

DPC
Separate all concrete from timber with DPC

GIB J Mould
5mm Negative detail between concrete and gib edge.

STRENGTH OF CONCRETE-NZS3604:4 .8.2
17.5MPa in general.
Else 20MPa for slabs exposed to weather at least 500m from high tide mark.
Else 25MPa for slabs exposed to weather within 500m of high tide mark.
SLAB THICKNESS-NZS3604:7 .5.8.2
100mm Minimum .

RIGID INSULATION
50mm Polystyrene insulation under reinforced concrete slab - Note: no polystyrene below footings.

DPM: Polyethylene (polythene) sheet damp-proof membranes AS PER NZS3604 7.5.6

SAND BLINDING
Refer to NZS3604:7 .5.6.2 Place a sand blinding surface over Granular fill to protect the DPM. Sand blinding surface to be a minimum of 5mm and maximum of 25mm. Thick layers of sand are unsatisfactory support for the slab. A Nominal 5-10mm thickness to fill gaps in the base course material plus a basecourse tolerance allowance of +/-15mm results in max thickness of 25mm.

GRANULAR BASE In accordance with NZS3604:7 .5.3 Compact in layers of 150mm Maximum thickness of the area beneath the proposed ground slab. So that total thickness of granular base is not less than 75mm or nor more than 600mm. Granular fill material shall be composed of rounded gravel, crushed rock or scoria and: 1) Not more than 5% shall pass through a 2.2mm sieve. B0 100% shall pass either: (i) A 19mm sieve for any fill thickness; or (ii) A 37.5mm Sieve for a fill thickness exceeding 100mm.

1 Footing Detail
52.09 1:5 @ A3

000049

RECEIVED
13 JAN 2014
BY: _____

TILE: Selected Tile.

MEMBRANE & ADHESIVE: Branz Appraised ARDEX WPM750 0.5mm tile membrane system. Installed to AS/NZS4858 and to manufactureres instructions.

VILLABOARD: 9mm Fibre reinforced cement sheet tile substrate. Install to manufacturers 'Installation Manual' as a TILE substraigh. Note max tile thickness on 600mm CTR studs =13mm. BRANZ 239 (1995)

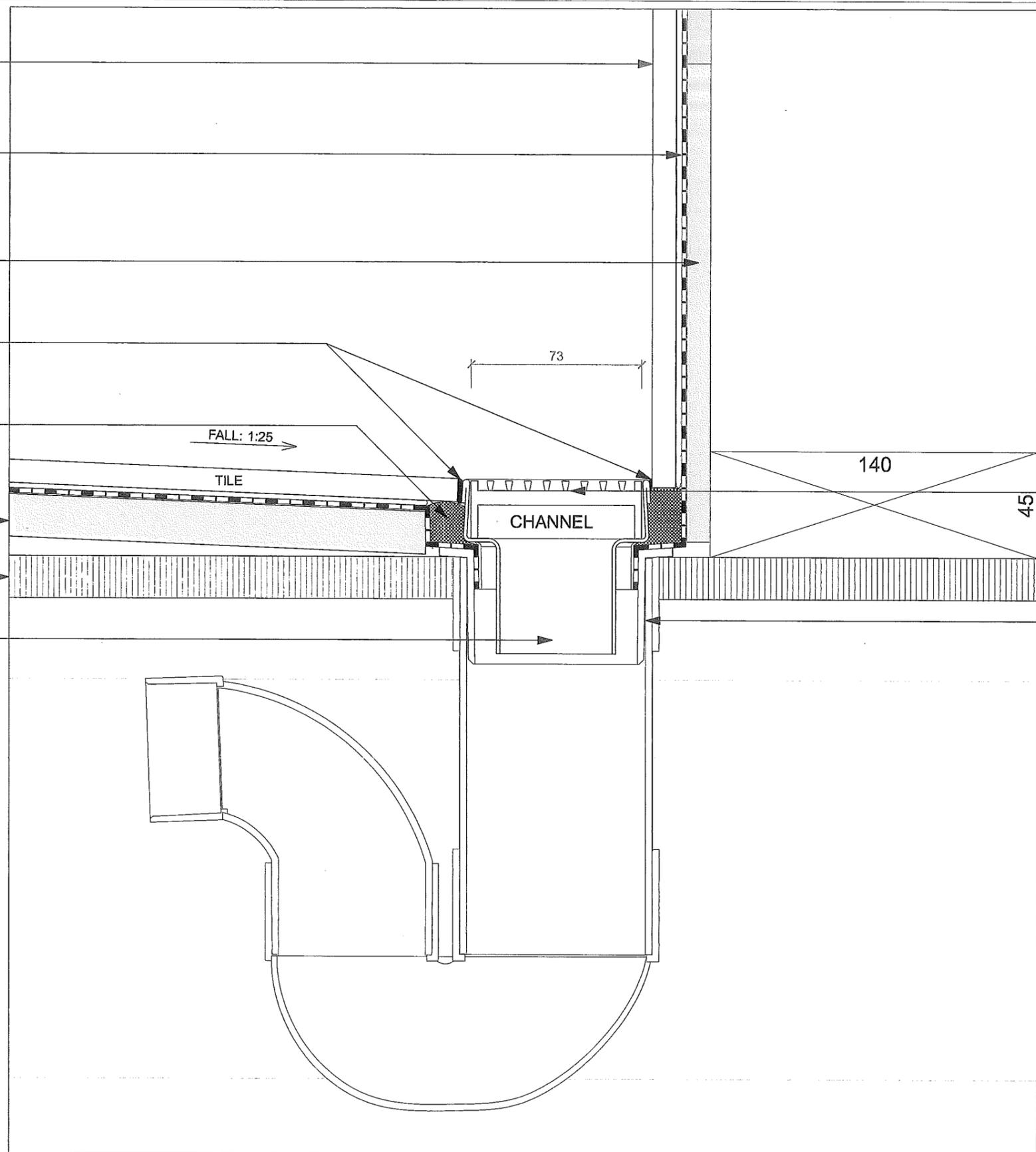
SILCONE SEALANT: Silicone sealant compatible with tile membrane.

SCREED: Sand and Cement screed

COMPRESSED SHEET: 18mm Compressed fiber cement sheet tile underlay with packing below . Install to manufacturers instructions.

PLY 18mm H3.2

SPIGOT



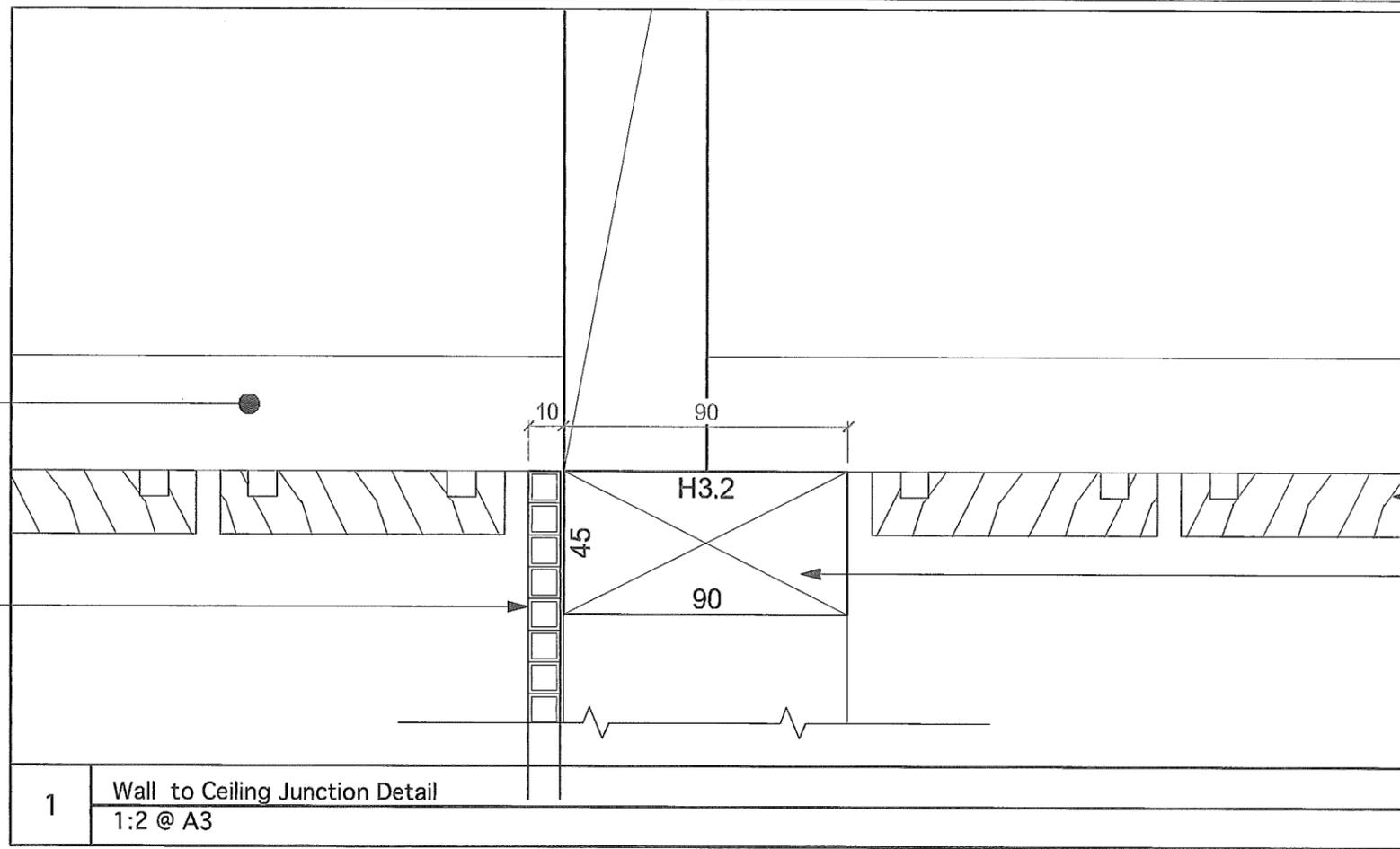
GRATE
ALLPROOF Vision Series 'Equator Channel V900E' 73mm Grate installed 1-2mm lower than tile.

WATERPROOF FLANGE

1 Internal Waterproofing Detail
1:2 @ A3

000050

RECEIVED
13 JAN 2014
BY: _____



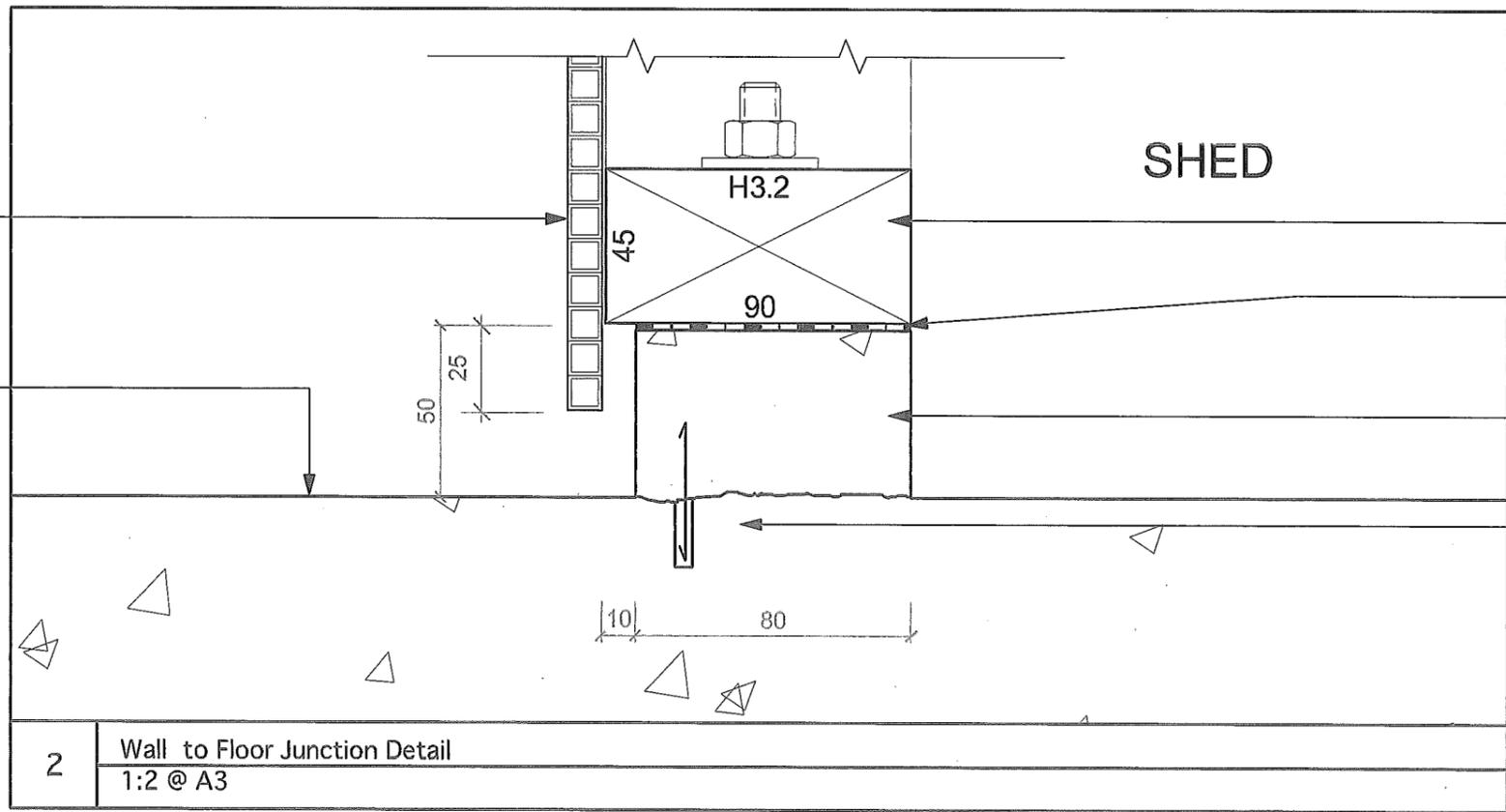
1 Wall to Ceiling Junction Detail
1:2 @ A3

HYJOIST FRAMING

TWIN WALL
6mm Polycarbonate Translucent extruded plastic sheeting. Screw fixed with washers. Available through YPP Plastics (09) 274 1800.

WEATHERGROOVED TIMBER BATTEN
Heart Macrocarpa 20 x 100mm Boards with MIN 6x6mm weathergrooves in accordance ES2.A1 Figure 119.

FRAMING
90x45 Timber Framing . H3.2



2 Wall to Floor Junction Detail
1:2 @ A3

TWIN WALL
6mm Polycarbonate Translucent extruded plastic sheeting. Screw fixed with washers. YPP Plastics.

CONCRETE SLAB 125

FRAMING
90x45 Timber Framing . H3.2

DPC
Damp Proof Course

NIB
50mm Concrete Nib upstand to concrete slab.

REBATE
Reinforcing and Waterbar epoxied into sawcut into original slab. Refer Fig. 3 of 'Lifting the Plate' BRANZ website.

SHED

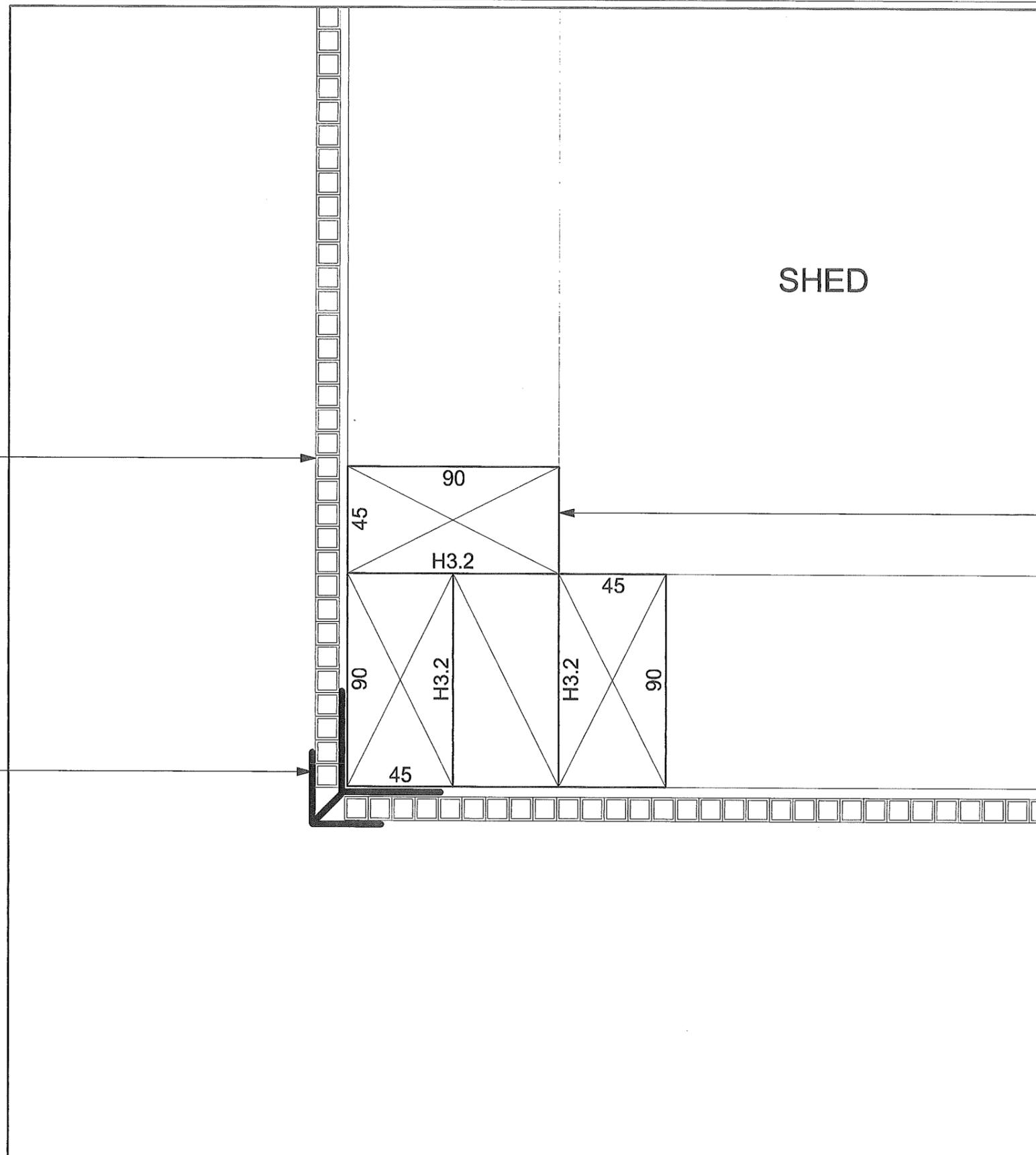
RECEIVED
13 JAN 2014
BY:

SHED

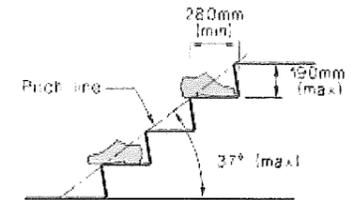
TWIN WALL
6mm Polycarbonate Translucent extruded plastic
sheeting . Screw fixed with washers .YPP Plastics .

FRAMING
90x45 Timber Framing . H3.2

EXTERNAL CAPPING
HOLDFAST SERATONE SLIMLINE PVC Wall
board mouldings External Corner .4.75x2400mm



1 Corner Detail
1:2 @ A3



Common stairways and main private stairways

UNDERSTRUNG STAIR TWO
Unders Trung Stair, 18MM Particle board rise and run ready to accept timber overlay and carpet runner Detail.
Run: 1680- 6 Runs = 280mm Tread
Height 1200mm - 7 Risers =171mm.

UNDERSTRUNG STAIR ONE
Unders Trung Stair, 18MM Particle board rise and run ready to accept timber overlay and carpet runner Detail.
Run: 2520- 9 Runs = 280mm Tread
Height 1845mm -10 Risers =185mm.

