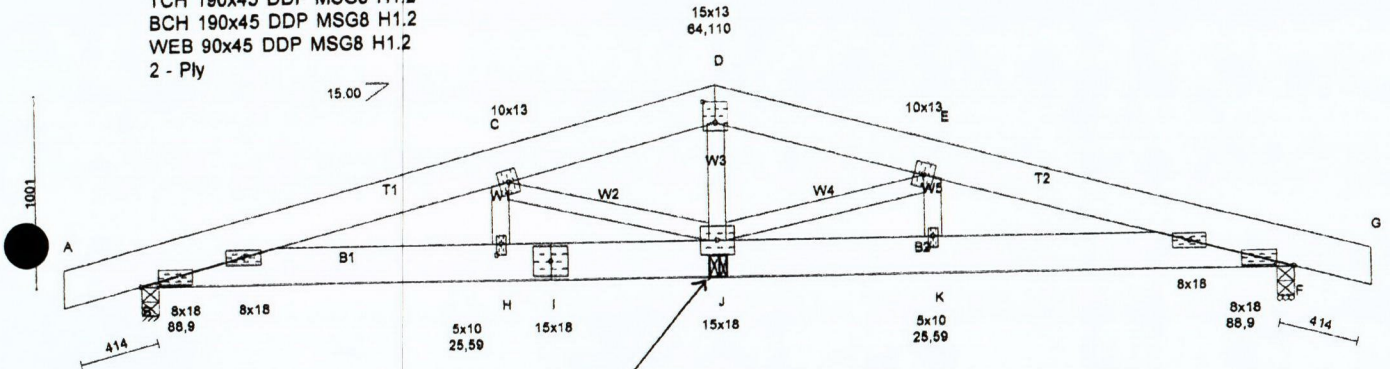
Phone: Pg 2
Printed: 15:28:44 03 Aug 2018



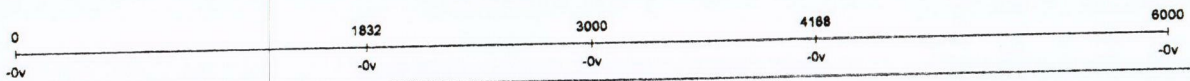
Make 1-ply of truss T01 and nail to existing trusses. (see Pg 1 for strengthening of existing truss)

CHECK ALL TRUSS DIMENSIONS PRIOR TO FABRICATION

TCH 190x45 DDP MSG8 H1.2
BCH 190x45 DDP MSG8 H1.2
WEB 90x45 DDP MSG8 H1.2
2 - Ply



New Truss



***** Designed with warnings *****

Truss spacing of 3900mm exceeds 2400mm.
Uplift at joint(s) B and F exceeds the capacity of two wire dogs. Please ensure that adequate fixing is provided
Fabricator adjusted camber at joint J = 2 mm
All members at each joint must be touching for at least 50% of the possible contact area, with any gap being limited to a maximum of 2mm.
Overall Truss Height: 1108 mm

CHORDS		WEBS	
All:	190x45 DDP MSG8 H1.2	All:	90x45 DDP MSG8 H1.2
CONNECTORS		MULTI-PLY NAILING	
8/GNQ-5x10	8/GNQ-10x13	4/GNQ-15x13	18/GNQ-8x18
8/GNQ-15x18			
Top Chord	2 rows of 90 x 2.8 dia. nails at 340 mm		
Bottom Chord	2 rows of 90 x 2.8 dia. nails at 340 mm		
Other	1 row of 90 x 2.8 dia. nails at 180 mm		



Building Code Clause(s) B1

PRODUCER STATEMENT – PS1 – DESIGN

(Guidance notes on the use of this form are printed on page 2)

ISSUED BY: T. Drupsteen Consulting Engineer
(Design Firm)

TO: Mr Michael O'Halloran
(Owner/Developer)

TO BE SUPPLIED TO: Far North District Council
(Building Consent Authority)

IN RESPECT OF: Proposed (and partly constructed) residential Garage
(Description of Building Work)

AT: No 3 State Highway 12, Opononi
(Address)
LOT 1 DP 171461 (SO)
studs, top plates, lateral loads, footings (Trusses by others) (Lintels by others)

We have been engaged by the owner/developer referred to above to provide Structural Engineering consultancy services in respect of the requirements of Clause(s) B1 of the Building Code for All or Part only (as specified in the attachment to this statement), of the proposed building work.

The design carried out by us has been prepared in accordance with:

- Compliance Documents issued by the Ministry of Business, Innovation & Employment. NZS 1170, NZS 3603 or (verification method / acceptable solution)
- Alternative solution as per the attached schedule

The proposed building work covered by this producer statement is described on the drawings titled O'Halloran Proposed Garage by H.M. Design and numbered sheets 2, 3, 4, 6 together with the specification, and other documents set out in the schedule attached to this statement.

On behalf of the Design Firm, and subject to:

- Site verification of the following design assumptions
- (ii) All proprietary products meeting their performance specification requirements; AE

I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the persons who have undertaken the design have the necessary competency to do so. I also recommend the following level of construction monitoring/observation: Normal Council Inspections

CM1 CM2 CM3 CM4 CM5 (Engineering Categories) or as per agreement with owner/developer (Architectural)

I, Thijs Drupsteen am: CPEng 61652 #
(Name of Design Professional)

Reg Arch #

I am a Member of: IPENZ NZIA and hold the following qualifications: BE, CP Eng, Int PE, MNZIE
The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance no less than \$200,000*.

The Design Firm is a member of ACENZ:

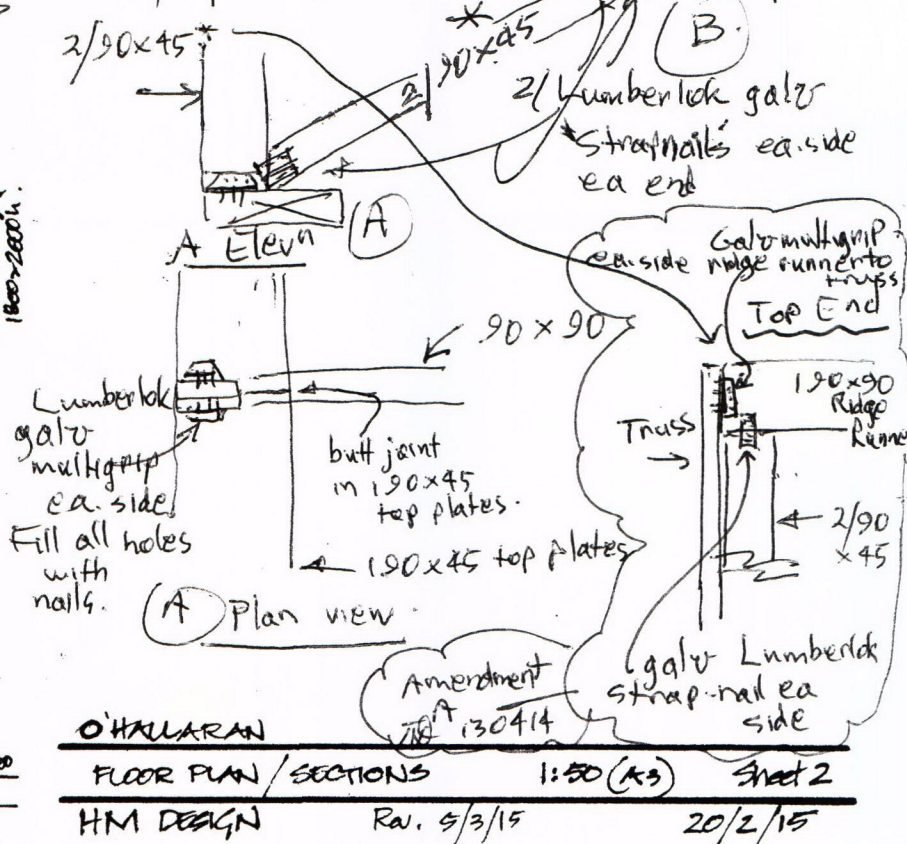
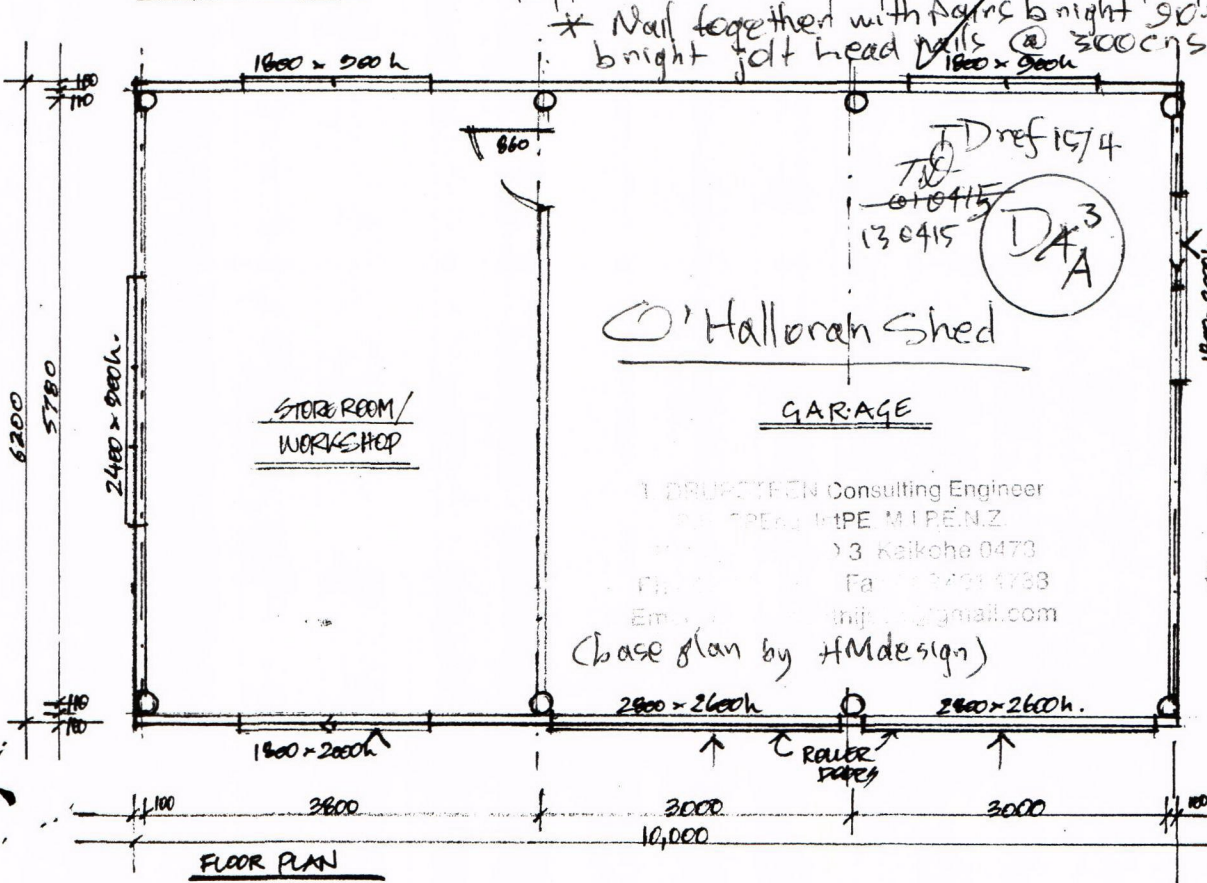
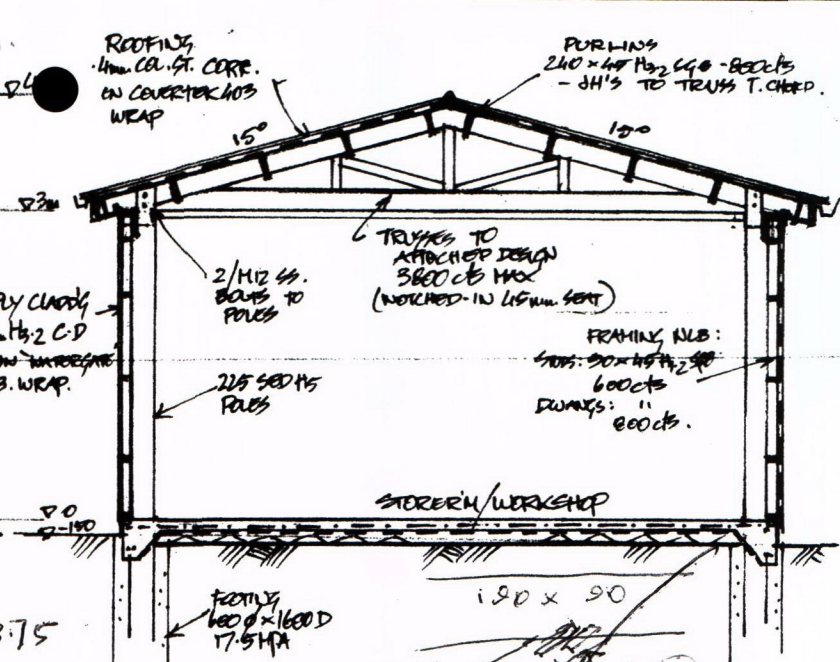