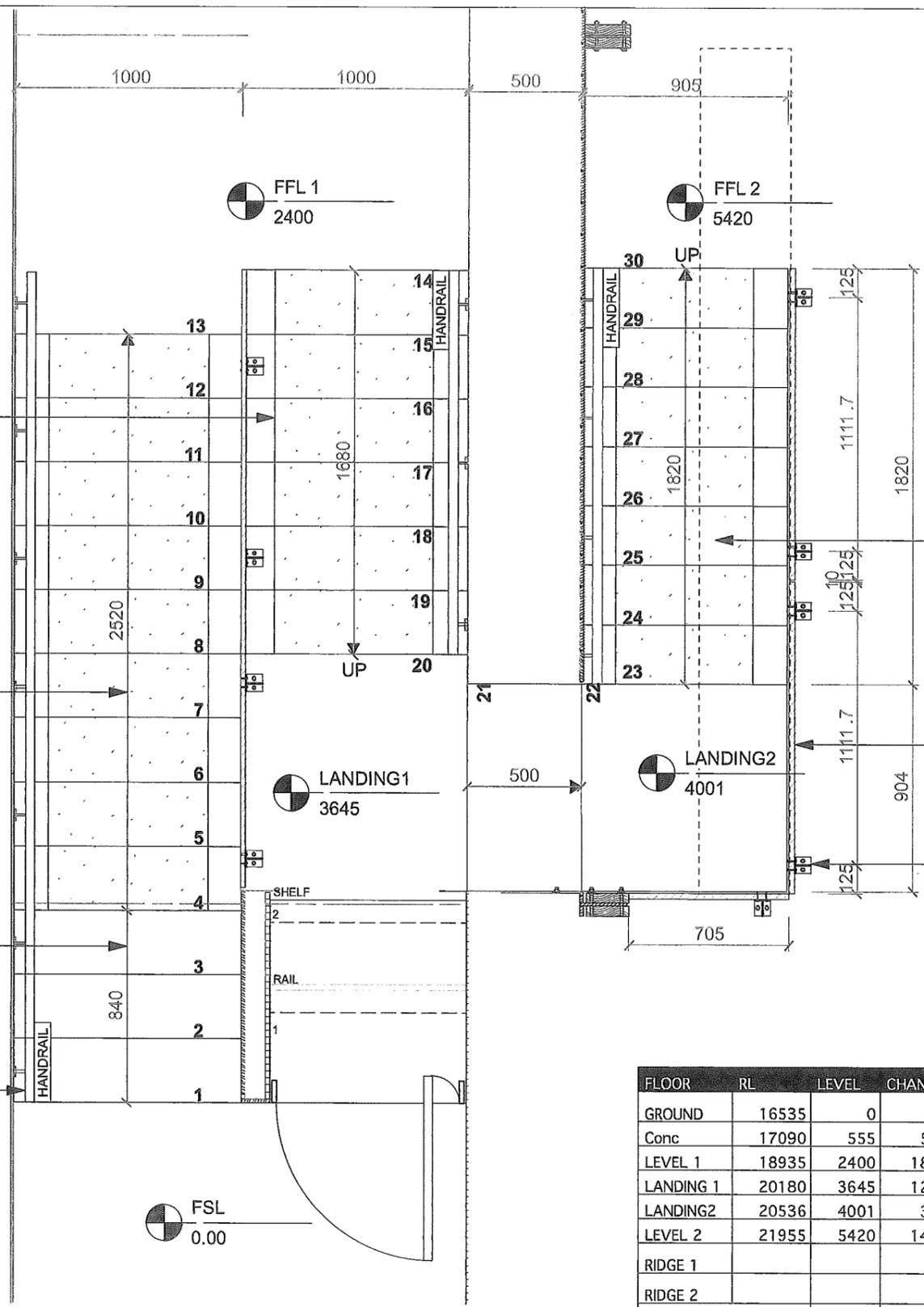
UNDERSTRUNG STAIR THREE
Under Strung Stair, 18MM Particle board ready to accept timber overlay and carpet runner.
Run: 1820- 7 Runs = 280mm Tread 20mm Nose
Height 1419mm - 8 Risers =177mm.

BALUSTRADE PANEL
Matai Veneer panel on 24mm Custwood. Clear Spray finish.

BALUSTER
Custom made steel baluster. Refer to Drawing 62.05 for detail.

INSITU CONCRETE STAIR BASE
Refer slab plan.

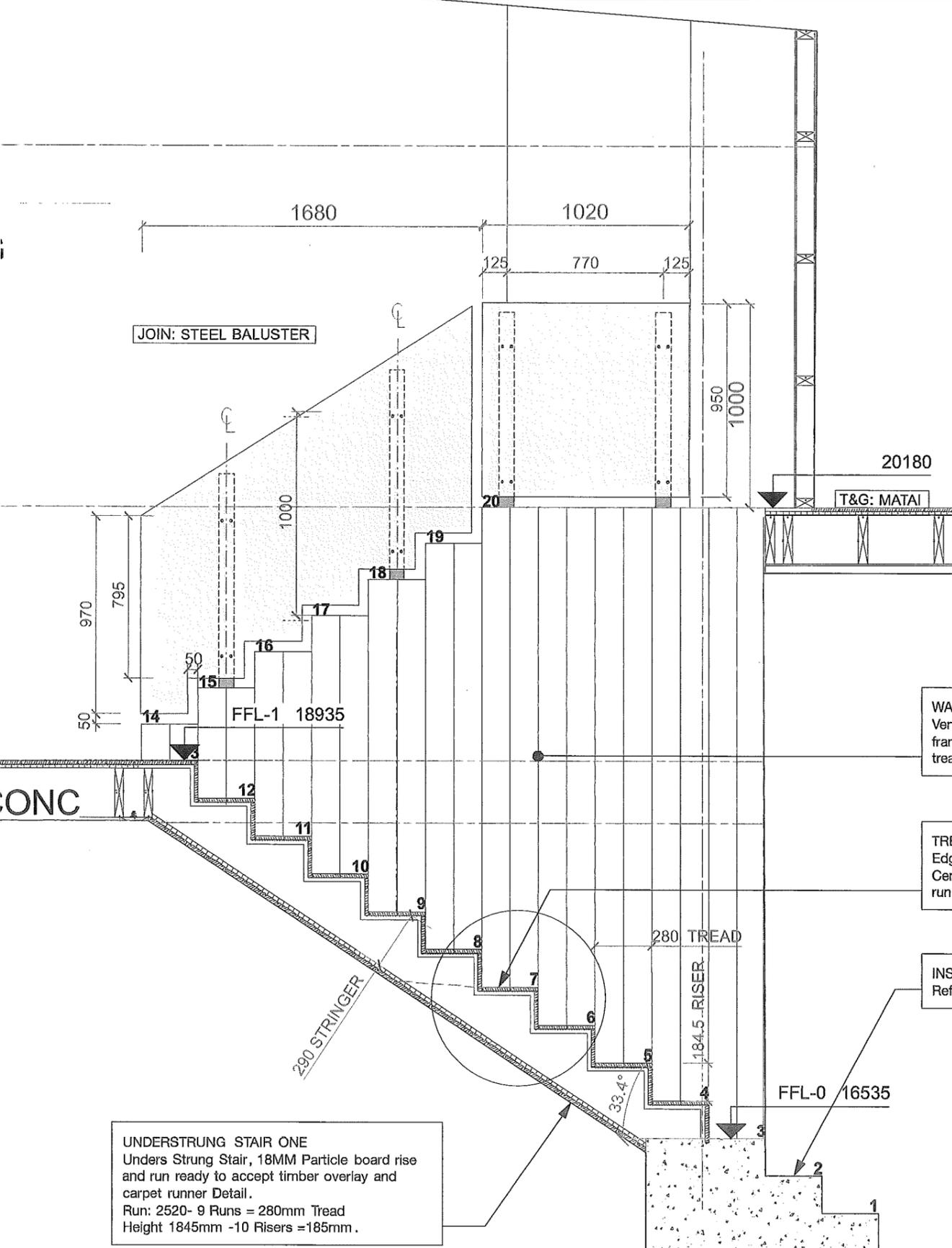
40mm MATAI HAND RAIL
40MM Round Matai Handrail. On custom made steel wall bracket, Refer to drawings 62.04 for detail.



FLOOR	RL	LEVEL	CHANGE	RISERS	HEIGHT	#	TREAD	NOSE	UNIT L.
GROUND	16535	0							
Conc	17090	555	555	3	185	3	280	0	560
LEVEL 1	18935	2400	1845	10	184.5	13	280	0	2520 STAIR 1
LANDING 1	20180	3645	1245	7	178	20	280	0	1680 STAIR 2
LANDING2	20536	4001	356	2	178	22	500	0	500
LEVEL 2	21955	5420	1419	8	177	30	280	20	1820 STAIR 3
RIDGE 1									
RIDGE 2									
RL OF OPENING AT STE	22570								
Opening Height	2034								

1 Level 0 Stair Plan
1:25 @ A3

13 JAN 2014
BY:

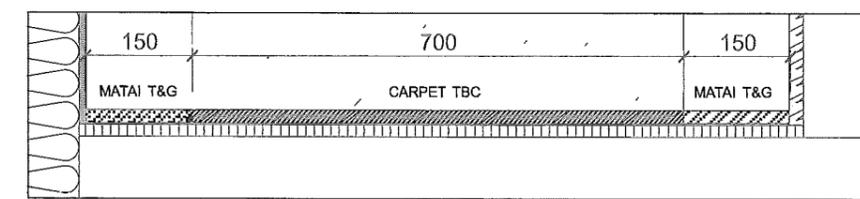
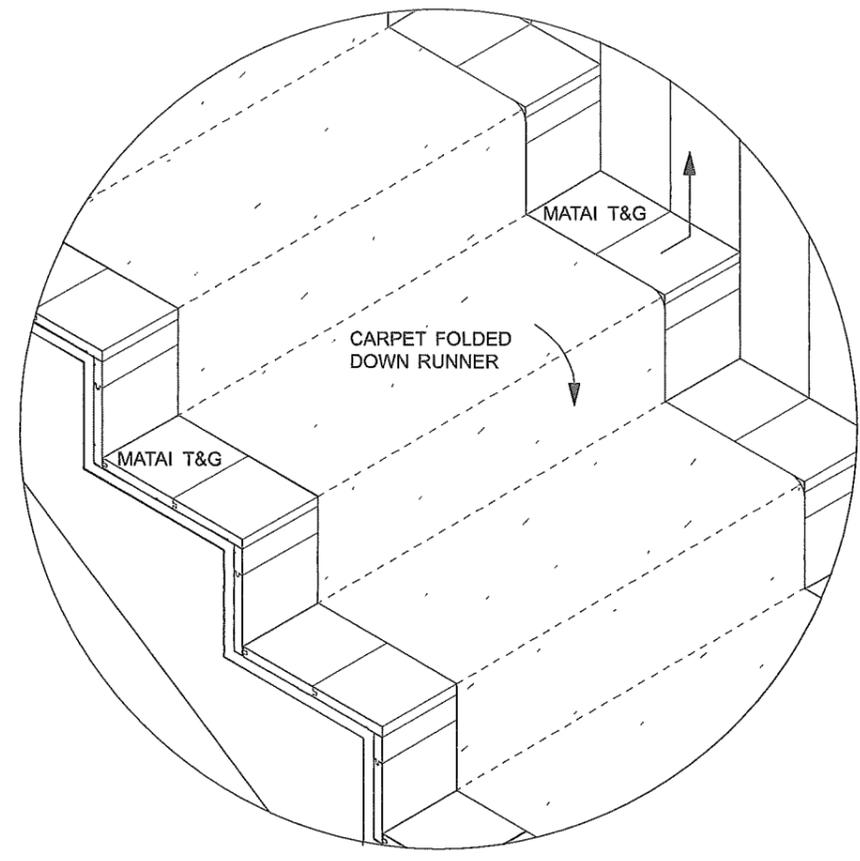


WALL PANEL
Vertical T&G Matai 18mm fixed to 90x45mm framing. Line of boards to follow down to stair tread.

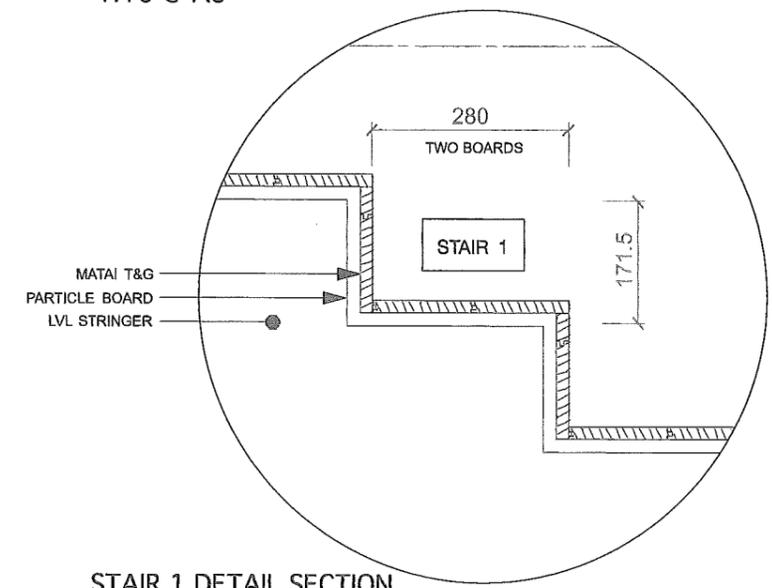
TREAD & RISER
Edges to have T&G Matai 18mm, 150mm Cover. Central runner to be carpet folded down stair run. Securely fixed to prevent slippage.

INSITU CONCRETE STAIR BASE
Refer slab plan.

UNDERSTRUNG STAIR ONE
Unders Trung Stair, 18MM Particle board rise and run ready to accept timber overlay and carpet runner Detail.
Run: 2520- 9 Runs = 280mm Tread
Height 1845mm -10 Risers =185mm.



STAIR CROSS SECTION
1:10 @ A3



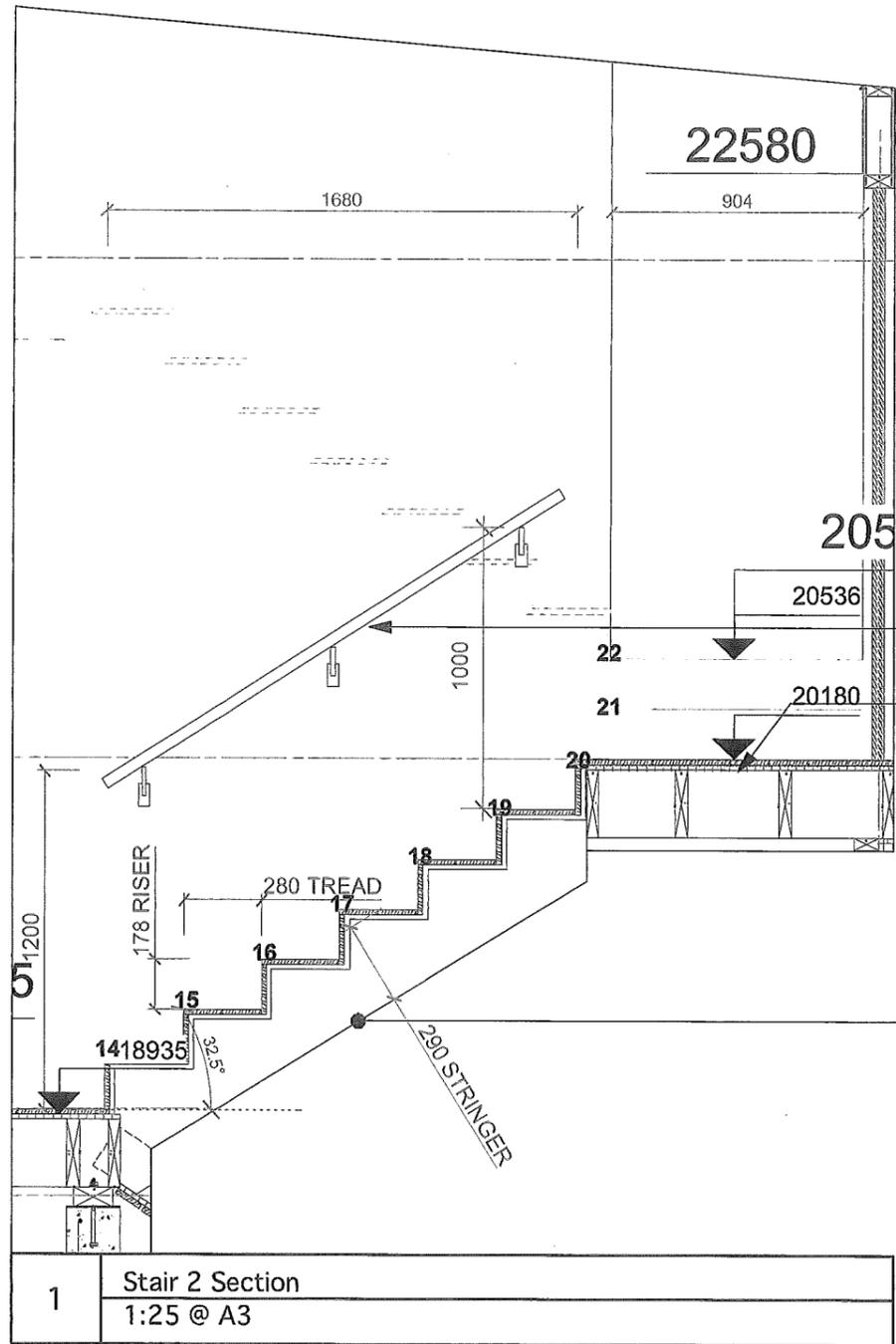
STAIR 1 DETAIL SECTION
1:10 @ A3

1	Stair 1 Section 1:25 @ A3
---	------------------------------

1307 O'Brien House 7 Tutere St Waikanae Jill & Shane O'Brien PROJECT	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 565 363 NOT FOR CONSTRUCTION	A 10/12/13 BUILDING CONSENT ISS DATE NOTE
--	--	--

ASSEMBLY
ARCHITECTS
LIMITED

Stair 1 Setout	62.01	A	DRAWING NUMBER REV
----------------	-------	---	--------------------



BALUSTRADE PANEL
Matai Veneer panel on 24mm Custwood. Clear Spray finish.

BALUSTER
Custom made steel baluster. Refer to Drawing 62.05 for detail.

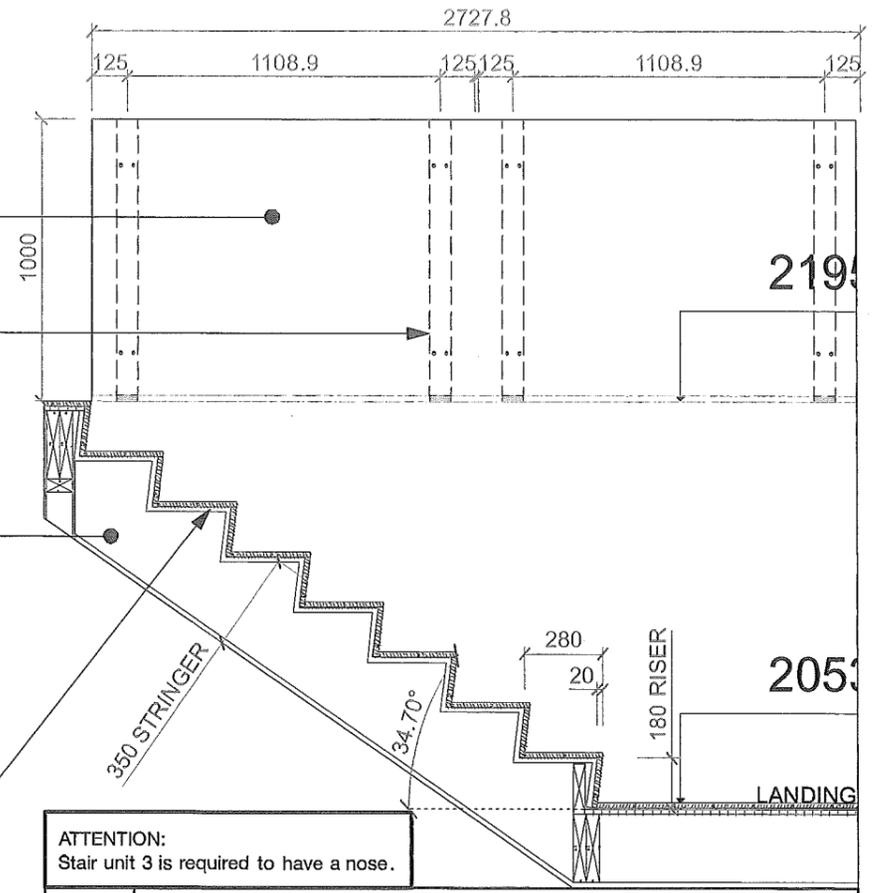
UNDERSTRUNG STAIR THREE
Under Strung Stair, 18MM Particle board ready to accept timber overlay and carpet runner.
Run: 1820- 7 Runs = 280mm Tread 20mm Nose
Height 1419mm - 8 Risers = 177mm.

40mm MATAI HAND RAIL
40MM Round Matai Handrail. On custom made steel wall bracket, Refer to drawings 62.04 for detail.

LANDING RISERS
Platforms constructed by carpenter. Refer framing for joists. T&G Matai 18mm on 18mm Ply.

TREAD & RISER
Edges to have T&G Matai 18mm, 150mm Cover. Central runner to be carpet folded down stair run. Securely fixed to prevent slippage.

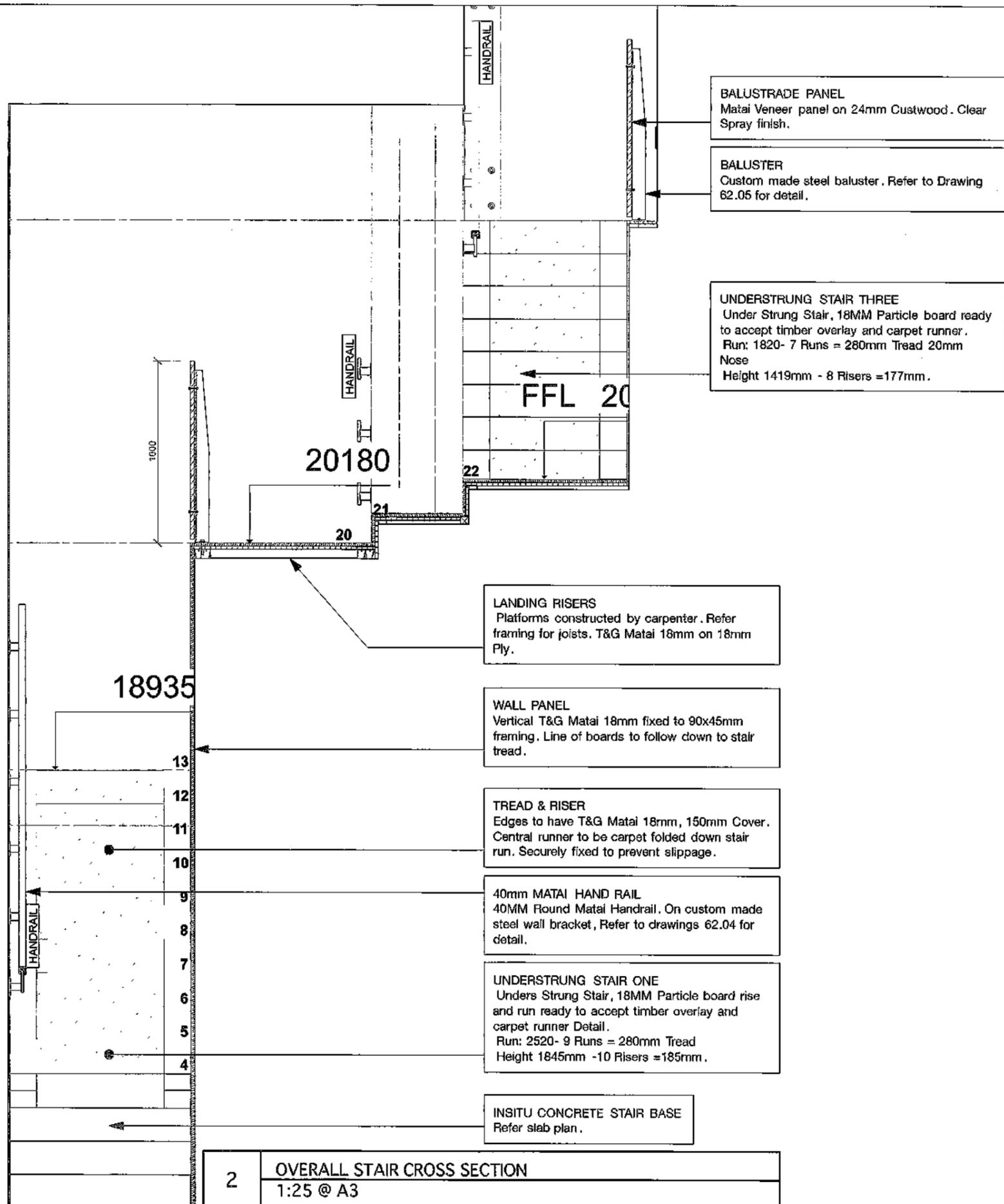
UNDERSTRUNG STAIR TWO
Unders Strung Stair, 18MM Particle board rise and run ready to accept timber overlay and carpet runner Detail.
Run: 1680- 6 Runs = 280mm Tread
Height 1245mm - 7 Risers = 178mm.



ATTENTION:
Stair unit 3 is required to have a nose.

2 Stair 3 Section
1:25 @ A3

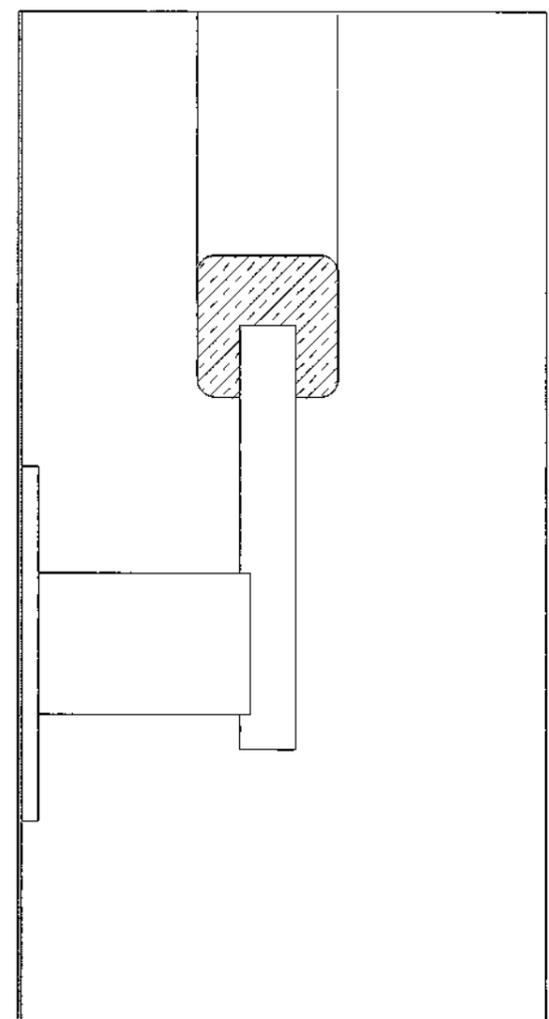
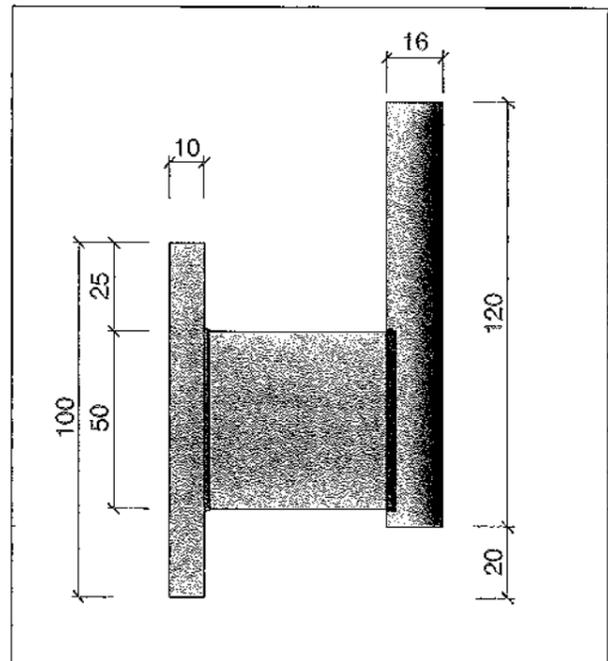
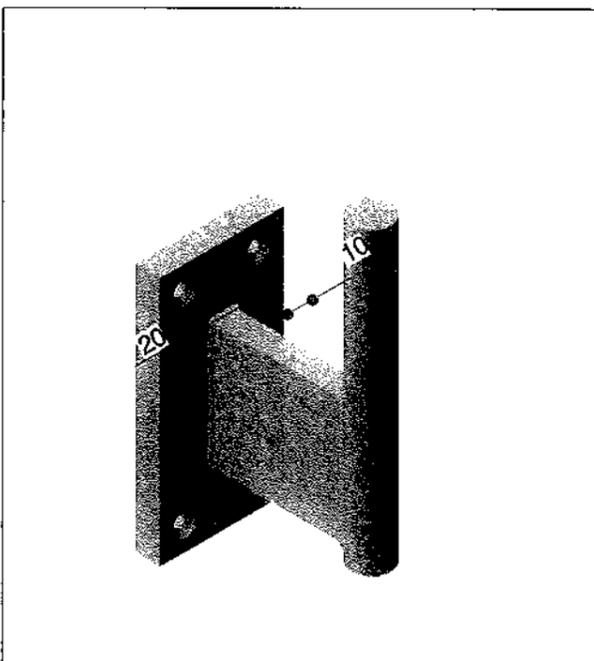
FLOOR	RL	LEVEL	CHANGE	RISERS	HEIGHT	#	TREAD	NOSE	UNIT L
GROUND	16535	0							
Conc	17090	555	555	3	185	3	280	0	560
LEVEL 1	18935	2400	1845	10	184.5	13	280	0	2520 STAIR 1
LANDING 1	20180	3645	1245	7	178	20	280	0	1680 STAIR 2
LANDING2	20536	4001	356	2	178	22	500	0	500
LEVEL 2	21955	5420	1419	8	177	30	280	20	1820 STAIR 3
RIDGE 1									
RIDGE 2									
RL OF OPENING AT STEEL		22570							
Opening Height		2034							

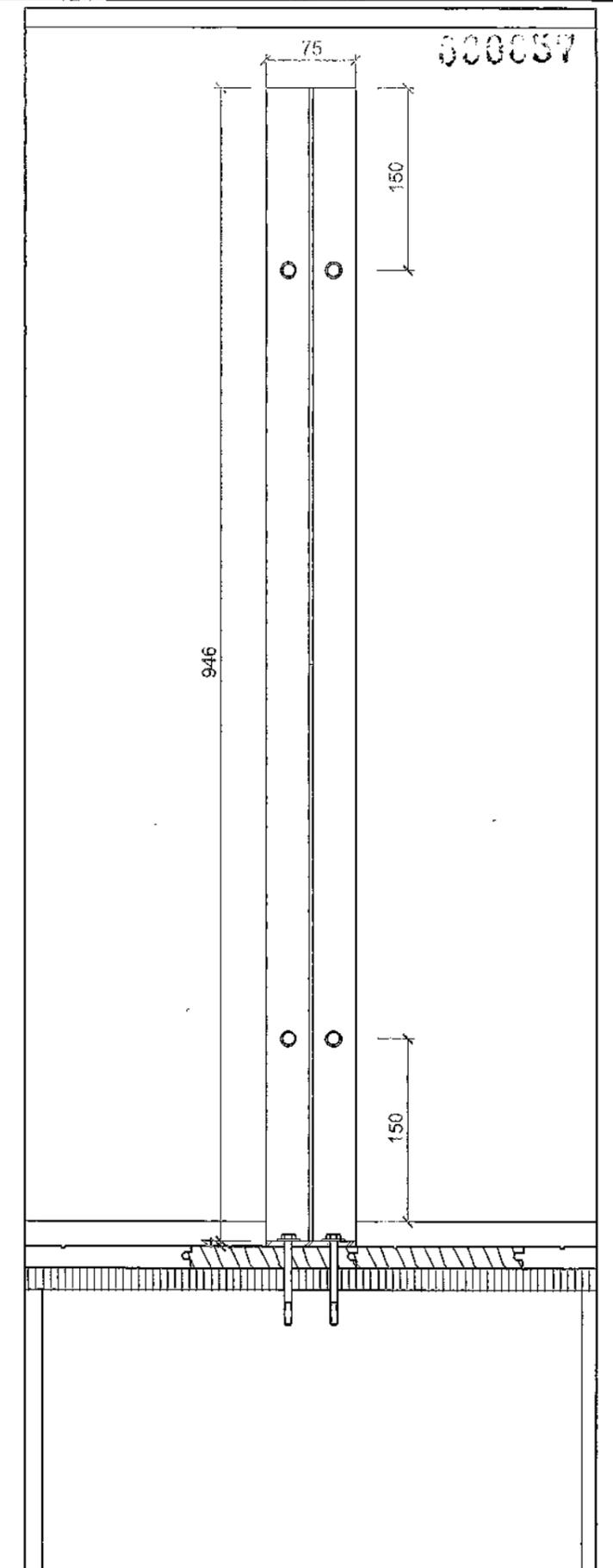
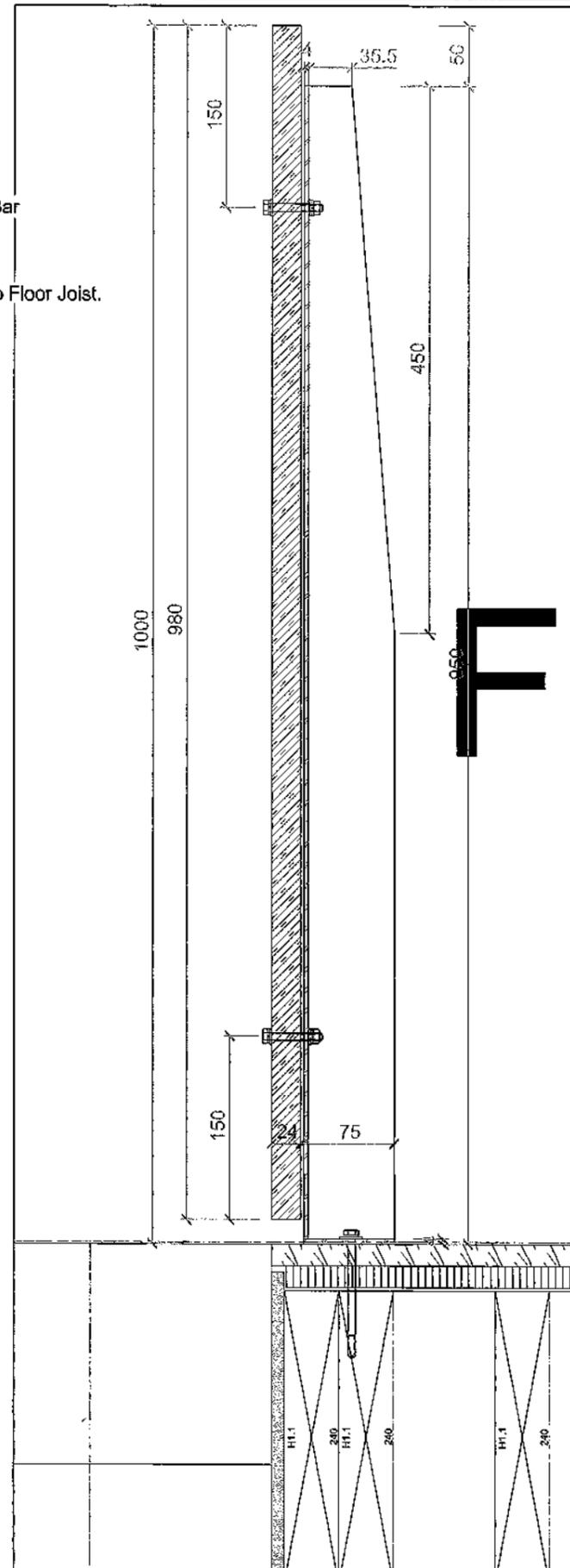
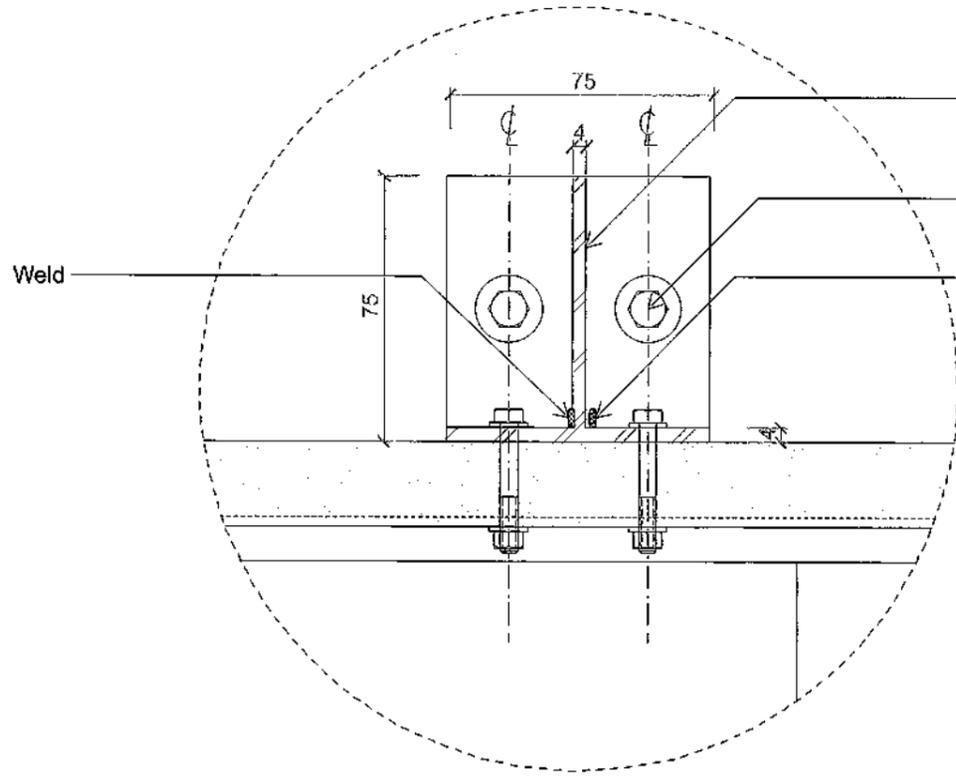


2 OVERALL STAIR CROSS SECTION
1:25 @ A3

JOIN: HANDRAIL

JOINERY: STAIR HANDRAIL
 FSC SAPELE TIMBER: 40 x 40 with 5mm radiused edges
 Custom Steel Bracket Wall Connections - see detail 3
 As per drawing dimensions. Check and confirm all dims on site.
 50mm clear space to adjacent wall.
 SAPELE: Sand and Seal to match finish of T&G Flooring
 BRACKET: Prep, Prime and Paint steel brackets.





1307 O'Brien House 7 Tutere St Waikanae Jill & Shane O'Brien	©COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 686 363	A 10/12/13 BUILDING CONSENT
	NOT FOR CONSTRUCTION	ISS DATE NOTE