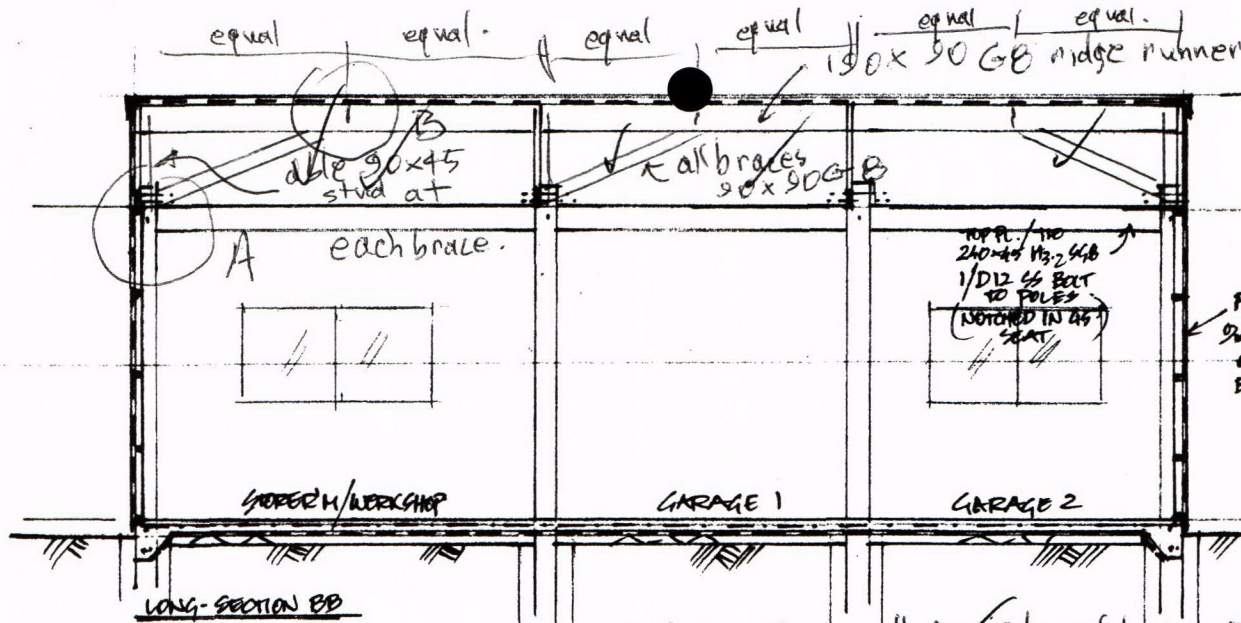
SIGNED BY Thijs Drupsteen ON BEHALF OF T. Drupsteen Consulting Engineer
(Design Firm)

Date: 07 05 2015 (signature) T. Drupsteen

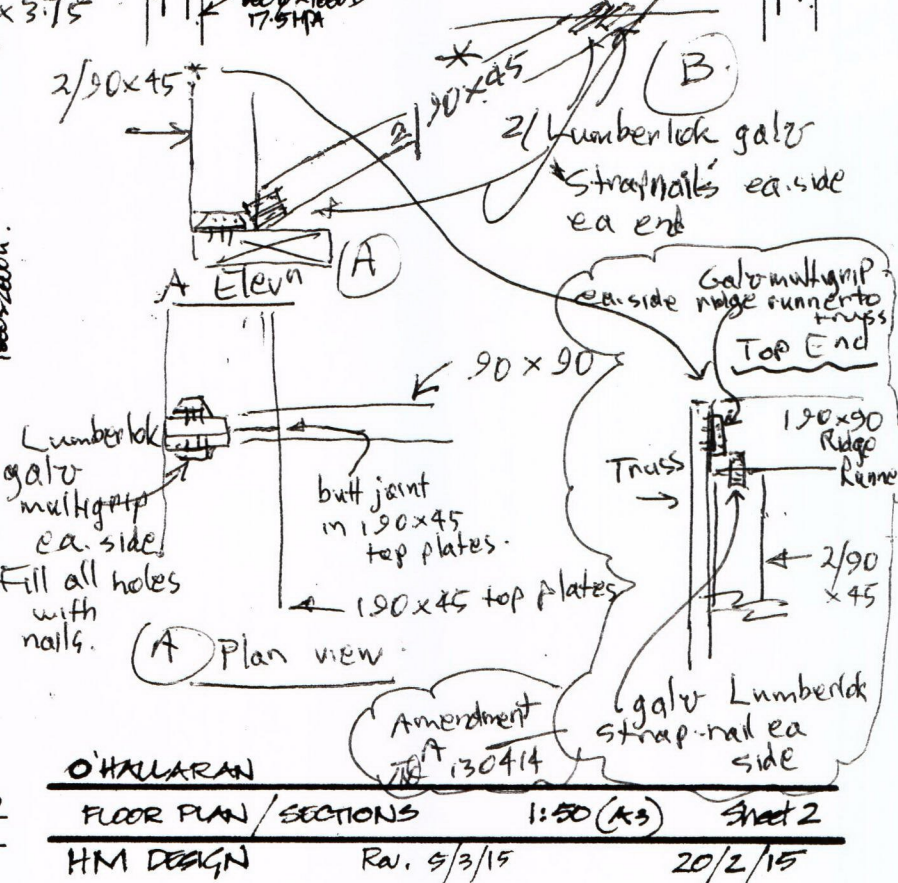
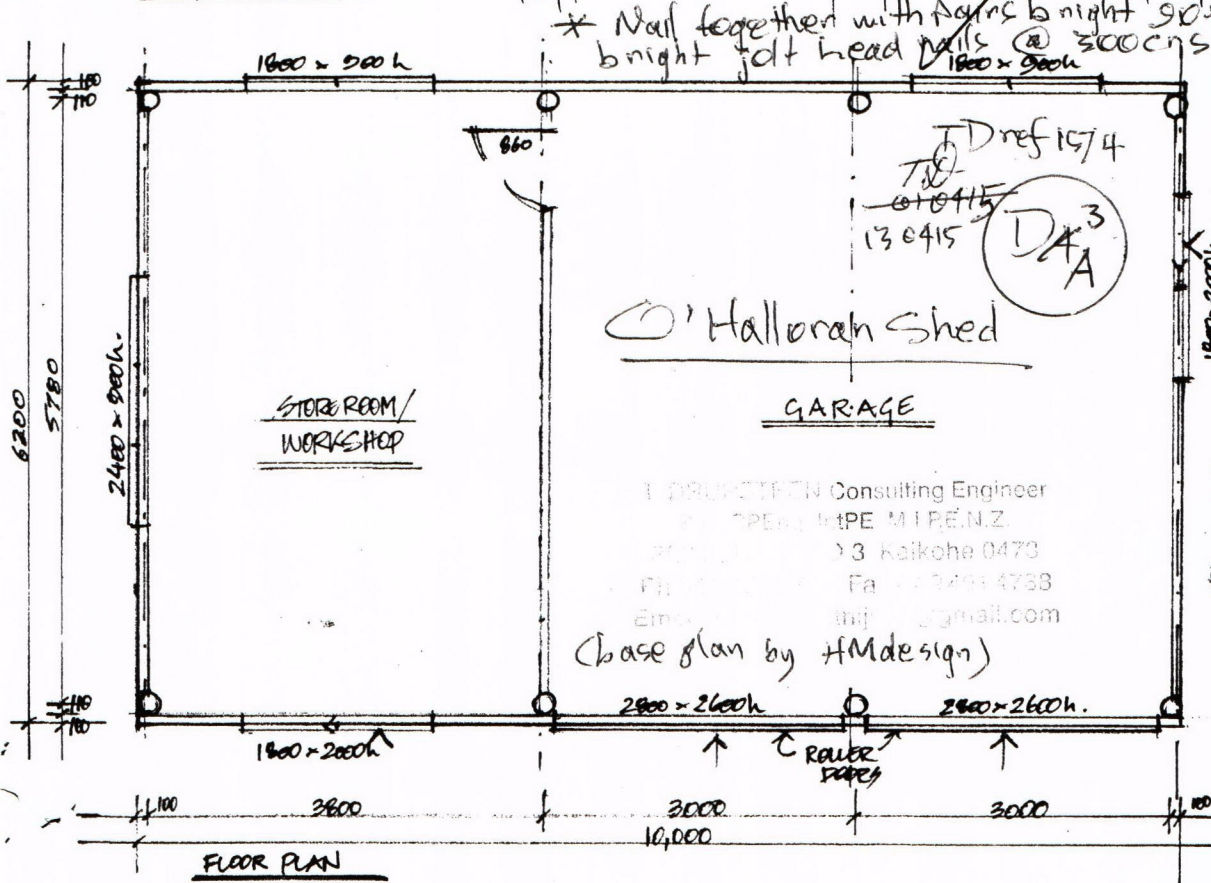
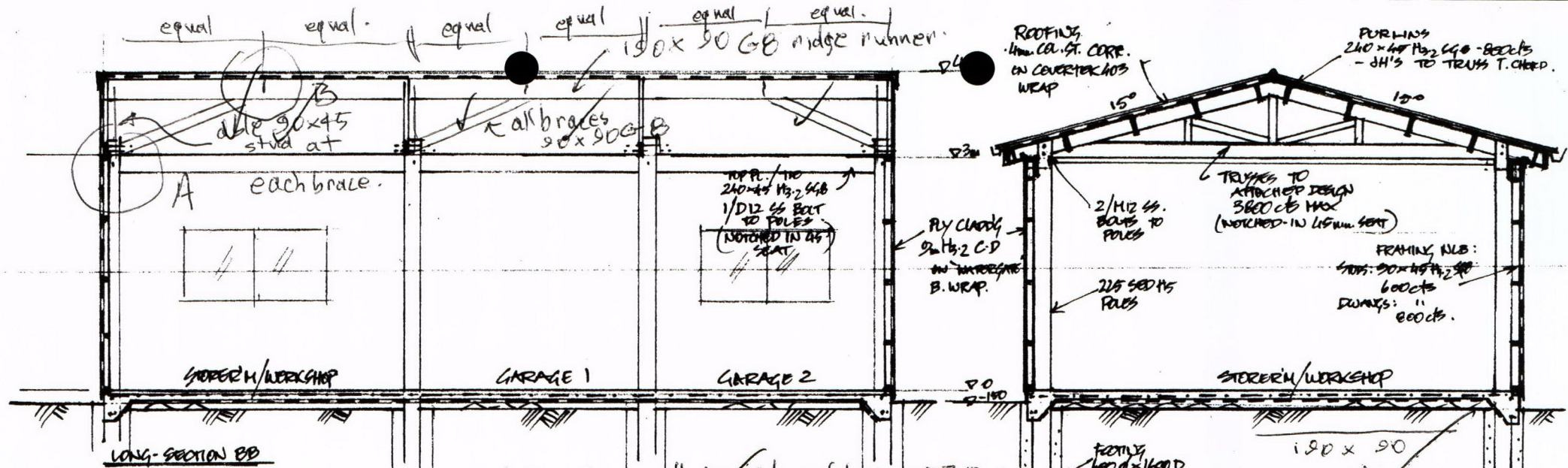
Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in contract, tort or otherwise (including negligence), is limited to the sum of \$200,000*.

This form is to accompany Form 2 of the Building (Forms) Regulations 2004 for the application of a Building Consent.