ASSEMBLY
ARCHITECTS
LIMITED

13 JAN 2014

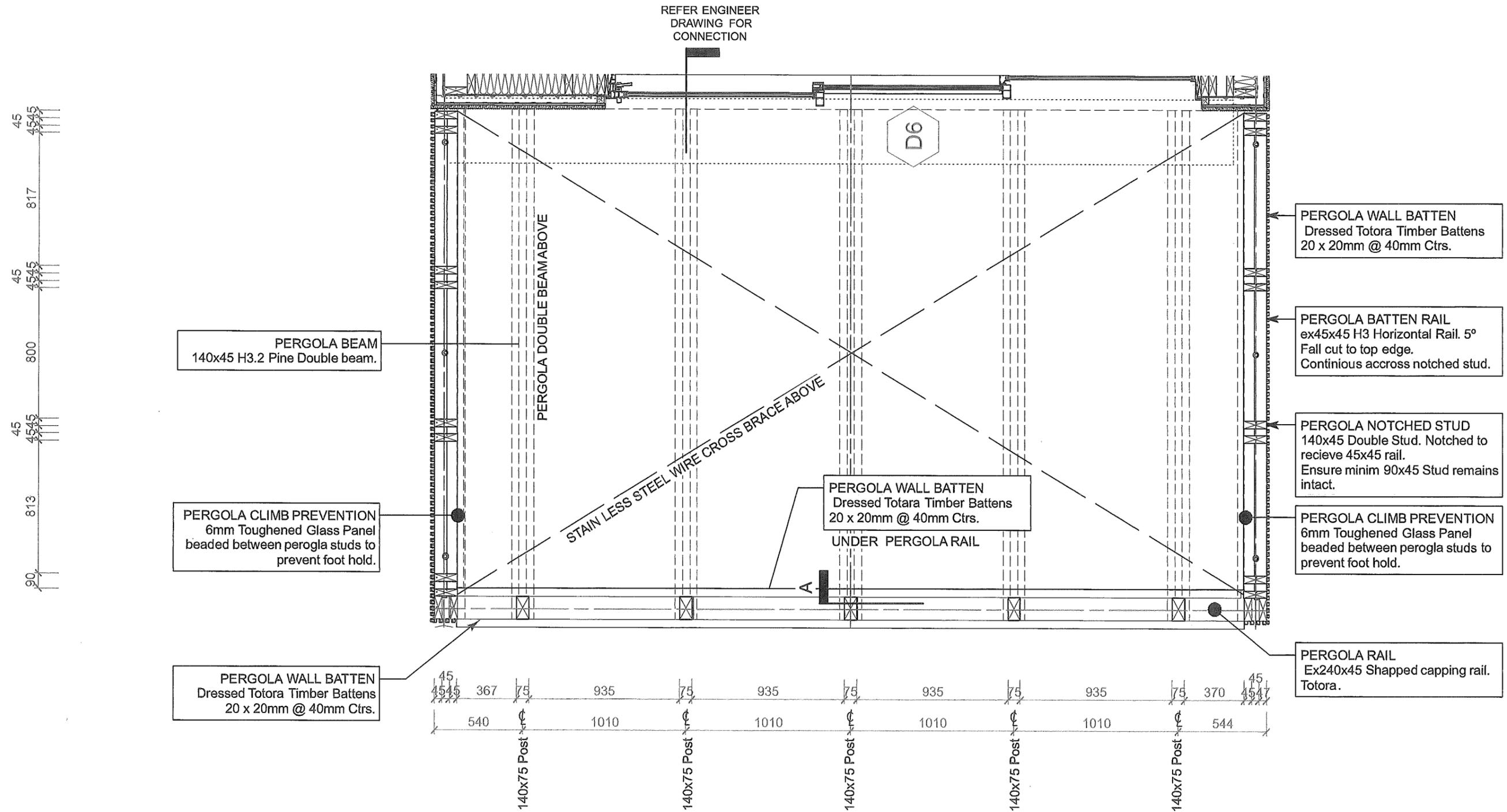
Steel Balustrade Detail

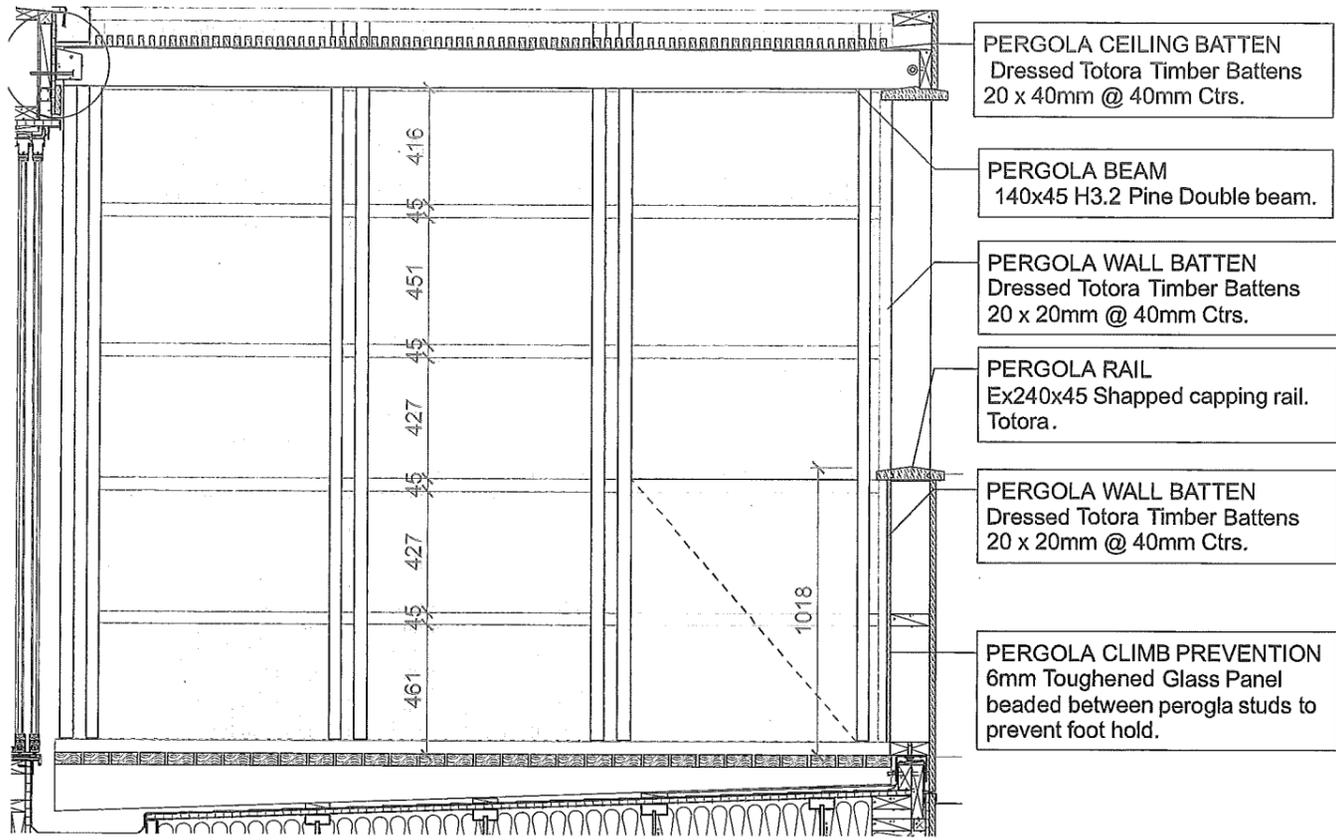
62.05

A

DRAWING NUMBER REV

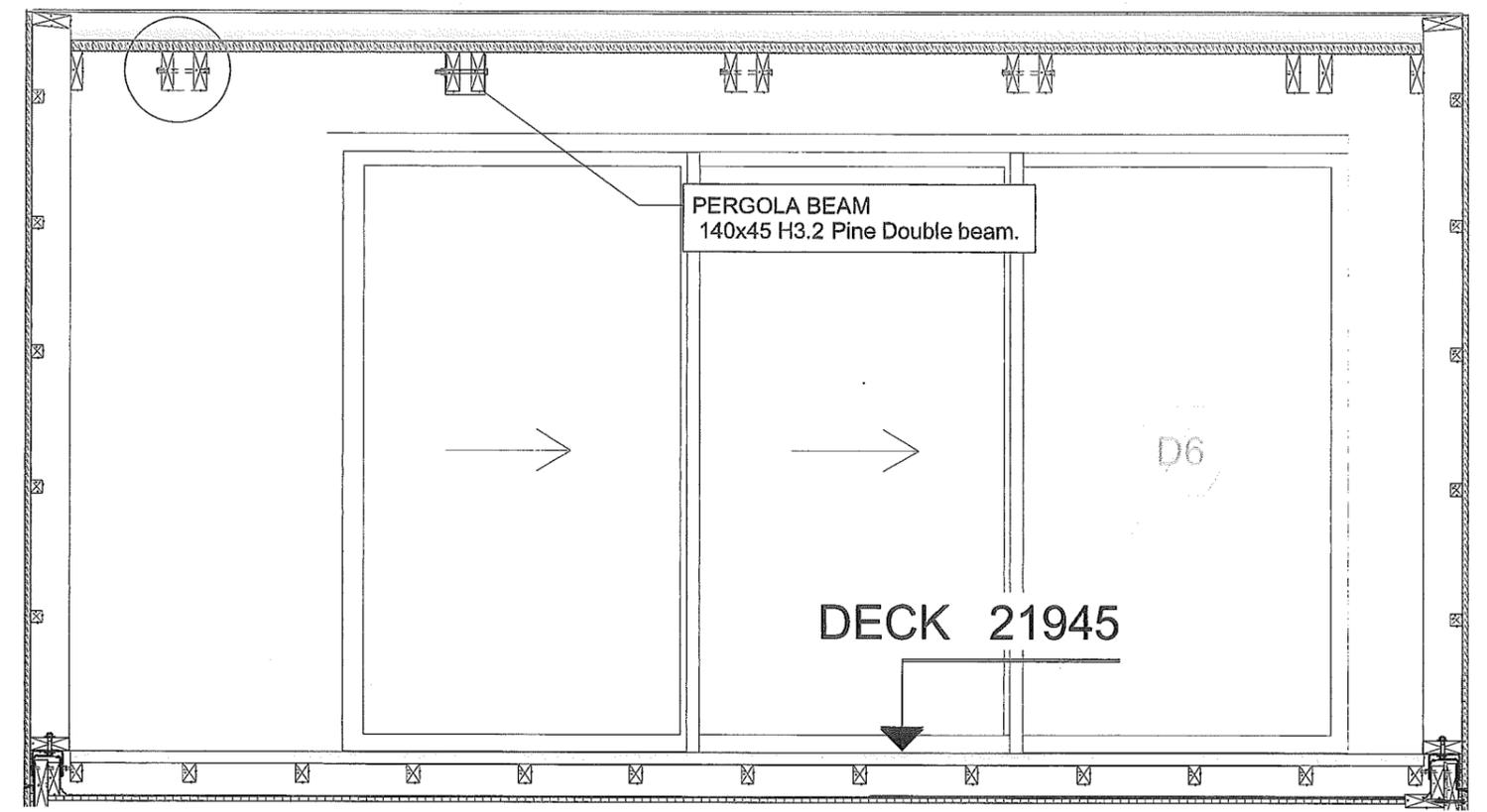
3307- 0615-193



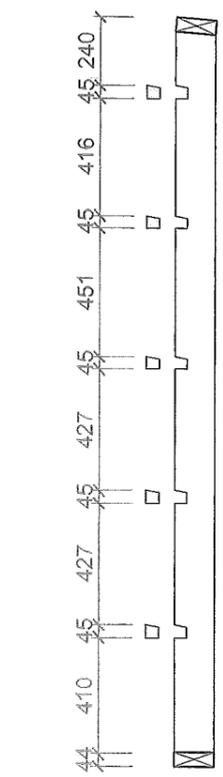


- PERGOLA CEILING BATTEN
Dressed Totara Timber Battens
20 x 40mm @ 40mm Ctrs.
- PERGOLA BEAM
140x45 H3.2 Pine Double beam.
- PERGOLA WALL BATTEN
Dressed Totara Timber Battens
20 x 20mm @ 40mm Ctrs.
- PERGOLA RAIL
Ex240x45 Shapped capping rail.
Totora.
- PERGOLA WALL BATTEN
Dressed Totara Timber Battens
20 x 20mm @ 40mm Ctrs.
- PERGOLA CLIMB PREVENTION
6mm Toughened Glass Panel
beaded between perogla studs to
prevent foot hold.

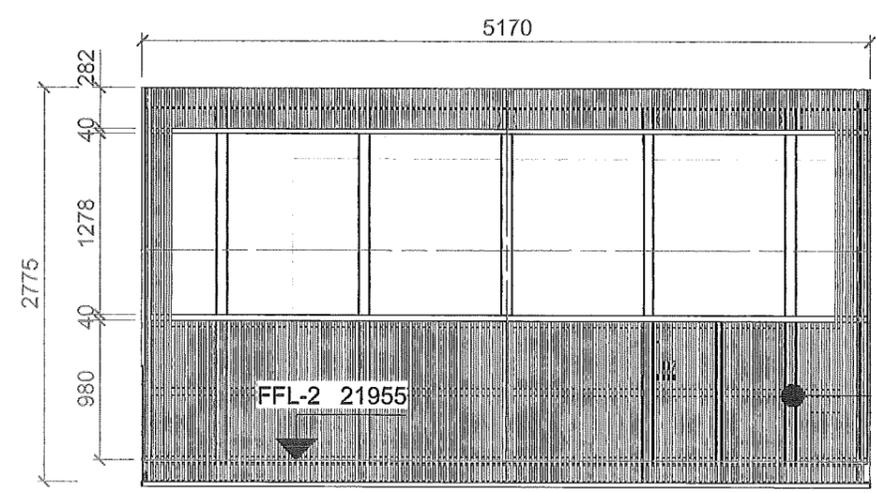
1 PERGOLA SECTION SHORT
Scale: 1:25



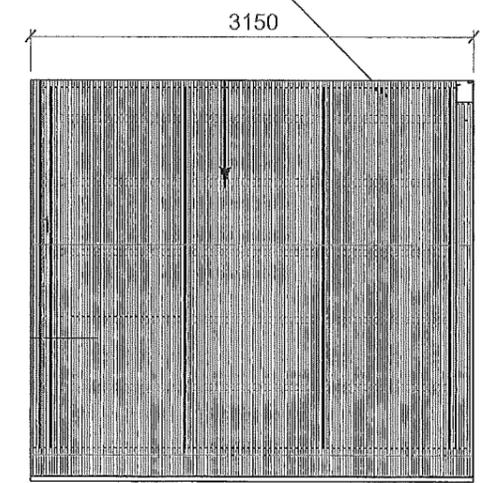
3 PERGOLA SECTION LONG
Scale: 1:25



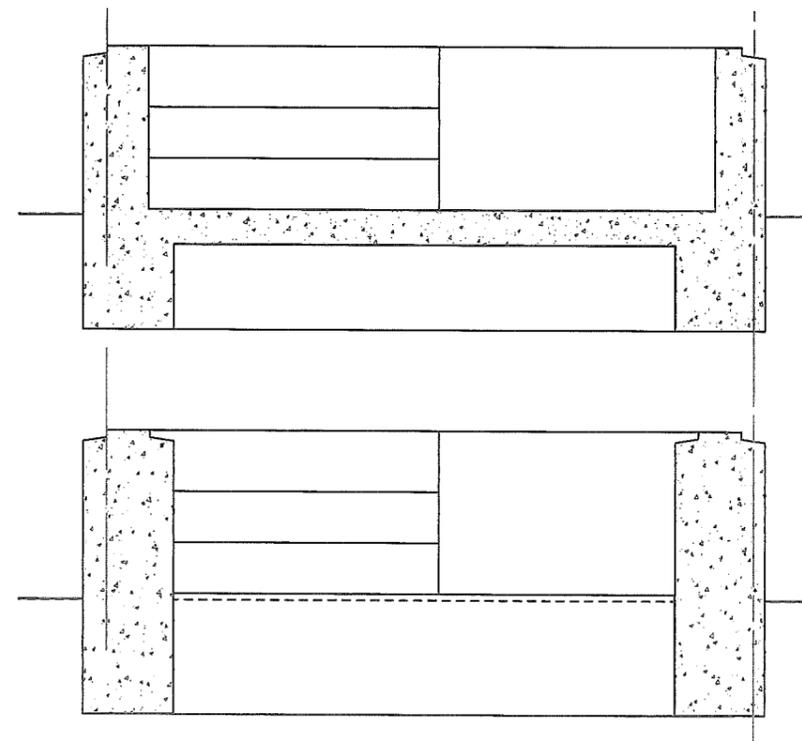
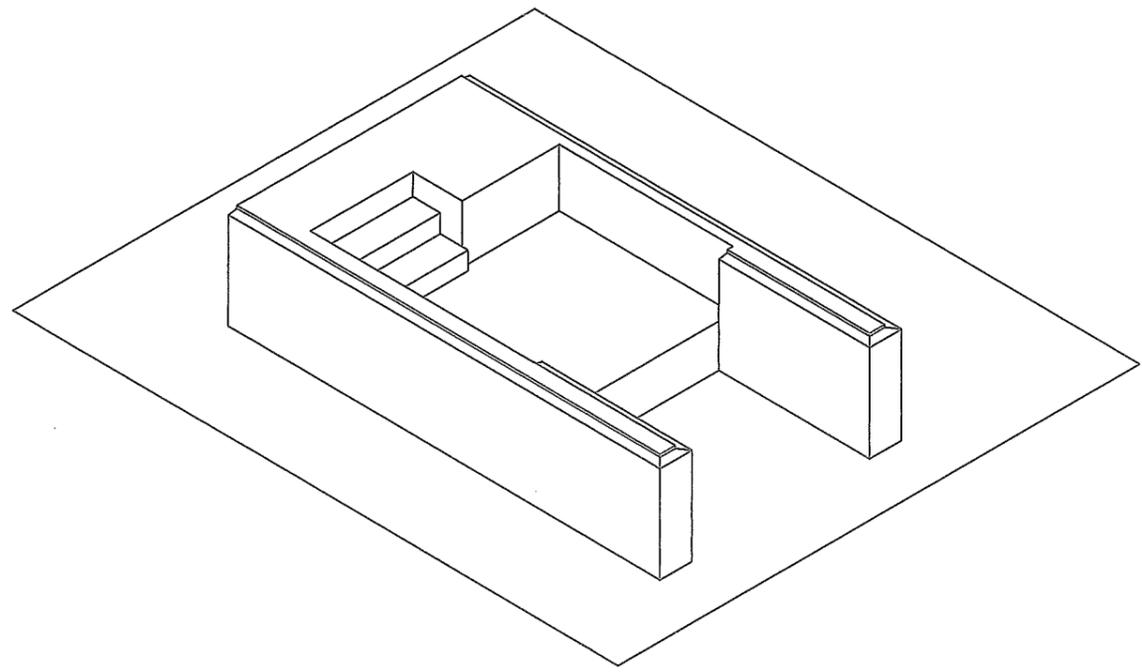
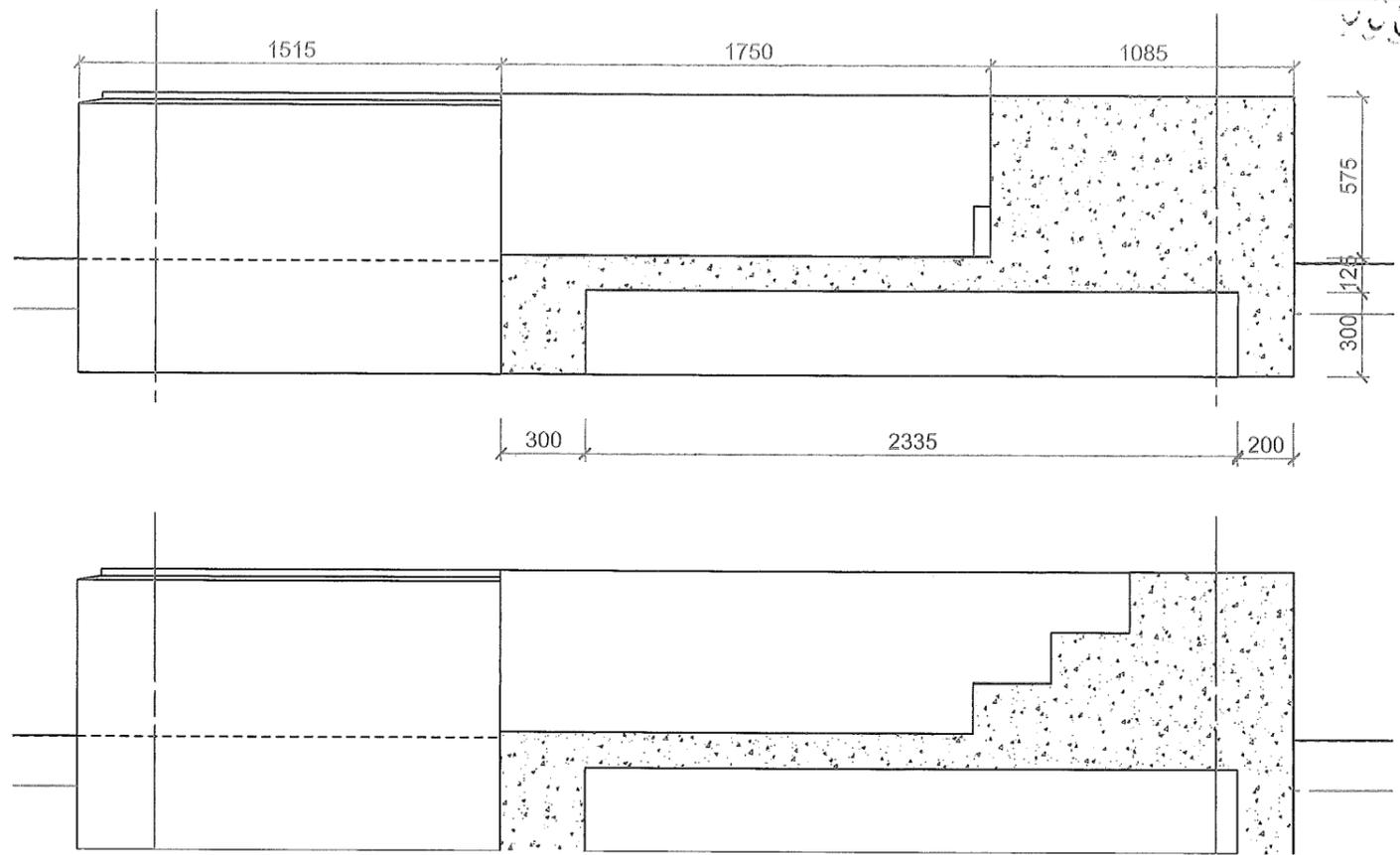
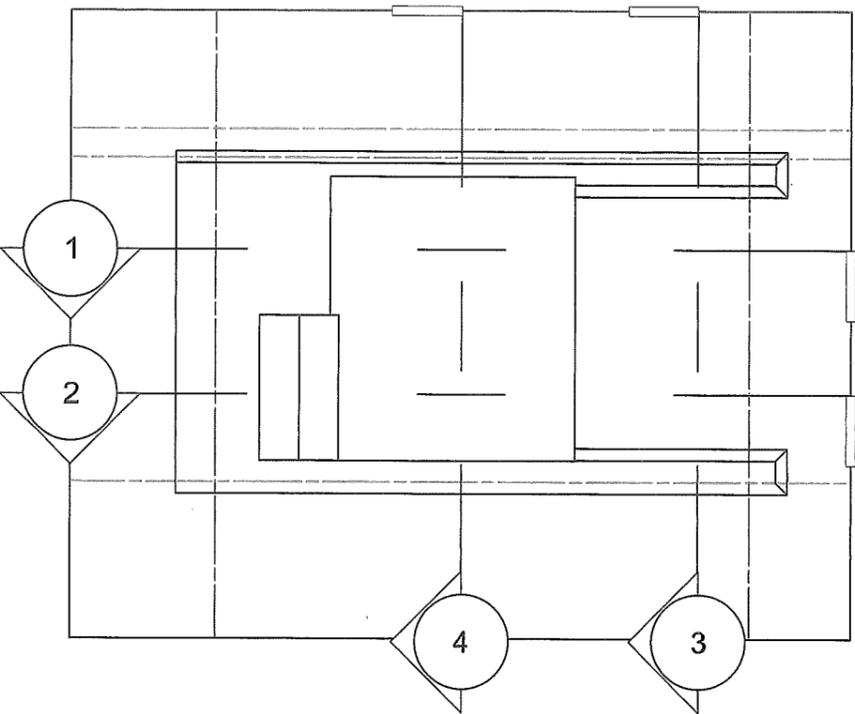
- PERGOLA WALL BATTEN
Dressed Totara Timber Battens
20 x 20mm @ 40mm Ctrs.