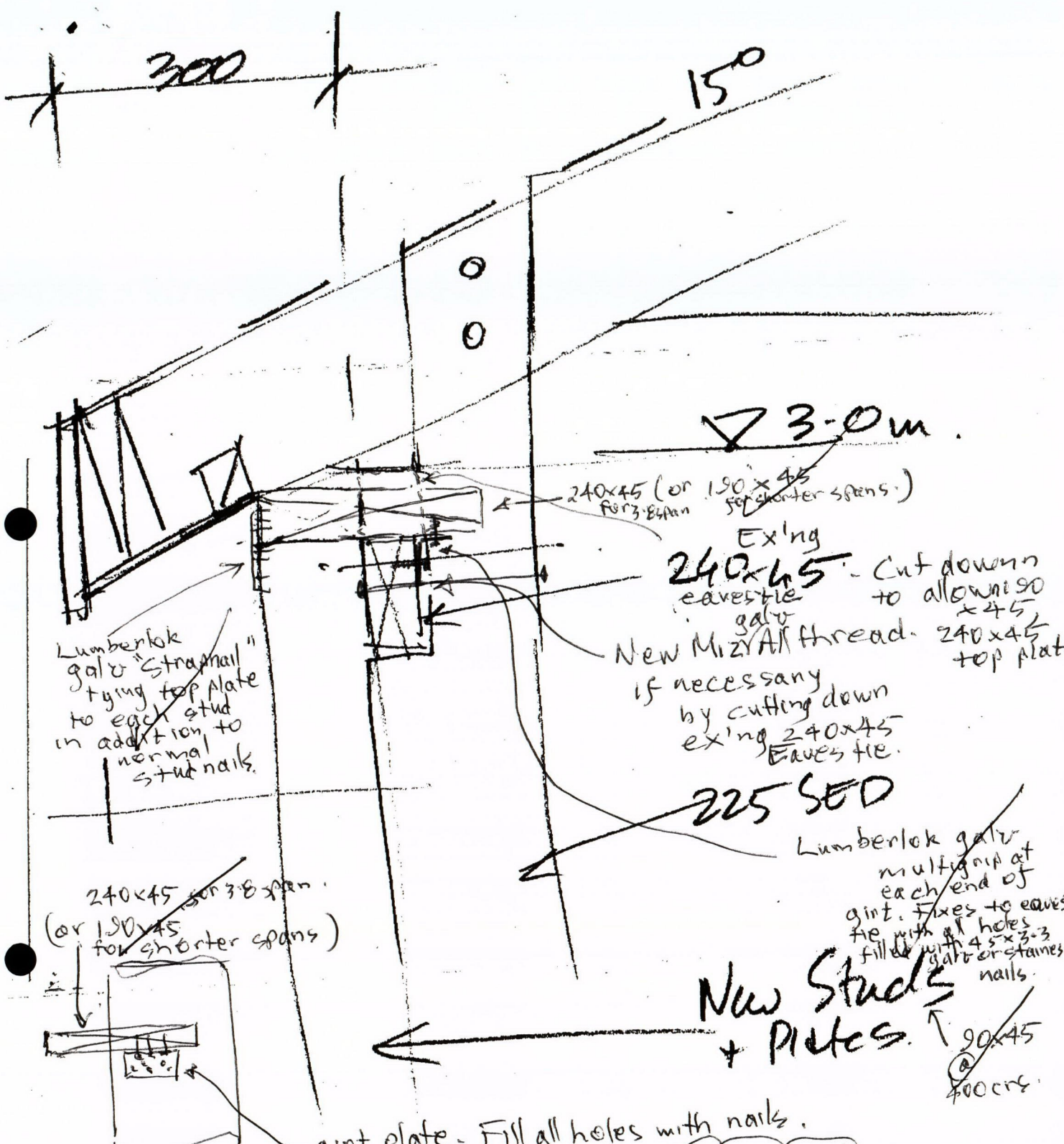
THIS FORM AND ITS CONDITIONS ARE COPYRIGHT TO ACENZ, IPENZ AND NZIA



O'HALLORAN
 FLOOR PLAN/SECTIONS 1:50 (As) Sheet 2
 HM DESIGN Rev. 5/3/15 20/2/15



I DRUMCOTTEN Consulting Engineer
 10 SPYGLASS MIREN.Z.
 301/303 Kaitake Rd, 3 Kaitake 0473
 Phone: 0473 4738
 Email: i@drumcotten.com
 (base plan by HMdesign)



Lumberlok galv "Strapmail" tying top plate to each stud in addition to normal stud nails.

240x45 (or 190x45 for shorter spans.)

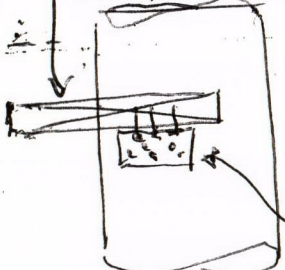
Ex'ing 240x45 - Cut down to allow 90x45 galv New MIZAL thread. 240x45 top plate if necessary by cutting down ex'ing 240x45 Eaves tie.

225 SED

Lumberlok galv multigrup at each end of girt. Fixes to eaves tie with 4 holes filled with 4.5x3.3 galv or stainless nails.

New Studs + Plates. 90x45 @ 400c/c.

240x45 for 3.8 span. (or 190x45 for shorter spans)



Alternative Top plate attachment to pole

girt plate - Fill all holes with nails.

long walls
Amendment A: galv multigrup joining top plate ends to eaves tie @ 140415