6 PERGOLA EAST ELEVATION
Scale: 1:50



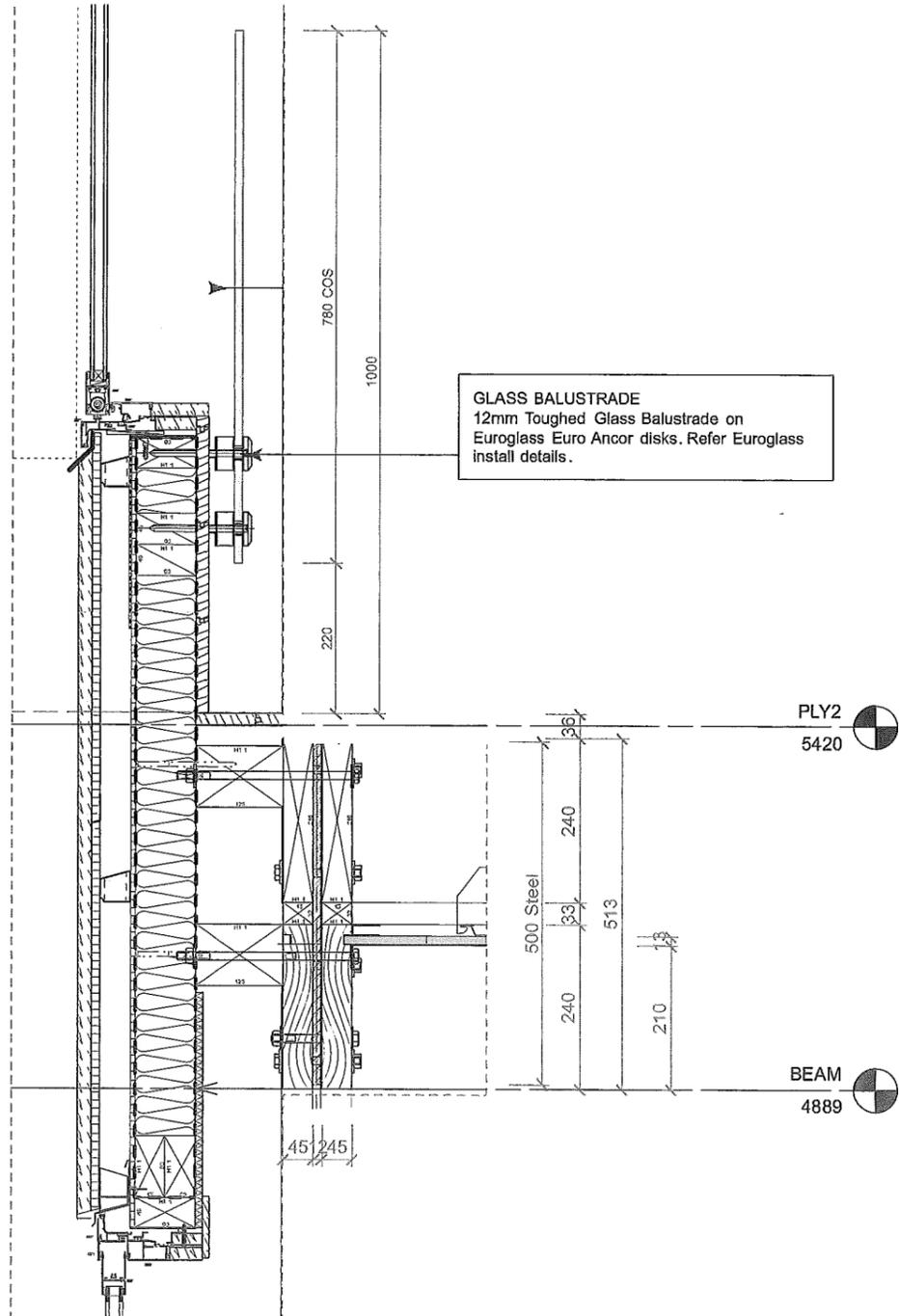
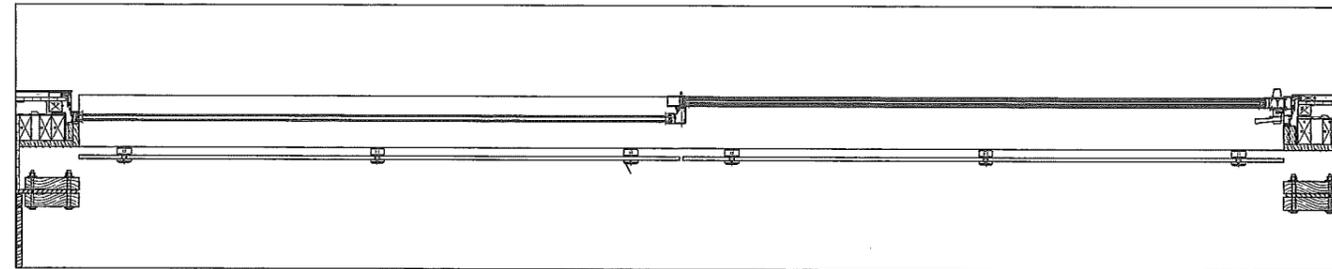
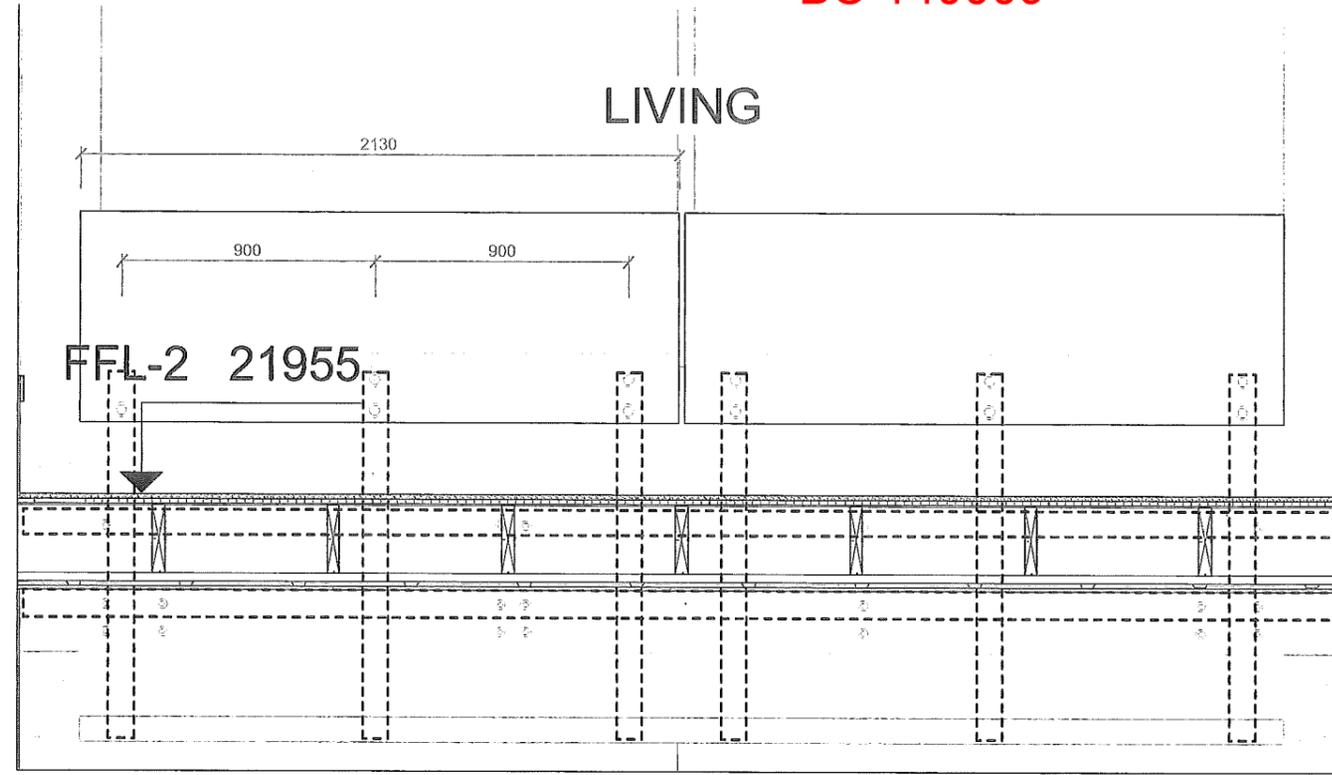
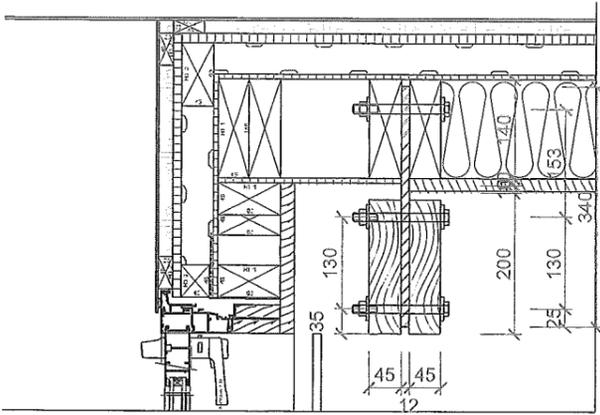
7 PERGOLA NORTH / SOUTH
Scale: 1:50



1307	O'Brien House 7 Tulere St Walkanae Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILKUS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 555 953	A	10/12/13	BUILDING CONSENT
	PROJECT	NOT FOR CONSTRUCTION	ISS	DATE	NOTE

ASSEMBLY
ARCHITECTS
LIMITED

BY:	RECEIVED	13 JAN 2014	Entry Concrete	65.00	A
	DRAWING	NUMBER	REV	1307- 0615.v02	



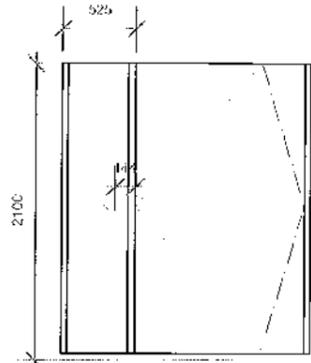
GLASS BALUSTRADE
12mm Toughed Glass Balustrade on Euroglass Euro Ancor disks. Refer Euroglass install details.

1307 O'Brien House 7 Tutere St Walker Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILKIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 665 363	A	10/12/13	BUILDING CONSENT
	NOT FOR CONSTRUCTION	ISS	DATE	NOTE

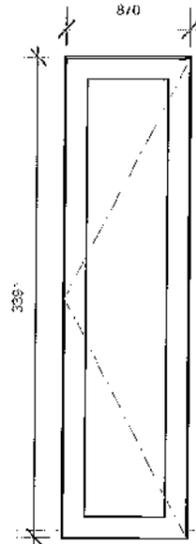
ASSEMBLY ARCHITECTS LIMITED

Glass Balustrade		66.00	A
DRAWING	NUMBER	REV	

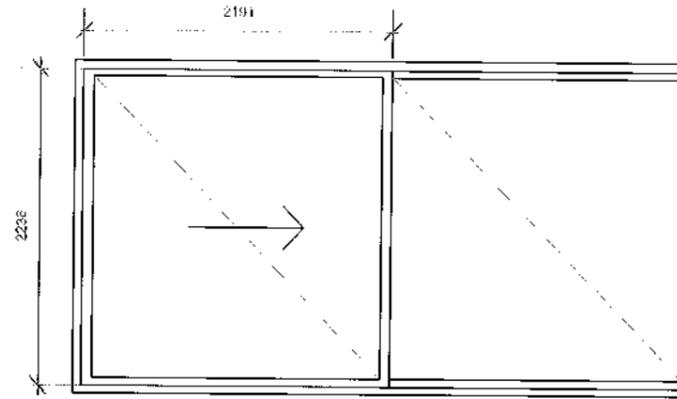
21 MAR 2014



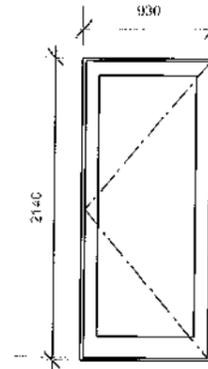
D1
Exterior Aluminium
Frame
Hinge Door



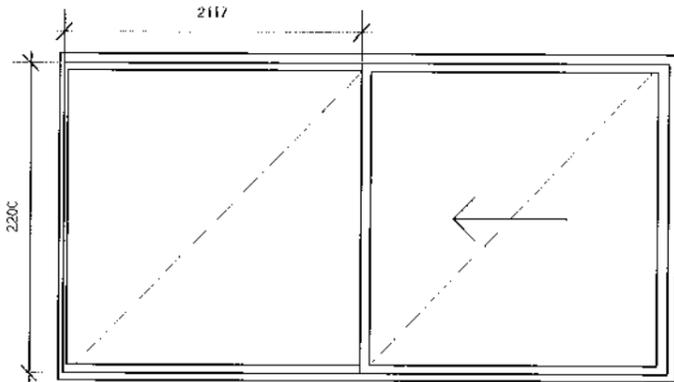
D2
Exterior Aluminium
Frame
Hinge Door



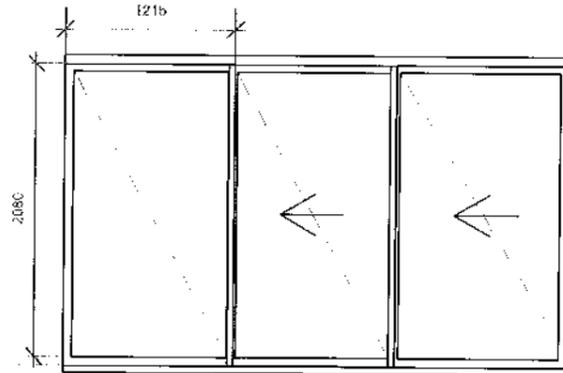
D3
Exterior Aluminium Frame
Sliding Door



D4
Exterior Aluminium
Frame
Hinge Door

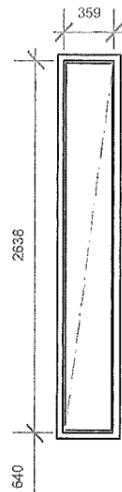


D5
Exterior Aluminium Frame
Sliding Door

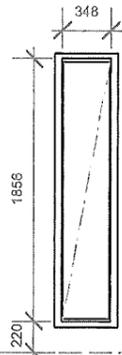


D6
Exterior Aluminium Frame
Stacker Door

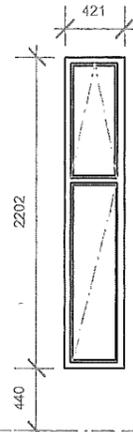
Item		Opening Area	Percentage
Kitch/Dining/Living	73	9.7	13.2%
Guest Toilet	2.1	0	FAN
Guest Bath	6.1	0.95	15.6%
Bed 1	11.4	1.8	15.7%
Laundry	4.4	1.33	30.2%
Bed 2	16.2	0.819	4.9%
Masterbed	18.5	4.9	5.05%
Ensuite	8.7	0.927	10.6%
Stair Toilet	2.6	0.64	24.6%
All Areas comply with being a minimum of 5% of the net area per room.			



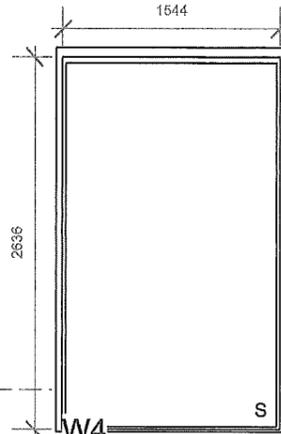
W1
Aluminium Awning Window



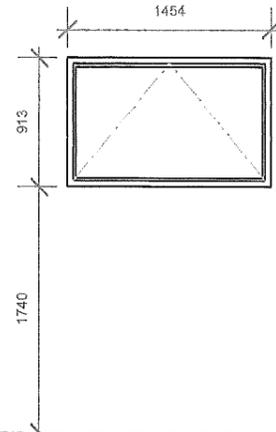
W2
Aluminium Awning Window



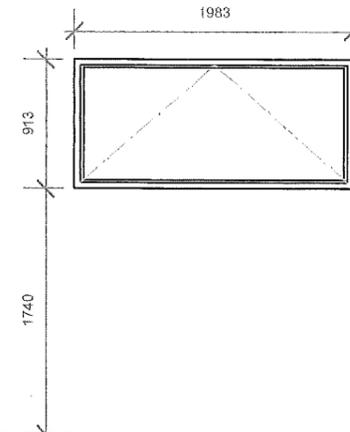
W3
Aluminium Awning Window



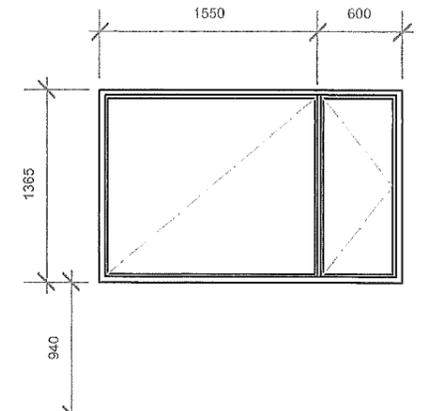
W4
Aluminium Awning Window



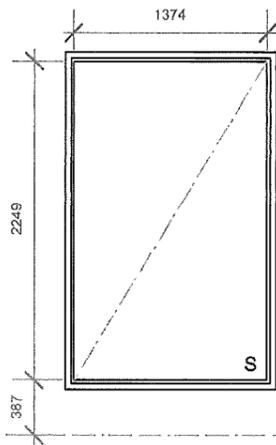
W5
Aluminium Awning Window



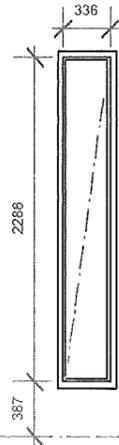
W6
Aluminium Awning Window



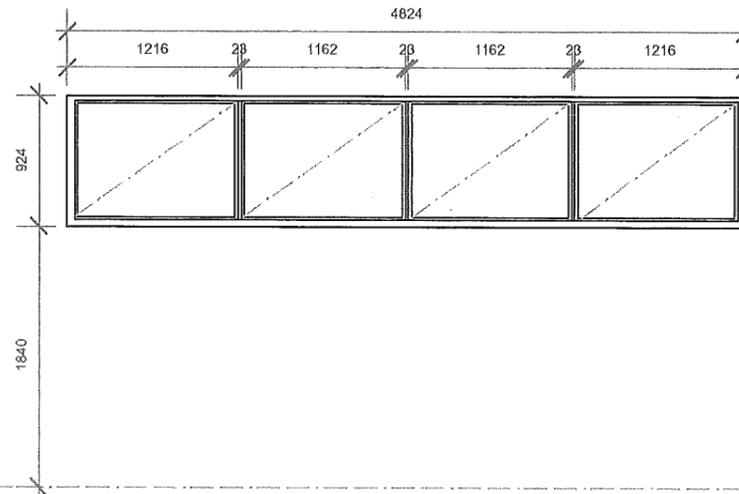
W7
Aluminium Casement Window



W8
Aluminium Casement Window



W9
Aluminium Casement Window



W10
Aluminium Casement Window

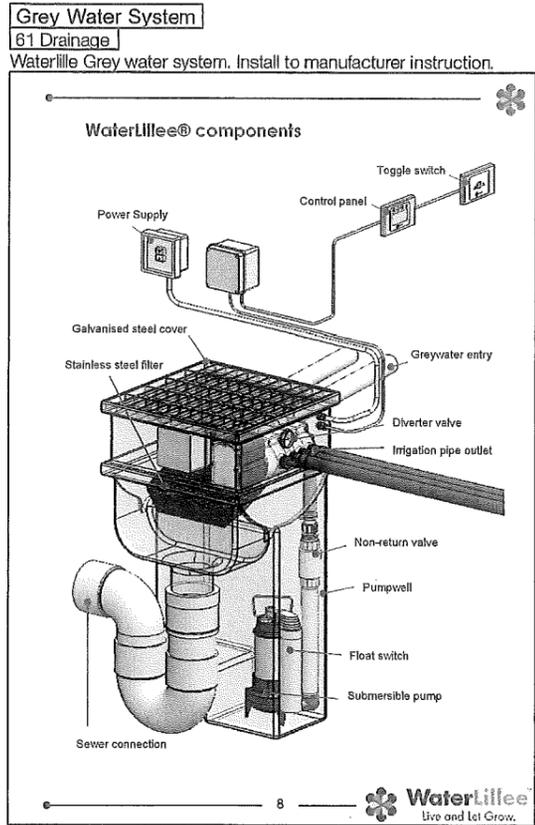
RECEIVED
13 JAN 2014
BY:

1307 O'Brien House 7 Tutere St Waikanae Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 565 363	A 10/12/13 BUILDING CONSENT
	NOT FOR CONSTRUCTION	ISS DATE NOTE

ASSEMBLY ARCHITECTS LIMITED

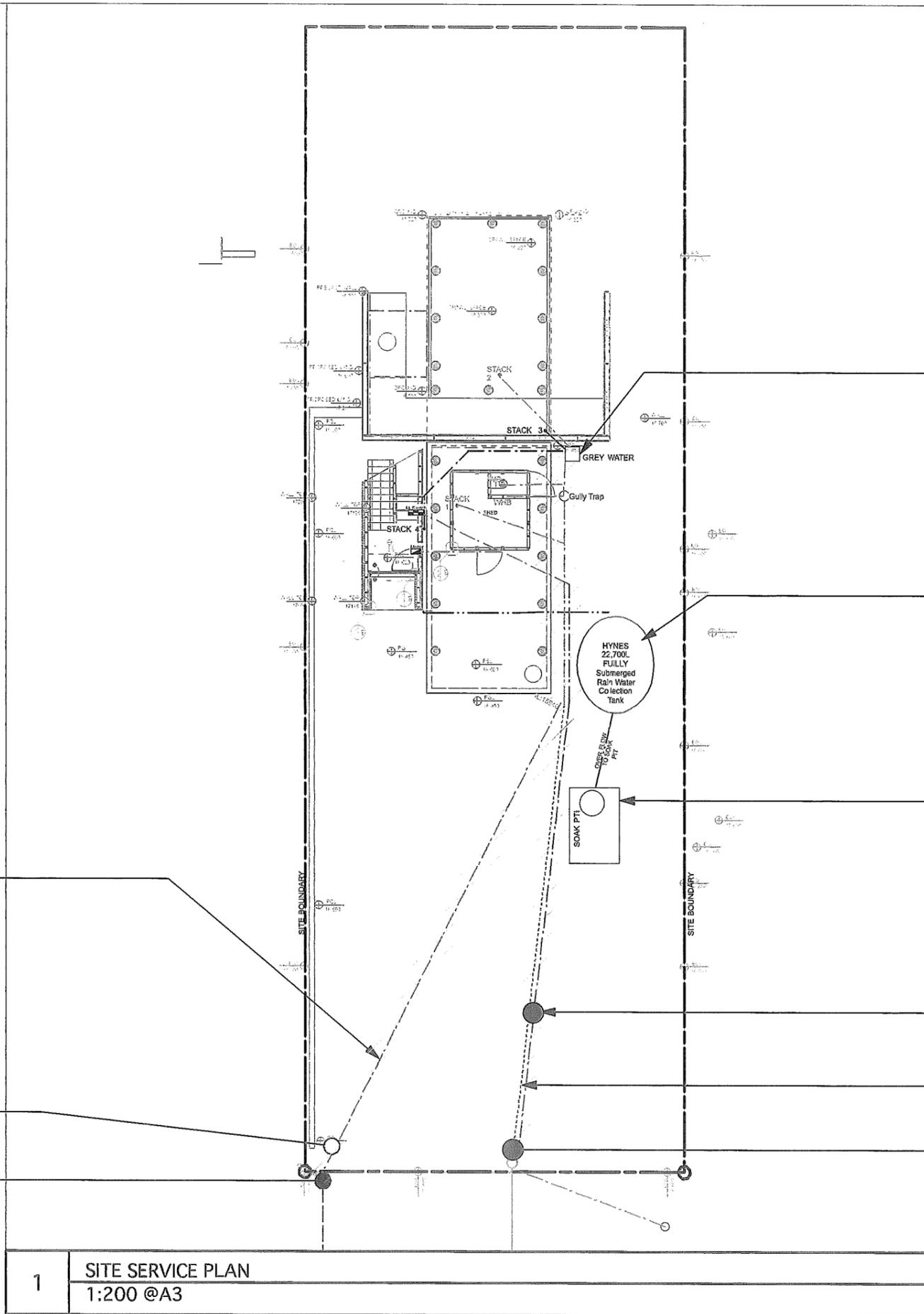
Window Schedule	70.01	A
DRAWING	NUMBER	REV

000004
 RECEIVED
 13 JAN 2014
 BY:



BUILDER TO ENSURE THAT PROPOSED FOUNDATION HEIGHT WILL ALLOW A SATISFACTORY DRAINAGE CONNECTION TO THE COUNCILS SEWER

CERTIFYING PLUMBER/DRAINLAYER TO FILL OUT ATTACHED PRODUCER STATEMENT FORMS AND RETURN TO COUNCIL ALSO PROVIDE NEAT ASBUILT DRAINAGE PLAN SHOWING SEWER STORMWATER AND WATER



'WATER LILLEE' Grey water collection and distribution system. Install in accordance with manufacturer instruction.

HYNES CONCRETE WATER TANK 22K liter fully submerged water collection tank. Feed all stormwater collection to tank. Connect Overflow to soak pit.

SOAK PIT Refer to Drawing 80.03 SOAK PIT for typical install detail.

SINGLE PHASE MAINS SUPPLY, Install main supply cable to AS/NZS 4961 and AS/NZS 3008.1.2. Minimum rating of 60 amps per phase. Obtain and comply with all relevant Network Utility Operators requirements. Cable to be laid safely underground in trench. Lay marker tape and back fill.

SHARED TRENCH FOR POWER AND WATER SUPPLY

SITE WATER CONNECTION Connect to water supply at boundary. Run new water supply in shared trench.

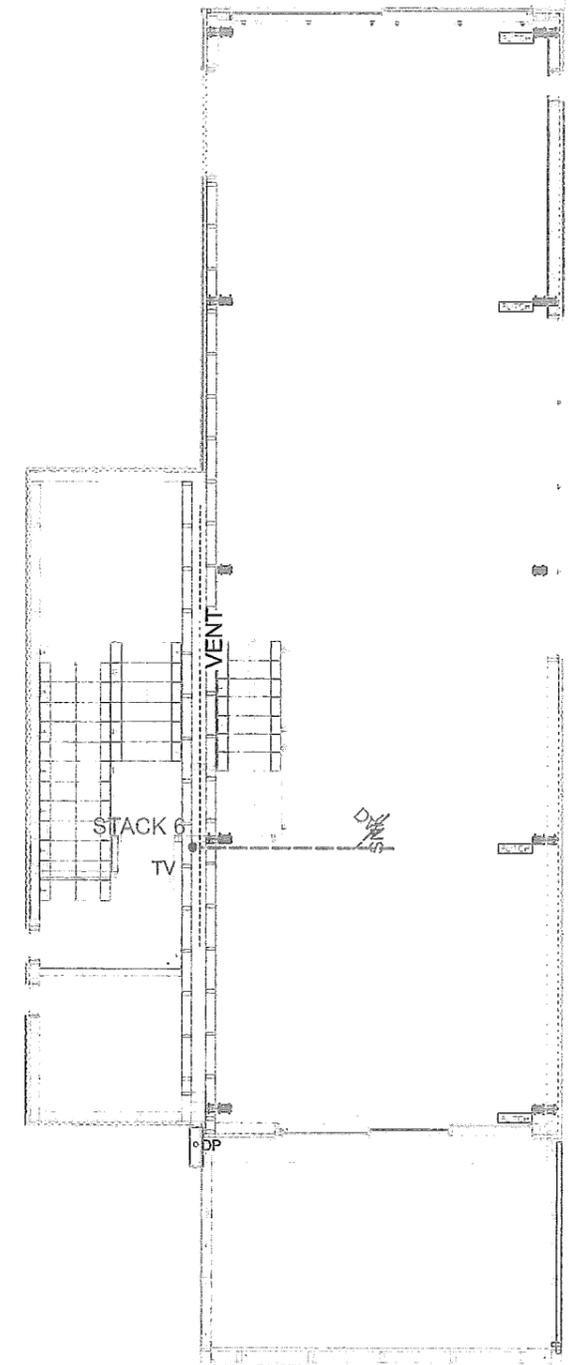
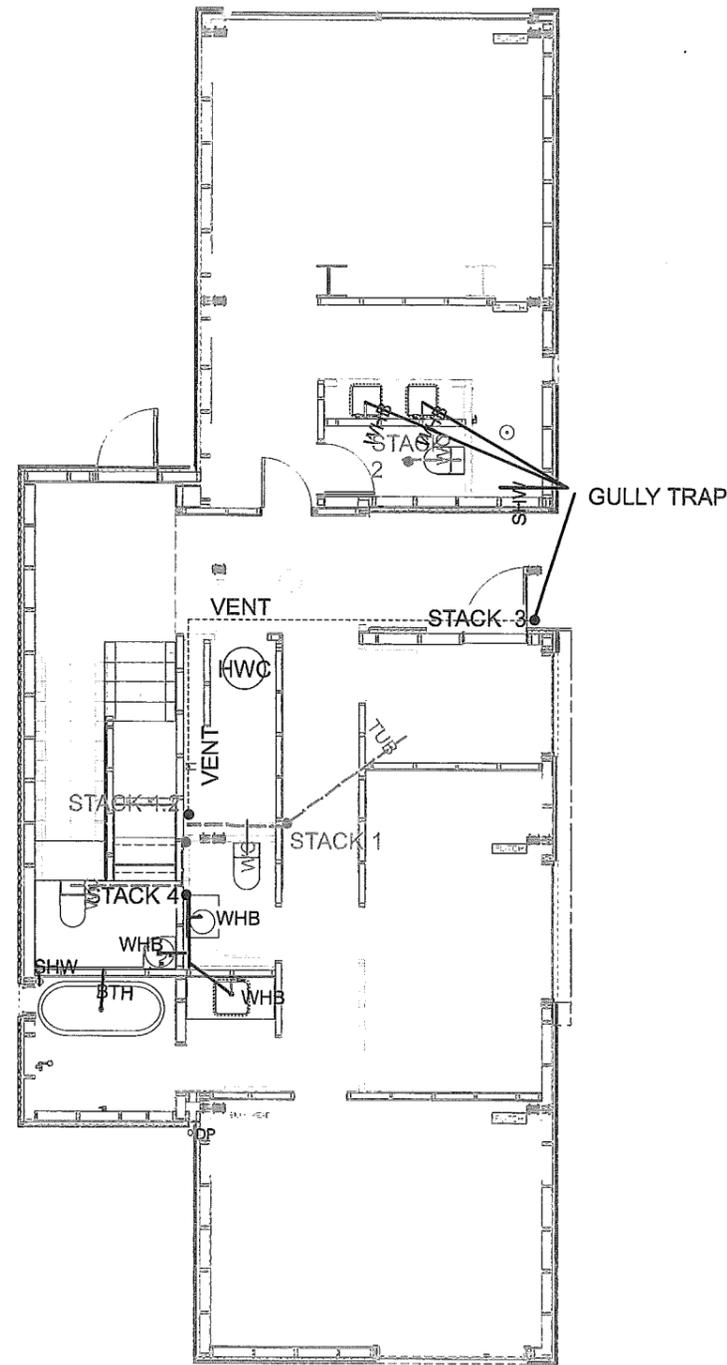
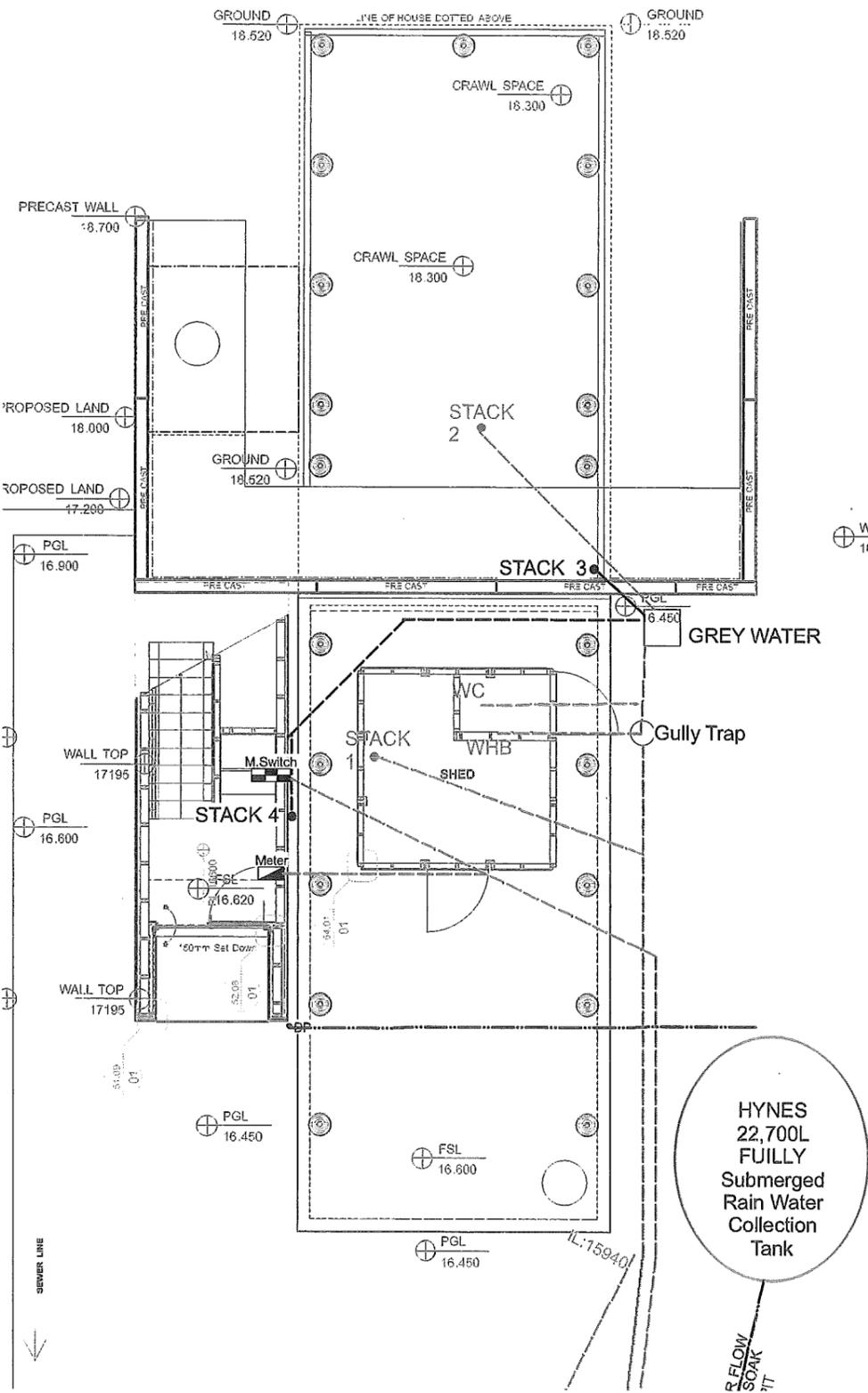
SEWAR IN TRENCH IN ACCORDANCE WITH G13 Fig 7

PROVIDE ACCESS INSPECTION POINT positioned immediately inside of boundary and outfall in accordance with G13 5.7.4 a & b

CONNECT TO EXISTING SEWER AT BOUNDARY

1 SITE SERVICE PLAN
 1:200 @A3

RECEIVED
13 JAN 2014
BY:



A 20MM copper TPR drain from the HWC is to run from the tundish to the discharge point at low level outside of the building at low level
Plastic pipe not to be used!

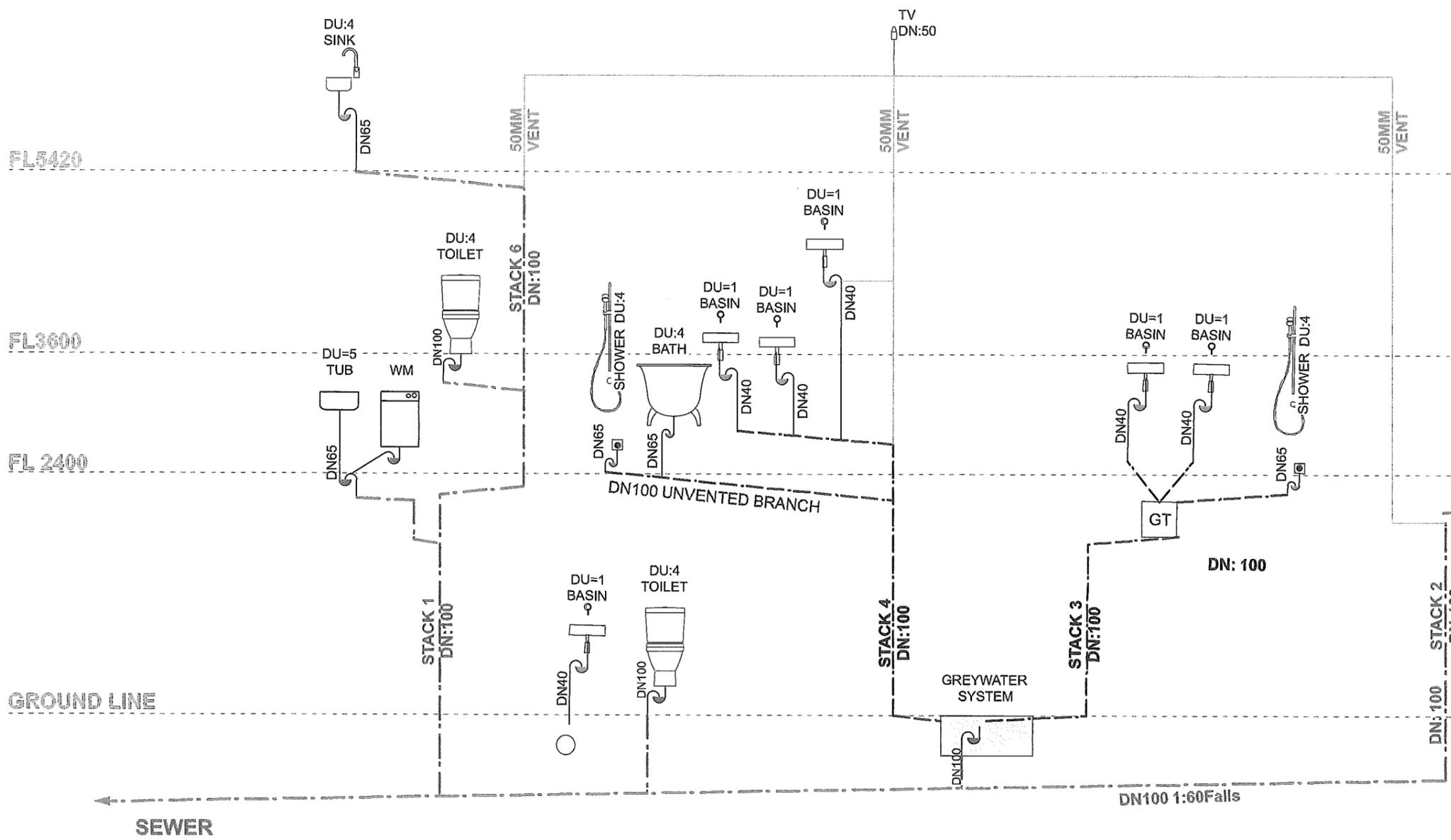
1307	O'Brien House 7 Tutere St Walkanae Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 555 353	A 10/12/13 BUILDING CONSENT
	PROJECT	NOT FOR CONSTRUCTION	ISS DATE NOTE

ASSEMBLY ARCHITECTS LIMITED

Plumbing Plan		80.01	A
DRAWING	NUMBER	REV	

TOTAL DISCHARGE UNITS:

TUB	1
BASIN:	4
BATH	1
SHOWER	2
TOILET	3
SINK	1
WASH	1
DW	1
TOTAL	14



Ensure that the upstairs soil and wastepipes can run to the exterior without damaging any structural members

2x45 degree bends required at the base of the soil stack.

Any branches into the vertical soil stack are to installed with 45 degree junctions not strap bosses.

Water test soil stacks at the preline plumbing inspection stage

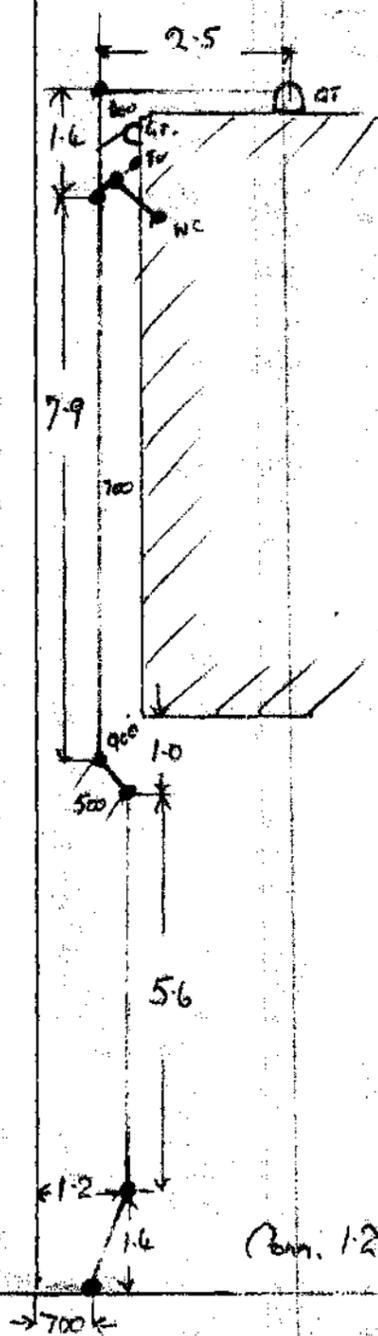
1	Plumbing Diagram
---	------------------

1307 O'Brien House 7 Tutere St Walkanae Jill & Shane O'Brien PROJECT	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 565 353 NOT FOR CONSTRUCTION	A 10/12/13 BUILDING CONSENT ISS DATE NOTE
--	---	--

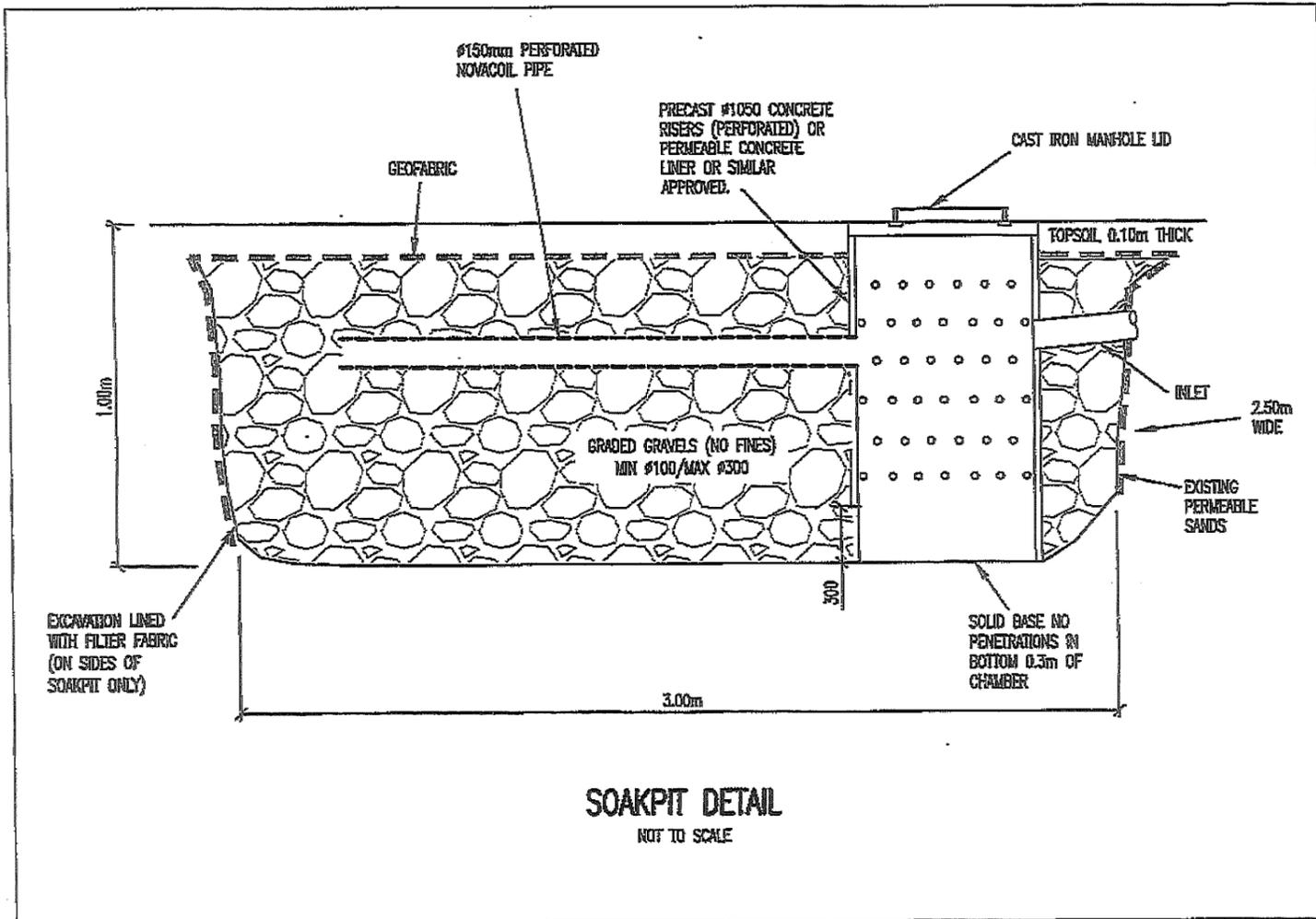
ASSEMBLY ARCHITECTS LIMITED

Plumbing Diagram	80.02	A
DRAWING	NUMBER	REV

RECEIVED
13 JAN 2014
BY:



Hughson - 7 Tutave Street.
 Drainlayer M. Phillips.