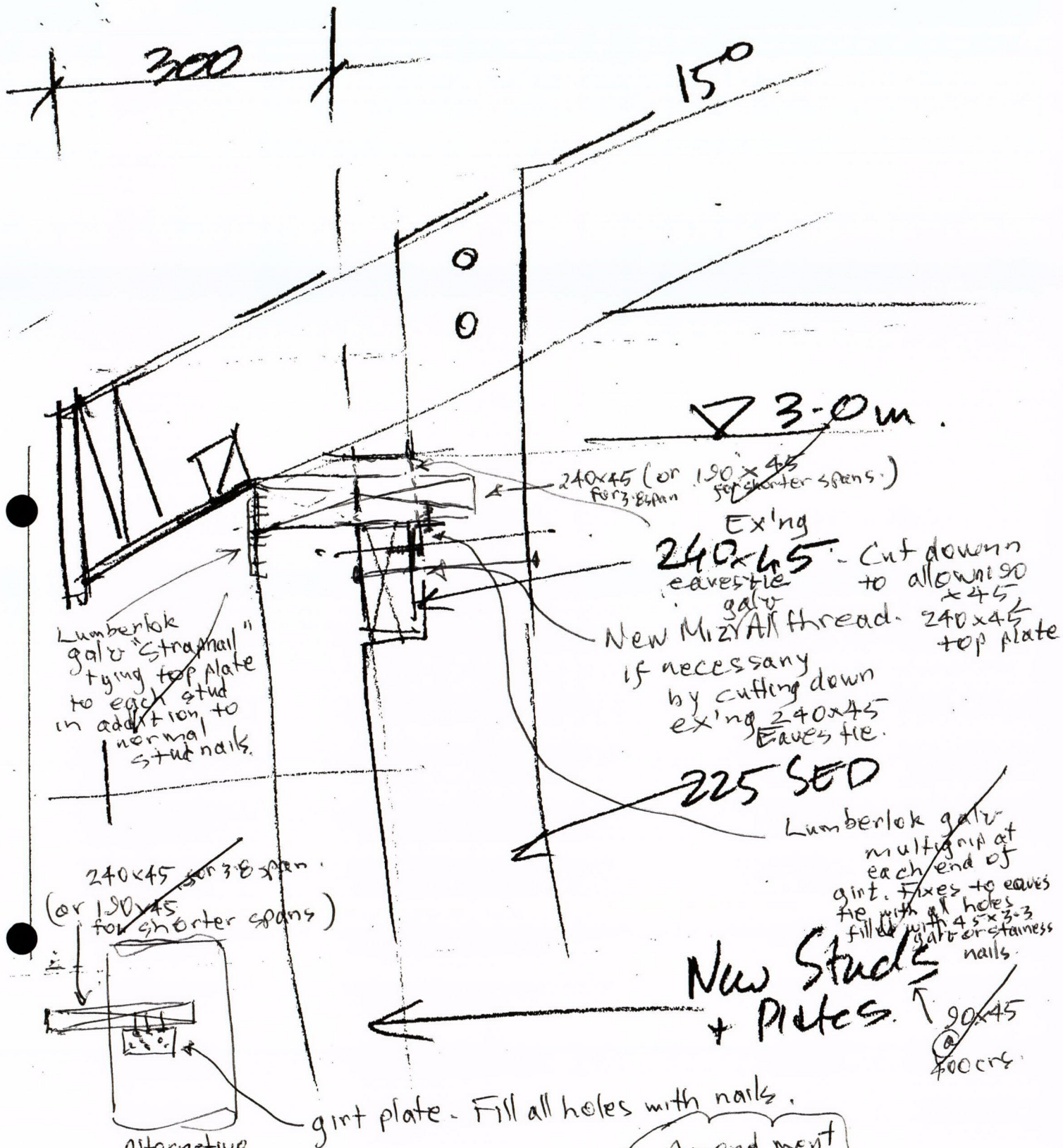
T-Dref 15/5
T-Dref 15/5
2 of 3
D/A
14 of 15

T. DRUPSTEEN Consulting Engineer
B.E. CPEng, IntPE, M.I.P.E.N.Z.
3254 SH 12, RD 3 Kaikohe 0473
Ph 6494014737 Fax 6494014738
Email: drupsteen@compuserve.com

(Base plan by Hill design)

O' Halloran Shed

Long Sidewall framing



Lumberlok galv "Stramail" tying top plate to each stud in addition to normal stud nails.

240x45 (or 190x45 for 3.8 span)

Ex'ing 240x45 eaves tie galv
Cut down to allow 190x45 top plate

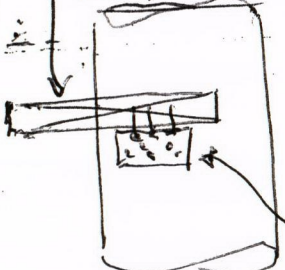
New MIZRAL thread 240x45 top plate if necessary by cutting down ex'ing 240x45 Eaves tie.

225 SED

Lumberlok galv multigrip at each end of girt. Fixes to eaves tie with 4 holes filled with 4.5x3.3 galv or stainless nails.

New Studs + Plates. 90x45 floors.

240x45 for 3.8 span (or 190x45 for shorter spans)



Alternative Top plate attachment to pole

girt plate - Fill all holes with nails.

long walls
Amendment A: galv multigrip joining top plate ends to eaves tie 140415

T-Dref: 15/5
T-Dref: 14/15
2 of 3
15 at 15

T. DRUPSTEEN Consulting Engineer
B.E. CPEng, IntPE, M.I.P.E.N.Z.
3254 SH 12, RD 3 Kaikohe 0473
Ph 649 401 4737 Fax 649 401 4738
Email: drupsteen@co2@gmail.com

(base plan by HML design)

O' Halloran Shed
Long Sidewall framing

15/5
 T. Drupsteen
 26 0315

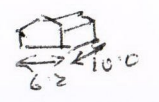
O'Halloran Garage Struct Calcs.

Basic Input Data.

Windage

NZS 3604 Very High

Roof walls
 F1.00
 Earthquake



$V_w = 50 \text{ m/sec}$
 $q_w = 1.5 \text{ kPa}$

light timber
 concrete
 much less than
 wind.

Assumed
 Ground
 Ultimate
 strength

300kpa
 Ultimate

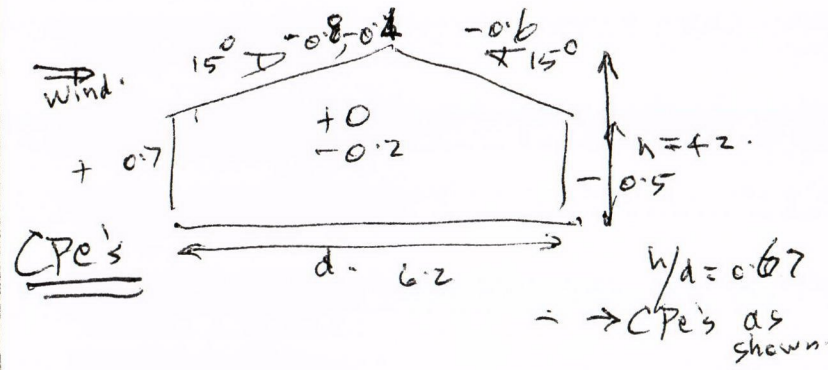
Soil design
 skin friction
 with
 concrete

Clay \rightarrow 11
 kPa

Roof G

0.3 kPa
 (no ceiling
 or insulation)
 $Q = 0.25 \text{ kPa}$
 $1.26 + 1.5Q = 0.735 \text{ kPa}$
 $LC = 1.1 \text{ kPa}$

Wind uplift



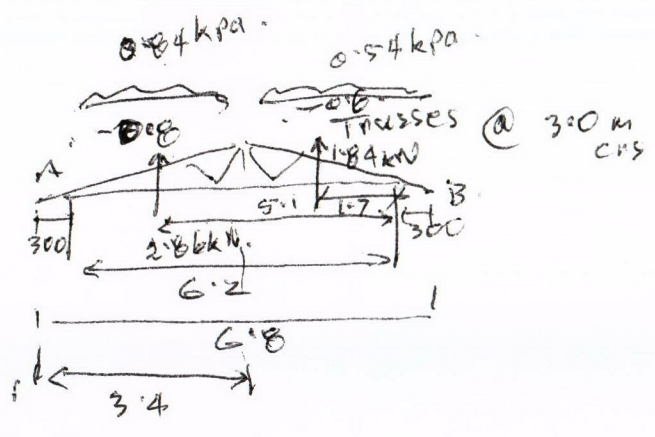
Roof
 $AV Cpe$
 $= \frac{-0.18 - 0.16}{2}$
 $= -0.17$
 $\therefore SA$
 $= 0.7 \times 1.5 \times 0.2 \times 0.3$
 $= 0.78 \text{ kPa}$

Trusses
 Designed
 By

Mitek NZ
 Ltd.
 29 Sept 2010
 Kaipara
 Trusses
 Signed: J. Hansen

15/5
 27 03 15

Trusses uplift.



$$R_A = \frac{1}{2} \left[\frac{2.86}{6.2} \times 6.2 + 1.84 \text{ kN} \times 1.2 \right]$$

$$R_B = (2.86 + 1.84) \text{ kN/m} \times 2.86 \text{ kN} = 1.84 \text{ kN}$$

Truss Crs 3.0m $\rightarrow 2.86 \times 3 = 8.58 \text{ kN}$ Design point. NP/pole = 8.57 kN

M12 Ndes $2.0 \text{ kN} \times 0.7 \text{ Q} = 1.4 \text{ kN}$

$2 \times 1.4 = 2.8 \text{ kN} = \text{OK}$ ($> 9.74 \text{ kN N}^*$)

Pole size
 Poles against uplift.

225 Q.

600 Q x 1600 des
 skin adhesion Ndes \downarrow
 $= 11 \text{ kPa} \times \pi \times 0.6 \times 1.6$
 $= 33 \text{ kN} \gg \text{N}^* \text{ of } 8.57 \text{ kN}$

NP/pole = 8.57 kN
 2/M12 OK
 225 Q ample for vertical loads by inspect?

\downarrow on pole founds

Roof \downarrow

$$3.0 \text{ m} \times \frac{6.0}{2} \times 0.735 \text{ kPa} = 7.50 \text{ kN}$$

600 Q x 16 deep conc. surround

7.50 kN

OK 600 Q Ndes @ 150 kPa = 42.3 kN OK pole founds

External wall studs
 studs 3.0m
 90x45 high
 600 CRS

Utilitarian Ply cladding - not brittle structure - design for ULS only

ECp 0.9 $0.9 \times 1.5 = 1.35 \text{ kPa}$

$w^*_{u/m} = 1.35 \times 0.6 = 0.81 \text{ kN/m}$

$M^*_{u} = \frac{32}{8} \times 0.81 = 0.911 \text{ kNm/stud}$

Mdes SGB 90x45 = 0.68 kNm UP studs.

Assume studs already in @ 600 CRS; need to double UP studs.

$\rightarrow M^*_{u}/\text{stud} = 0.456$

External wall studs: SGB @ 400 CRS.

fb can be as low as $14 \times \frac{0.456 \times 9.4}{0.68} \text{ MPa}$ (fb SGB)

BUT: studs not in yet, \therefore can be $\frac{600 \text{ CRS} \times 0.68}{0.911} = 0.448 \text{ CRS} \rightarrow 400 \text{ CRS}$

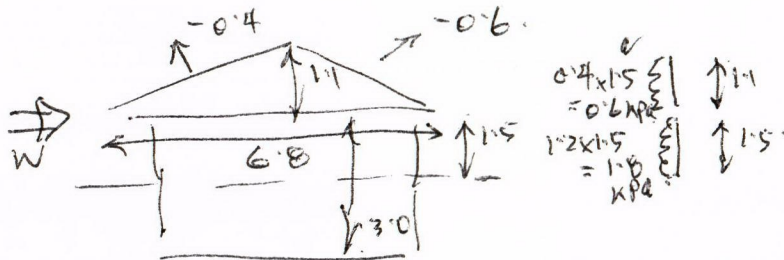
Internal wall studs

$\leq C_p 0.6 \rightarrow 0.9 \text{ kPa}$. If $0.6 \text{ cm} \rightarrow W^* = 0.9 \text{ kN/m}^2$
 $M^*_{u}/\text{stud} = \frac{3.0^2}{8} \times 0.9 = 0.608 \text{ kNm}$

$< M_{des}/508 \text{ studs}$

15/5
 3
 270315
 GB 90x45 @ 600 CRS.

Lateral loads Across



$1.1 \times 0.6 + 1.8 \times 1.5 = 3.36 \text{ kN/m}$

3.4m max loaded dimension to a pole $\rightarrow 11.4 \text{ kN}$

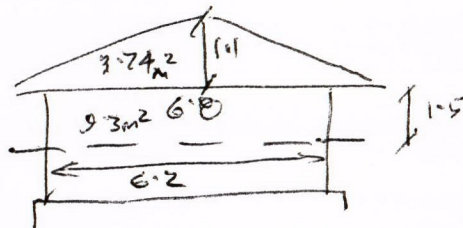
$M^*_{u}/\text{pole} = \left(\frac{11.4}{2}\right) \times 3 = 5.7 \times 3 = 17.1 \text{ kNm}$

$M_{des}/\text{pole} \text{ fb } 23 \times 1.05 \text{E} = 24.2 \text{ kNm} - \text{OK}$

Transverse $P^*_{max}/\text{pole} = 5.7 \text{ kN}$

poles OK for Transverse.