SOAK PIT 1 CALCULATIONS

9.0.5

The volume of storage required in the soak pit, V_{stor} (m³), shall be calculated by:

$$V_{stor} = R_c - V_{soak}$$

where:

R_c = run-off discharged from catchment to soak pit in 1 hour (m³).

V_{soak} = volume disposed of by soakage in 1 hour (m³).

$$R_c = 10CIA$$

where

C = run-off coefficient (see Table 1).

I = rainfall intensity (mm/hr) based on 1 hour duration of an event having a 10% probability of occurring annually.

A = area (hectares) of the catchment discharging to the soak pit.

$$V_{soak} = A_{sp} S_r / 1000$$

where

A_{sp} = area of the base of the soak pit (m²).

S_r = soakage rate (mm/hr) determined from 9.0.2

9.0.5

Where the soak pit comprises a rock filled hole, then the volume available for storage, V_{stor} , shall be taken as 0.38 times the volume of the hole.

Proposed Soak Pit Storage Volume is greater than the required V_{store} , hence as per E1/M1 the proposed soak pit meet the performance requirements of the building code.

Run Off Discharged to Pit (RC)	Const	Run Off Coefficient	RainFall Intensity	Area (hectares)
2.55 m ³	10	0.90	27	0.011

Vsoak	Area Base of Pit (A _{sp})	Soak Rate (S _r)	Const
2	4 M ²	500	1000

Vstore	Run Off Discharge (RC)	Discharge Volume (V _{Soak})
0.55 m ³	2.5515	2

Soak Pit Size Req	Store Req	Rock Factor
1.45 m ³	0.5515	0.38

Proposed Soak Pit	Width (m)	Length (M)	Height (M)	Volume (M ³)
V _{Proposed}	2	2	0.5	2 m ³
Rock Factor (9.0.6)				0.38
STORAGE VOLUME			V_{store}	0.76 m³

Table 1: Run-off Coefficients	
Paragraphs 2.0.1, 2.1.1, 2.1.3	
Description of surface	C
Natural surface types	
Non-impermeable clay with no interception channels or run-off control	0.70
Non-vegetated soil of medium soakage	0.60
heavy clay soil types:	
- pasture and scrub cover	0.40
- bush and scrub cover	0.35
- cultivated	0.30
Medium soakage soil types:	
- pasture and scrub cover	0.30
- bush and scrub cover	0.25
- cultivated	0.20
High soakage gravel, sandy and volcanic soil types:	
- pasture and scrub cover	0.20
- bush and scrub cover	0.15
- cultivated	0.10
Parks, playgrounds and reserves:	
- mainly grassed	0.30
- predominantly bush	0.25
Gardens, lawns, etc.	0.25
Developed surface types	
fully roofed and/or sealed developments	0.90
Steel and non-absorbent roof surfaces	0.90
Asphalt and concrete paved surfaces	0.85
near flat and slightly absorbent roof surfaces	0.80
Stone, brick and precast concrete paving panels	
- with sealed joints	0.80
- with open joints	0.60
Unsealed roads	0.60
Lawns and unsealed yards and similar surfaces	0.35
Land use types	
industrial, commercial, shopping areas and town house developments	0.60
Residential areas in which the impervious area is less than 30% of gross area	0.45
Residential areas in which impervious area is 30% to 50% of gross area	0.35
Note:	
Where the impervious area exceeds 50% of gross area, use method of Paragraph 2.1.2	

Hynds concrete water tanks provide reliable storage of cool, clear and safe drinking water in rural areas.

Hynds tanks are strong and durable and will never burn or rust and are much less susceptible to damage caused by wind, vandalism, or vermin. Hynds tanks offer a long and virtually maintenance free service life.

APPLICATIONS

- Reliable storage of cool, clear and safe drinking water

FEATURES

Hynds concrete water tanks offer the following features:

- Low maintenance and long life
- High strength
- Cool water storage
- Reduces the chance of algae growth
- Stock and fire resistant
- Less susceptible to theft or vandalism
- Raised manhole installed into roof with secure lid

Tank Capacities & Types

The tank capacity is 22,700 litres (5,000 gallons).

Standard tanks are designed to be either free standing above the ground or partially buried to within 300mm of shoulder.

Fully buried (flat top) tanks are designed to be buried with a maximum of 300mm of earth cover.

Connections

Inlet connections (Top)

- 2 x 100mm (located at opposite ends)

Outlet connections (Bottom)

- 2 x 50mm (located same end)
- 2 x 32mm (Capital region only)

One connection is capped, the second threaded male connection is bare, ready for fitting of the shut off valve.

Concrete Water Tank					
Code	Description	Capacity	A	B	Weight
WT5000ELT	Oval Water Tank	5000 Gallon / 22700 Litres	2940mm	2790mm	8.5 Tonne
WT5000ELFT	Flat Top Oval Water Tank	5000 Gallon / 22700 Litres	—	2790mm	9.5 Tonne

Concrete Water Tank Accessories	
Code	Description
RHCONTV090	Marley Vacuum Kit for Concrete Tanks
RHCI	Marley Calmed Inlet
RHFO	Marley Floating Outtake
WATERLEVEL	Water Level Indicator
WATERLEVEL + EXT	Water Level Indicator Meter Extension
RHMG	Marley Mechanical Water Gauge

Concrete Water Tank Accessories	
Code	Description
RHCONTV090	Marley Vacuum Kit for Concrete Tanks
RHCI	Marley Calmed Inlet
RHFO	Marley Floating Outtake
WATERLEVEL	Water Level Indicator
WATERLEVEL + EXT	Water Level Indicator Meter Extension
RHMG	Marley Mechanical Water Gauge

Female Tank Fittings		Male Tank Fittings	
Code	Diameter	Code	Diameter
LDF-TFFB	15mm	LDF-TFMB15	15mm
LDF-TFFB	20mm	LDF-TFMB20	20mm
LDF-TFFB	25mm	LDF-TFMB25	25mm
LDF-TFFB	32mm	LDF-TFMB32	32mm
LDF-TFFB	40mm	LDF-TFMB40	40mm
LDF-TFFB	50mm	LDF-TFMB50	50mm

Brass Tank Fittings	
Code	Diameter
BTS20	20mm
BTS25	25mm
BTS32	32mm
BTS40	40mm
BTS50	50mm



Branches Nationwide

- Northland Whangarei • Auckland Warkworth, Albany, Avondale, Penrose, Manukau, Pukekohe • Waikato Hamilton, Te Kuiti, Taupo
- Bay Of Plenty Tauranga, Rotorua • Taranaki New Plymouth • Manawatu Palmerston North • Wellington Masterlon, Kapiti, Peoria, Kaiwharawhara
- Hawkes Bay Hastings • Nelson/Malborough Nelson, Elnheim • Otago/Southland Oamaru, Dunedin, Cromwell, Winton, Invercargill
- Canterbury Amberley • Christchurch Hornby, Bromley, Waimakariri

Support Office & Technical Services 09 274 0318

0800 WE PIPE (93 7473)
www.hynds.co.nz



Installation Guidelines

Site Access

- Access to the site must have adequate width, clearance to allow the truck unrestricted entry to the site.
- Weight of truck and tank can be up to 22 tonnes.
- The site must be level and free from any obstructions such as large rocks. The site foundation must be completely solid so as to disperse the truck weight evenly.
- Room for the truck Hiab stabilising arms must also be allowed for on site. The arms extend 2.5 m either side of the truck.
- The site must also be clear of overhead wires. All overhead wires must be a minimum of 4m from the Hiab hook at all times.
- For partially buried tanks the centre of the tank cannot be further than 5m from the position of the truck rear wheels. Allowances must be for excavation batters in this measurement.

Tank Dimensions

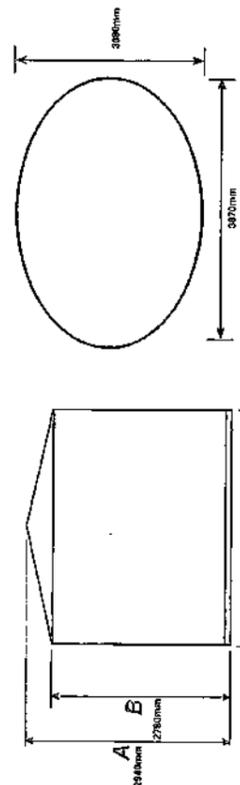


Figure 1: Dimensions of water tanks.

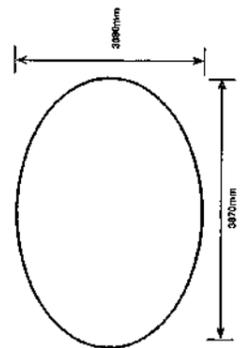
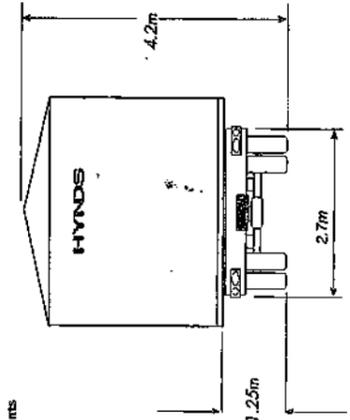


Figure 2: Dimensions of water tank plan view.

Site Clearance Requirements



Site Preparation

The Hynds Elite+ Water Tank must be installed on solid ground capable of taking the weight of the tank and water contents (31.5 tonnes).
The material forming the tank foundations must have a safe bearing capacity of 100kpa (Normal house foundations).
Under no circumstances can any part of the tank be installed on fill material or be part of a retaining structure.

Installation

Tanks must always be placed on a bed of compacted sand or fine aggregate of a similar grade, screeded level to a minimum thickness of 50 mm to a maximum of 150 mm. The base should be approximately 1 m greater in diameter than the tank.
This will ensure a consistent transferring of the tank weight to the ground.

Multiple tanks to have at least 1500 mm distance between them. No business, trees, power lines may pass underneath or adjacent or within a minimum of 2 metres of the water tank wall.

Connections

Buried specially ordered tanks should not be backfilled until the water tightness of all connections is tested.
It is recommended that all tank outlets be fitted with a shut off valve as close as practical to the tank.
It is recommended that your tank has an overflow outlet and this is piped well clear of the tank foundations.

Partially Buried Tanks

For specially ordered partially buried tanks, the area surrounding the tank must be free draining.
Tanks must also not be installed such that only one side of the tank is resting on the backfilled earth. In these situations decompacted and concrete metal must be placed directly next to the tank to ensure no hydrostatic pressure builds up against the tank wall.
The Elite+ tank will float if the local groundwater rises over 800 mm from the bottom of the tank.
A standard Elite tank can be set in the ground to within 800 mm of the bottom of the tank floor.

Buried Tanks

If a tank is to be fully buried a 'Flat Top' tank is required. These have a flat roof and a support pillar in the centre of the tank. Flat top water tanks can only be buried to a minimum depth of 300 mm below ground level or a maximum overburden loading of 10 kpa.
Other than the earth cover, buried water tanks cannot be driven on, or take any external loading, live or static within a distance of 3.2m to the nearest edge of the tank.
Care must also be taken in high groundwater areas that hydrostatic pressure does not lift the tank.

Tank Filling

A new above ground water tank should never be filled completely to the top in one step, this can cause stress cracks.

The recommended procedure is:

- Fill approximately one quarter.
- Leave for two days.
- Fill another quarter.
- Leave for another two days.
- Continue process until tank is filled.

This allows the reinforcing in the tank walls to expand gradually. Partially and buried tanks can be filled in one step to the same level as the outer back fill.

000008

13 JAN 2016 11:30 AM PAGE 9

1	Plumbing Diagram
---	------------------

-High-Intensity Rainfall System V3
 Results for 7 Tutere Street Waikanae
 Intensity-Duration-Frequency results (produced on Wednesday 25th of September 2013)
 Sitename: 7 Tutere Street Waikanae
 Coordinate system: NZMG
 Easting: 2680793
 Northing: 6036531

Rainfall intensities (mm/h)

ARI (y)	aep	Duration									
		10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.833	43.2	30.0	24.4	16.9	11.3	6.0	4.0	2.7	1.8	1.1
2.00	0.500	46.8	32.4	26.2	18.2	12.2	6.4	4.3	2.9	1.7	1.2
5.00	0.200	59.4	41.1	33.2	23.0	15.2	7.9	5.2	3.5	2.0	1.5
10.00	0.100	69.6	48.3	38.8	26.9	17.6	9.1	6.0	3.9	2.3	1.6
20.00	0.050	81.0	55.8	45.2	31.2	20.4	10.3	6.7	4.4	2.5	1.8
30.00	0.033	88.2	60.9	49.2	34.0	22.1	11.2	7.2	4.7	2.7	2.0
40.00	0.025	93.6	64.8	52.2	36.2	23.4	11.8	7.6	4.9	2.9	2.1
50.00	0.020	98.4	67.6	54.8	37.9	24.5	12.2	7.9	5.1	3.0	2.2
60.00	0.017	102.0	70.5	56.8	39.4	25.4	12.7	8.2	5.3	3.1	2.2
80.00	0.012	108.8	75.0	60.4	41.8	26.9	13.3	8.6	5.5	3.2	2.3
100.00	0.010	113.4	78.6	63.4	43.8	28.1	13.9	8.9	5.7	3.3	2.4

Coefficients

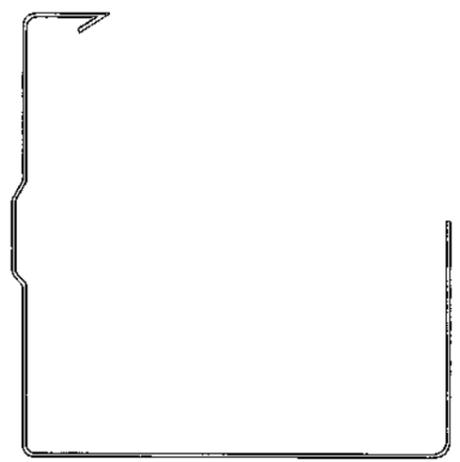
c1	c2	c3	d1	d2	d3	e	f
-0.0008	-0.0141	0.0001	0.4714	0.4245	0.2135	0.2074	2.8253

log(I(D))

10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.792	1.099	0.893	0.000	-0.893	-1.792	-2.485	-3.178	-3.871	-4.277

Standard errors (mm/h)

ARI (y)	aep	Duration									
		10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
1.58	0.833	1.9	1.0	0.7	0.4	0.2	0.1	0.1	0.0	0.0	0.0
2.00	0.500	1.9	1.1	0.8	0.4	0.2	0.1	0.1	0.0	0.0	0.0
5.00	0.200	2.2	1.3	1.0	0.6	0.3	0.2	0.1	0.1	0.0	0.0
10.00	0.100	2.7	1.8	1.4	0.9	0.4	0.2	0.1	0.1	0.0	0.0
20.00	0.050	3.7	2.6	2.0	1.3	0.6	0.3	0.2	0.1	0.1	0.0
30.00	0.033	4.5	3.2	2.5	1.6	0.8	0.4	0.3	0.1	0.1	0.1
40.00	0.025	5.2	3.8	2.9	1.9	0.9	0.5	0.3	0.2	0.1	0.1
50.00	0.020	5.7	4.2	3.3	2.1	1.0	0.5	0.3	0.2	0.1	0.1
60.00	0.017	6.3	4.6	3.6	2.4	1.0	0.6	0.4	0.2	0.1	0.1
80.00	0.012	7.2	5.4	4.2	2.7	1.2	0.7	0.4	0.2	0.1	0.1
100.00	0.010	8.1	6.0	4.7	3.1	1.3	0.7	0.5	0.2	0.1	0.1



**SELECTED GUTTER
BOX 125**

3.1.4 Continued

- Enter Table 3.1.C on the catchment area line and extend across to the rain intensity column. This will provide the effective cross sectional area your proposed gutter will need to have. Interpolate between columns if necessary.
- The flow capacity limit for each of the standard Dimond gutters is indicated in Table 3.1.C by a stepped line. Select the appropriate Dimond gutter and refer to Sections 3.1.4.1 to 3.1.4.10 for detailed design information.

Table 3.1.C Effective Cross Section of Gutter A_e (mm²)

Catchment Area Per Downpipe A _c (m ²)	Rainfall Intensity I (mm/hr)								
	40	60	80	100	120	140	160	180	200
20	1370	1900	2390	2860	3300	3740	4160	4570	4970
25	1640	2270	2860	3410	3950	4470	4970	5460	5940
30	1900	2630	3300	3950	4570	5170	5750	6320	6880
35	2150	2970	3740	4470	5170	5850	6510	7150	7780
40	2390	3300	4160	4970	5750	6510	7240	7960	8660
50	2860	3950	4970	5940	6880	7780	8660	9510	10350
60	3300	4570	5750	6880	7960	9000	10020	11010	11980
70	3740	5170	6510	7780	9000	10180	11330	12450	13550
80	4160	5750	7240	8660	10020	11330	12610	13860	15070
90	4570	6320	7960	9510	11010	12450	13860	15230	16560
100	4970	6880	8660	10350	11980	13550	15070	16560	18020
120	5750	7960	10020	11980	13860	15670	17440	19170	20850
140	6510	9000	11330	13550	15680	17730	19730	21680	23590
160	7240	10020	12610	15070	17440	19730	21960	24130	26250
180	7960	11010	13860	16560	19170	21680	24130	26510	28840
200	8660	11980	15070	18020	20850	23590	26250	28840	31380
250	10350	14320	18020	21540	24930	28200	31380	34480	37510
300	11980	16560	20850	24930	28840	32630	36300	39890	43400
350	13550	18740	23590	28200	32630	36910	41070	45130	49100
400	15070	20850	26250	31380	36300	41070	45700	50210	54630
500	18020	24930	31380	37510	43400	49100	54630	60030	
600	20850	28840	36300	43400	50210	56800	63210		
700	23590	32630	41070	49100	56800	64260			

Quad S1
Box 110
150 Half Round
Deep Quad
Box 125

Box 175

Box 300

Continued on next page...

Dimond

February 2012

Hynds concrete water tanks provide reliable storage of cool, clear and safe drinking water in rural areas

Hynds tanks are strong and durable and will never burn or rust and are much less susceptible to damage caused by wind, vandalism, or vermin. Hynds tanks offer a long and virtually maintenance free service life.

APPLICATIONS

- Reliable storage of cool, clear and safe drinking water

FEATURES

Hynds concrete water tanks offer the following features:

- Low maintenance and long life
- High strength
- Cool water storage
- Reduces the chance of algae growth
- Stock and fire resistant
- Less susceptible to theft or vandalism
- Raised manhole installed into roof with secure lid

Tank Capacities & Types

The tank capacity is 22,700 litres (5,000 gallons).

Standard tanks are designed to be either free standing above the ground or partially buried to within 300mm of shoulder.

Fully buried (flat top) tanks are designed to be buried with a maximum of 300mm of earth cover.

Connections

Inlet connections (Top)

- 2 x 100mm (located at opposite ends)

Outlet connections (Bottom)

- 2 x 50mm (located same end)
- 2 x 32mm (Capital region only)

One connection is capped, the second threaded male connection is bare, ready for fitting of the shut off valve.