Longitudinal.



Total Long $W = 1.2 \times 1.5 (3.74 + 9.30) = 23.5 \text{ kN}$. Total

4 poles in row ea side wall

$\frac{23.5}{4 \times 2} = 2.94 \text{ kN}$

P^*_{max}
 2.94 kN
 Longit force/pole top
 (< than transverse)

Embedment.

under transverse

$A = \frac{1.17 P}{SB}$

~~$= \frac{1.17 \times 570}{134 \times 0.6} = 0.083$~~ without conc. floor
 S equiv to 150kPa des. strength.

$H = \sqrt{4.25 \frac{PL}{SB}} = \sqrt{\frac{4.25 \times 17.1}{134 \times 0.6}} = 0.95 \text{ m}$

actual = 1.6m - OK.

1.6m \times 0.6m d conc surround OK for both

External
Long side
wall top
plates:

L₀ Widest Bay = 3.0m at rear.

W*_u to top plate due to studs
 $= \frac{3 \text{ m} \times 1.35 \text{ kPa}}{2} = 2.03 \text{ kN/m}$
 140x45 mdes

full 3.0 span $\rightarrow \frac{3.0^2}{8} \times 2.03 = 3.66 \text{ kNm}$
 190x45 mdes = 3.03
 240x45 mdes = 4.04
 restraint at 1/2 length $\rightarrow 1.5 \text{ span} \rightarrow \frac{1.92}{8} \times 2.03 = 0.916 \text{ kNm}$
 $= 8.11 \text{ E}^{-6}$ 100x45 = 271 E⁻⁶
 $= 3\% \text{ of}$

or
 m des = 1.65 kNm $\rightarrow 140 \times 45$
 or continuous 90x45 $\frac{1.92}{10} \times 2.03 = 0.733$
 90x45 mdes = 0.68 kNm $\rightarrow 140 \times 45 \text{ req.}$
 3.0 span : $\frac{3.0^2}{8} \times 2.03 = 2.41 \text{ kNm}$ $\rightarrow 190 \times 45$

1.5² span side walls top plate.

$\frac{1.5^2}{10} \times 2.03 = 0.46 \text{ kNm}$

Internal
3.0m
Top plate
span
ECP 0.6

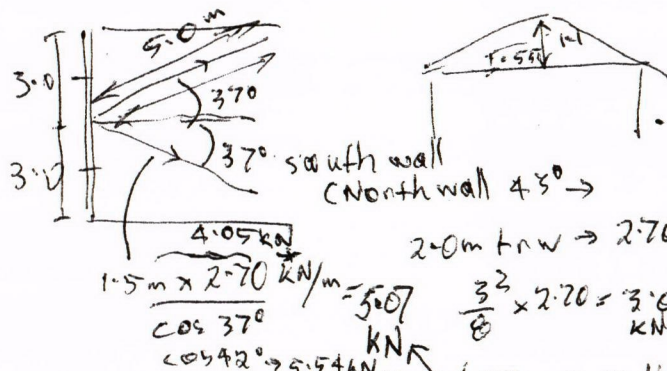
1.35 kN/m. $= \frac{3.0^2}{8} \times 1.35 = 1.51 \text{ kNm}$
 $\rightarrow 4.0$

3.0 Top Pl. end load

$2.03 \times 1.95 = 3.96 \text{ kN}$ $\rightarrow 5 \text{ nails}$ (0.8 kN mdes/nail)

5.0 span
diag. space
brace
in ceiling plane
for end
walls

$1.1 \times \frac{5.0 \times 1.5}{4} = 2.06 \text{ kNm}$ $\rightarrow 190 \times 45$



$L/4 = \frac{5 \text{ m}}{0.045} = 111$ $\rightarrow 7 \text{ Nails}$ each end
 $2 \frac{1}{2} \text{ at centre} \rightarrow (0.025 \times 5.07) \times \frac{5}{4} = 0.158 \text{ kNm}$
 $\rightarrow 50 \times 45 \text{ min size}$

15/5
 (4)
 300315
 external
sidewalls top
plate lateral
Load
 $= 2.03 \text{ kN/m}$
 (gable end walls
 2.70 kN/m)
 240x45

3.0 span
internal
wall top
plate needs
140x45
G.B.
 8/45 x 3.3 span
grooved nails
ea. end
 190x45
diag
space
brace
for endwalls
& internal
walls.

50x45
 190x45
 say
 8/45 x 3.3
annular
grooved
nails lateral
(more
than
plan)

Top plate
 problems
 with end
 fixings.

Top plate end load

V_{*} from pg 4 = 3.96 kN.

$\rightarrow 5/3.15 \Delta$ nails

Check shear in eaves tie:

240 x 45 cut down to

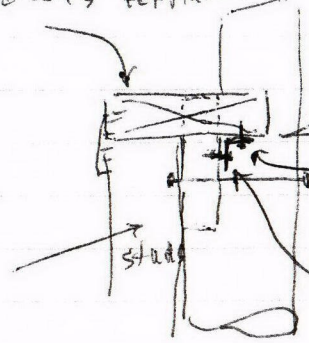
190 x 45.

$V_{des} = 0.7 \times 2/3 \times 190 \times 45 \times 3.8 \text{ MPa}$

= 19.2 kN $\gg V_{*}$

190 x 45
 cut-down
 size
 = OK.

240 x 45 top plate.



45 x 33 Ann grooved nails
 $N_{des} = 44 \times 3.1$
 $\times 9.15 \text{ N/mm}$
 $\times 0.7 \Delta$
 $= 0.87 \text{ kN/mm}$

$\rightarrow 5$ nails reqd.
 - say fill all holes.

galv multigrrip
 ann. Fill all
 holes
 with Lumber tie
 galv or
 stair
 45 x 33
 annular
 grooved
 nails.