Concrete Water Tank					
Code	Description	Capacity	A	B	Weight
WT5000ELT	Oval Water Tank	5000 Gallon/ 22700 Litres	2940mm	2790mm	8.5 Tonne
WT5000ELTFF	Flat Top Oval Water Tank	5000 Gallon/ 22700 Litres	—	2790mm	9.5 Tonne

Concrete Water Tank Accessories	
Code	Description
RHCONTV090	Marley Vacuum Kit for Concrete Tanks
RHCI	Marley Calmed Inlet
RHFO	Marley Floating Outtake
WATERLEVEL	Water Level Indicator
WATERLEVEL + EXT	Water Level Indicator Meter Extension
RHMG	Marley Mechanical Water Gauge

Concrete Water Tank Accessories	
Code	Description
RHCONTV090	Marley Vacuum Kit for Concrete Tanks
RHCI	Marley Calmed Inlet
RHFO	Marley Floating Outtake
WATERLEVEL	Water Level Indicator
WATERLEVEL + EXT	Water Level Indicator Meter Extension
RHMG	Marley Mechanical Water Gauge

Female Tank Fittings		Male Tank Fittings	
Code	Diameter	Code	Diameter
LDF-TFFB	15mm	LDF-TFMB15	15mm
LDF-TFFB	20mm	LDF-TFMB20	20mm
LDF-TFFB	25mm	LDF-TFMB25	25mm
LDF-TFFB	32mm	LDF-TFMB32	32mm
LDF-TFFB	40mm	LDF-TFMB40	40mm
LDF-TFFB	50mm	LDF-TFMB50	50mm

Brass Tank Fittings	
Code	Diameter
BTS20	20mm
BTS25	25mm
BTS32	32mm
BTS40	40mm
BTS50	50mm



Hynds Pipe Systems are members of the NZ Concrete Tank Manufacturers' Association.

Branches Nationwide

- Northland Whangarei • Auckland Warkworth, Albany, Avondale, Penrose, Manukau, Puketapu • Waikato Hamilton, Te Kuiti, Taupo
- Bay Of Plenty Tauranga, Rotorua • Taranaki New Plymouth • Manawatu Palmerston North • Wellington Masterton, Kapiti, Petone, Kaiwharawhara
- Hawkes Bay Hastings • Nelson/Malborough Nelson, Blenheim • Otago/Southland Oamaru, Dunedin, Cromwell, Winton, Invercargill
- Canterbury Amberley • Christchurch Hornby, Bromley, Waimahariri

Support Office & Technical Services 09 274 0316

0800 WE PIPE (93 7473)
www.hynds.co.nz



Installation Guidelines

Site Access

- Access to the site must have adequate width clearance to allow the truck unrestricted entry to the site.
- Weight of truck and tank can be up to 22 tonnes.
- The site must be level and free from any obstructions such as large rocks. The site foundation must be completely solid so as to disperse the truck weight evenly.
- Room for the truck High stabilising arms must also be allowed for on site. The arms extend 2.5 m either side of the truck.
- The site must also be clear of overhead wires. All overhead wires must be a minimum of 4m from the High back at all times.
- For partially buried tanks the centre of the tank cannot be further than 5m from the position of the truck rear wheels. Allowance must be for excavation batters in this measurement.

- For fully buried tanks the centre of the tank cannot be further than 4m from the position of the truck rear wheels. Allowance must be made for excavation batters in this measurement. The excavated hole must be stable and safe before off loading of the tank can commence.
- Tanks cannot be placed higher than the truck deck height or 1200 mm.
- If placement of the tanks is outside these measurements the tanks will require special onsite cranes for placement which is at the cost of the purchaser.

Notes: Should the delivery contractor experience conditions outside the above or others that delay the off loading of the tank the client will be charged on an hourly rate for an extra site visit at their cost.

Site Preparation
The Hynds Elite+ Water Tank must be installed on solid ground capable of taking the weight of the tank and water contents (31.5 tonnes).

The material forming the tank foundations must have a safe bearing capacity of 100kpa (Normal house foundations). Under no circumstances can any part of the tank be installed on fill material or be part of a retaining structure.

Installation
Tanks must always be placed on a bed of compacted sand or fine aggregate of a similar grade, screeded level to a minimum thickness of 50 mm to a maximum of 150 mm. The base should be approximately 1 m greater in diameter than the tank. This will ensure a consistent transferring of the tank weight to the ground.

Multiple tanks to have at least 1800 mm distance between them. No bushes, trees, power lines may pass underneath or adjacent or within a minimum of 2 metres of the water tank wall.

Connections
Buried specially ordered tanks should not be backfilled until the water tightness of all connections is tested. It is recommended that all tank outlets be fitted with a shut off valve as close as practical to the tank. It is recommended that your tank has an overflow outlet and this is piped well clear of the tank foundations.

Partially Buried Tanks
For specially ordered partially buried tanks, the area surrounding the tank must be free draining. Tanks must also not be installed such that only one side of the tank is restraining the backfilled earth. In these situations drainage and discharge must be placed directly next to the tank to ensure no hydrostatic pressure builds up against the tank wall.

The Elite+ tank will float if the local groundwater rises over 500 mm from the bottom of the tank.
A standard Elite tank can be set in the ground to within 900 mm of the bottom of the tank floor.

Buried Tanks
If a tank is to be fully buried a 'Flat Top' tank is required. These have a flat roof and a support pillar in the centre of the tank. Flat top water tanks can only be buried to a maximum depth of 300 mm below ground level or a maximum overburden loading of 10 kpa.
Other than the earth cover, buried water tanks cannot be driven on, or take any external loading, live or static within a distance of 3.2m to the nearest edge of the tank.
Cars must also be taken in high groundwater areas that hydrostatic pressure does not lift the tank.

Tank Filling

A new above ground water tank should never be filled completely to the top in one step, this can cause stress cracks.

The recommended procedure is:

- Fill approximately one quarter.
- Leave for two days.
- Fill another quarter.
- Leave for another two days.
- Continue process until tank is filled.

This allows the reinforcing in the tank walls to expand gradually. Partially and buried tanks can be filled in one step to the same level as the outer back fill.

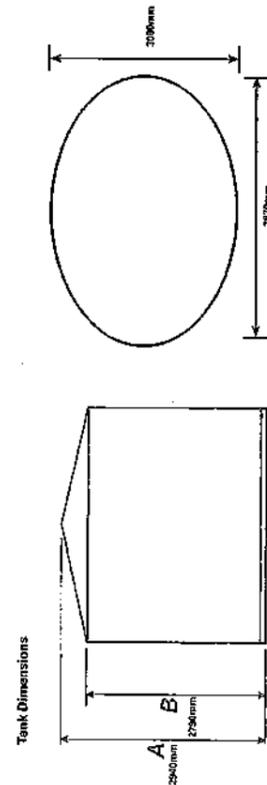


Figure 1: Dimensions of water tank.

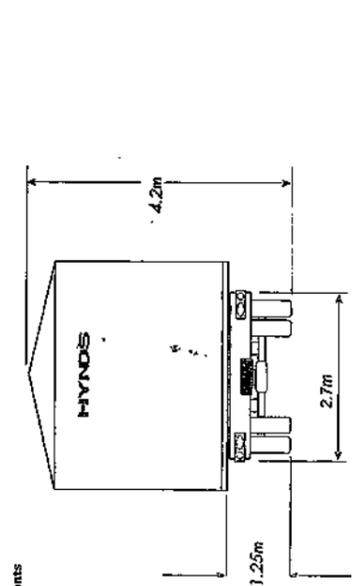


Figure 2: Dimensions of water tank site view.

Tank Dimensions

For partially buried tanks the centre of the tank cannot be further than 5m from the position of the truck rear wheels. Allowance must be for excavation batters in this measurement.

000070

13/01/2014 11:29 AM PAGE 6

1	Plumbing Diagram
---	------------------



2.3

Stormwater/Wastewater Tanks

The Promax Stormwater/Wastewater Tanks are suitable for the retention or detention of stormwater or the storage of wastewater. The tanks are fully tested and designed to withstand ground and water pressure at depth. The Promax Tank is engineered by geotechnical experts including Finite Element Analysis testing (FEA).



Promax Stormwater/Wastewater Tanks are ideal for:

- Stormwater retention
- Stormwater detention
- Wastewater storage
- Sizes: from 800L to 30,000L (larger on request)
- Suitable to be installed under driveways, footpaths, car parks forecourts and much more
- Multiple Inlet / Outlet Plumbing ports
- Optional dome or square lids
- Optional Extras include Welded PE spigots, PVC connectors and BSP Threaded Fittings
- Vehicular Traffic - Tested to AS/NZS 2566: 1 -1998 with a load rating of 28kpa. Performance of the tank is dependent on the surrounding native soil, embedment and depth of buried tank
- Non Vehicular Traffic - Tanks in non-critical areas can be placed at any depth that is required

QUICK FACT
 All Promax underground storage tanks can be joined together in series to meet site specific volumes or area requirements.



2.4

Underground Liquid Storage Tank Specifications

Rainwater Tanks

Code	Plan	Volume Litres/Gallons	W (mm)	L (mm)	Manhole (mm)
E1 5000	C	5,000 litre Underground Tank	1900	3500	600 dia
E1 7500	C	7,500 litre Underground Tank	1900	4500	600 dia
E1 10000	C	10,000 litre Underground Tank	1900	5500	600 dia
E1 15000	C	15,000 litre Underground Tank	1900	7500	600 dia
E1 20000	C	20,000 litre Underground Tank	1900	9500	600 dia
E1 25000	C	25,000 litre Underground Tank	1900	11500	600 dia
E1 30000	C	30,000 litre Underground Tank	1900	13500	600 dia

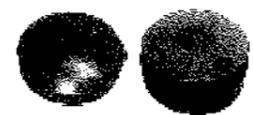
Rainwater, Stormwater/Wastewater Tanks

Code	Plan	Volume Litres/Gallons	W (mm)	L (mm)	Manhole (mm)
E1 0800	A	800 litre Underground Tank	670	2720	
E1 1250	A	1,250 litre Underground Tank	825	2720	
E1 1600	A	1,600 litre Underground Tank	670	5240	
E1 1750	A	1,750 litre Underground Tank	975	2720	450 dia
E1 2500	A	2,500 litre Underground Tank	825	5240	
E1 3000	A	3,000 litre Underground Tank	1280	5240	450 dia
E1 3600	A	3,500 litre Underground Tank	975	5240	450 dia
E1 6000	A	6,000 litre Underground Tank	1280	5240	600 dia
E1 1800	B	1,800 litre Underground Tank	1280	1736	600 dia
E1 3600	B	3,600 litre Underground Tank	1280	3440	450 dia
E1 4800	B	4,800 litre Underground Tank	1280	4358	600 dia
E1 6600	B	6,600 litre Underground Tank	1280	6041	600 dia
E1 7800	B	7,800 litre Underground Tank	1280	6970	600 dia
E1 9600	B	9,600 litre Underground Tank	1280	8576	600 dia
E1 5000	C	5,000 litre Underground Tank	1900	3500	600 dia
E1 7500	C	7,500 litre Underground Tank	1900	4500	600 dia
E1 10000	C	10,000 litre Underground Tank	1900	5500	600 dia
E1 15000	C	15,000 litre Underground Tank	1900	7500	600 dia
E1 20000	C	20,000 litre Underground Tank	1900	9500	600 dia
E1 25000	C	25,000 litre Underground Tank	1900	11500	600 dia
E1 30000	C	30,000 litre Underground Tank	1900	13500	600 dia

All Promax Underground Tanks can be installed in series to increase capacity

Technical Specification Drawings available on request.

Material complies with the following standards: AS/NZS 4020: 2002 Potable (Drinking) Water Standard
 AS/NZS 2070: Part 1 and Part 8 Australian Standards for Food Contact
 AS/NZS 4766 (INT): 2002 Polyethylene Storage Tanks for Water and Chemicals



Code	Description	Size (mm) Dia
DOME450	Underground Tank Dome Lid	450 dia
DOME600	Underground Tank Dome Lid	600 dia
TPUD	Underground Tank Tamper Proof Dome Lid	600 dia

ideal

larger on request)
 and water pressure
 rfs for inspection

orts

quirements of



1	Plumbing Diagram
---	------------------

1307 O'Brien House 7 Tutere St Waikanae Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSOX AVE, AROHWOTOWN Justin Wright 021 555 923	A 10/12/13 BUILDING CONSENT
	NOT FOR CONSTRUCTION	188 DATE NOTE



Plumbing Water Tank PLASTIC OPTION		80.07P	A
DRAWING	NUMBER	REV	

13 JAN 2014

PLUMBING & GAS FITTING

COMPLIANCE REQUIREMENTS

60 Plumbing & Gasfitting 1 General
Use only products and systems that comply with all relevant sections of the NZ Building Code, NZ Standards.
Notify, in writing, the contract administrator of any selected material, product, system, or installation Drawn or Specified in the Contract Works, that does not comply with the NZ Building Code or New Zealand Standards
Notify, in writing, the contract administrator of any trade publication that reports on superior material, product, system, or installation than is Drawn or Specified in the Contract Works.

COMPLY WITH:

- 60 Plumbing & Gasfitting 1 General**
- NZBC B1/AS1 Structure - general, 6.0 Drains
- NZBC E1/AS1 Surface water 3.0 Drainage system materials and construction
- NZBC E2/AS1 External moisture 12.3 Drainage
- NZBC G13/AS2 Foul Water - drainage
- AS/NZS 1254 PVC pipes and fittings for storm and surface water applications
- AS/NZS 1260 PVC pipes and fittings for drain, waste and vent applications
- AS/NZS 2032 Installation of PVC pipe systems
- AS/NZS 2033 Installation of Polyethylene pipe systems
- AS/NZS 2566.1 Buried Flexible Pipelines - Structural Design
- AS/NZS 2566.2 Buried Flexible Pipelines - Installation
- AS/NZS 3500.2 Plumbing and drainage - Sanitary plumbing and drainage
- AS/NZS 3500.3 Plumbing and drainage - Stormwater drainage
- AS/NZS 4671 Steel reinforcing materials
- AS/NZS 5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- NZS 3104 Specification for concrete production Plumbers, Gasfitters and Drainlayers Act 2006

WORK BY LICENSED PLUMBER

60 Plumbing & Gasfitting 1 General
All work to be carried out by, or under the supervision of, a Plumber with a current license meeting the terms of the Plumbers Gasfitters & Drainlayers Act 2006. Plumber must have experience with Relevant Sections of the Building Code, Applicable New Zealand Standards and the materials and techniques specified. Plumber must be up to with Trade publications that relate to the trade.

REFER PRELIM AND GENERAL

60 Plumbing & Gasfitting 1
Refer to the Preliminary and General Specification which forms part of this trades specification.

CORE HOLES / SLEEVES

60 Plumbing & Gasfitting 2 Water Supply
Co ordinate with concrete contractor to create core holes as required for water supply. Install penetrations in accordance with G12/AS1 Section 7.3.3 Movement in concrete or masonry.

ELECTROLYTIC ACTION

60 Plumbing & Gasfitting 2 Water Supply
Separate using tape, paint or physical gap, all metals subject to electrolytic action from each other, treated timber, concretes & lime based substances.
Eliminate any potential for electrolytic action cause by the continuity of water connecting dissimilar metals.

EQUIPOTENTIAL BONDING

60 Plumbing & Gasfitting 2 Water Supply
Earth any metallic water supply pipe and any metallic sanitary fixtures to NZBC G12/AS1: Water supplies: 9.0.

EXTERIOR TAPS

60 Plumbing & Gasfitting 2 Water Supply
If not specifically shown on the drawings, provide a minimum of 3 exterior taps.

WATER SUPPLY PIPES

60 Plumbing & Gasfitting 2 Water Supply
COLD WATER SUPPLY
Install cold water supply pipe work generally in accordance with NZBC G12/AS1, Section 7 Installation methods.

HOT WATER SUPPLY

Install hot water supply pipes in accordance with NZBC G12/AS1, Section 6 Hot Water Supply System
Install insulation to hot water supply pipes in accordance with NZBC H1/AS1 Energy Efficiency.

Securely fix all pipe work in place, so that noise caused by hammering of pipes is eliminated.

SIZE PIPE WORK

Size all pipes and branches to deliver flow rates to meet NZBC G12/AS1.
Increase the size of pipe, as required, to allow concurrent use of fixtures with out a drop in pressure at the fixtures.

INSTALL FIXINGS

Install all fixings as specified on the drawings. Unless specifically noted owner supplied. Supply all fixings as specified. Identify any fixing not specified and provide a PC sum for supply of fixing only.

SOUND INSULATION

60 Plumbing & Gasfitting 3 Waste water
Install lagging to pipes to reduce / remove plumbing noises to all habitable spaces.
Sound insulation is not required for drains within the substructure zone of the proposed building.

PROVIDE AS-BUILT RECORDS

60 Plumbing & Gasfitting 8
Take digital photos of all drawing line prior to back filling. Provide a printed and digital copy to the contract administrator prior to back filling. Mark up site plan at a suitable scale to accurately show the location of drains. Provide triangulated dimensions to locations of sumps, junctions, Inspection access points and changes of direction.

61 DRAINAGE

COMPLY WITH:

- 61 Drainage 1**
- NZBC B1/AS1 Structure - general, 6.0 Drains
- NZBC E1/AS1 Surface water 3.0 Drainage system materials and construction
- NZBC E2/AS1 External moisture 12.3 Drainage
- NZBC G13/AS2 Foul Water - drainage
- AS/NZS 1254 PVC pipes and fittings for storm and surface water applications
- AS/NZS 1260 PVC pipes and fittings for drain, waste and vent applications
- AS/NZS 2032 Installation of PVC pipe systems
- AS/NZS 2033 Installation of Polyethylene pipe systems
- AS/NZS 2566.1 Buried Flexible Pipelines - Structural Design
- AS/NZS 2566.2 Buried Flexible Pipelines - Installation
- AS/NZS 3500.2 Plumbing and drainage - Sanitary plumbing and drainage
- AS/NZS 3500.3 Plumbing and drainage - Stormwater drainage
- AS/NZS 4671 Steel reinforcing materials
- AS/NZS 5065 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- NZS 3104 Specification for concrete production Plumbers, Gasfitters and Drainlayers Act 2006

REFER PRELIM AND GENERAL

61 Drainage 1
Refer to the Preliminary and General Specification which forms part of this trades specification.

WORK BY LICENSED DRAIN LAYER

61 Drainage 1
All work to be carried out by, or under the supervision of, a Plumber with a current license meeting the terms of the Plumbers Gasfitters & Drainlayers Act 2006. Plumber must have experience with Relevant Sections of the Building Code, Applicable New Zealand Standards and the materials and techniques specified. Plumber must be up to with Trade publications that relate to the trade.

CONNECT DISCHARGE TO SEWER

61 Drainage 2
Confirm the requirements of the Sewer network utility operator's for connection. Connect accordingly. Pay all fees.

PLAN AND SET OUT DRAINS

61 Drainage 2
Plan the run of the drain, coordinate with other Trades providing under ground services, avoid conflicts. Drains to run in straight lines with even gradients. Confirm the positions of all down-pipes and associated level of ground.

WATER SUPPLY CONNECTION

61 Drainage 2 Water Supply
Confirm with the Utility Network Operator's (UNO) the requirements for connection. Arrange for all work required to meet the UNO requirements. Arrange for all inspections the UNO requires. Pay all associated fees.
Install all items required by Network Utility including, but not limited to, water meter, gate valve and back flow prevention.

UNDERGROUND WATER

61 Drainage 2 Water Supply
Trench, or coordinate with other trade to provide trench. Install water connection from toby at street to all structure as identified on the drawings.

DRAINS

61 Drainage 3
Select material and size and install in accordance with G13/AS2. Runs, Falls, Gully Traps, Grease Traps all to G13/AS2.

TEST

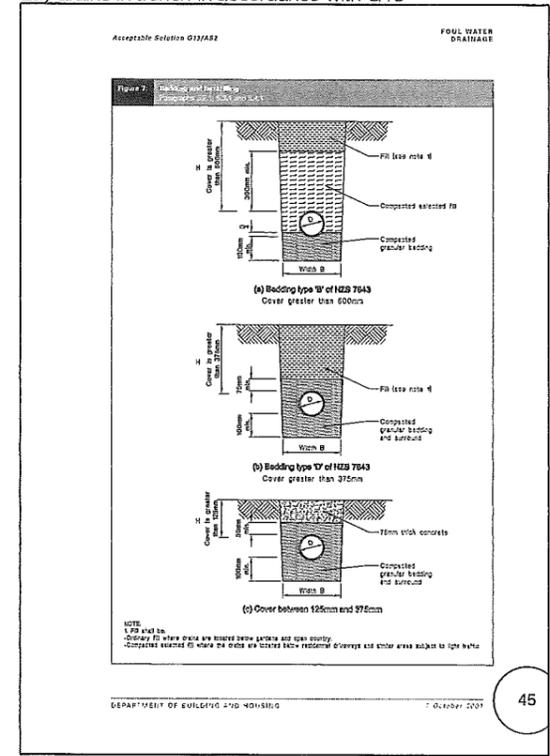
61 Drainage 3
Test in accordance with G13/AS2.
Provide a copy of the Territorial Authority inspection.

TOP SOIL TO TRENCH

61 Drainage 3
The top of the trench is to be generally covered with 150mm of topsoil, mound to 50mm above surrounding finished ground level.

TRENCH

61 Drainage 3
Lay drains in trench in accordance with G13



PLAN AND SET OUT STORMWATER

61 Drainage 6 Stormwater
Plan the run of the drain, coordinate with other Trades providing under ground services, avoid conflicts. Stormwater to run in straight lines with even gradients.

Confirm the positions of all down-pipes and associated level of ground.

PROVIDE AS-BUILT RECORDS

61 Drainage 8
Take digital photos of all drawing line prior to back filling. Provide a printed and digital copy to the contract administrator prior to back filling. Mark up site plan at a suitable scale to accurately show the location of drains. Provide triangulated dimensions to locations of sumps, junctions, Inspection access points and changes of direction.

BUBBLE UP CHAMBER

61 Drainage 6 Stormwater
Provide a bubble up chamber to storm water runs as required for invert levels to drain properly to storm water connection point.
Select and install in accordance with E1/AS1.

CONNECT TO STORMWATER

61 Drainage 6 Stormwater

storm water from the new roof area is to be run to a suitably sized soakpit

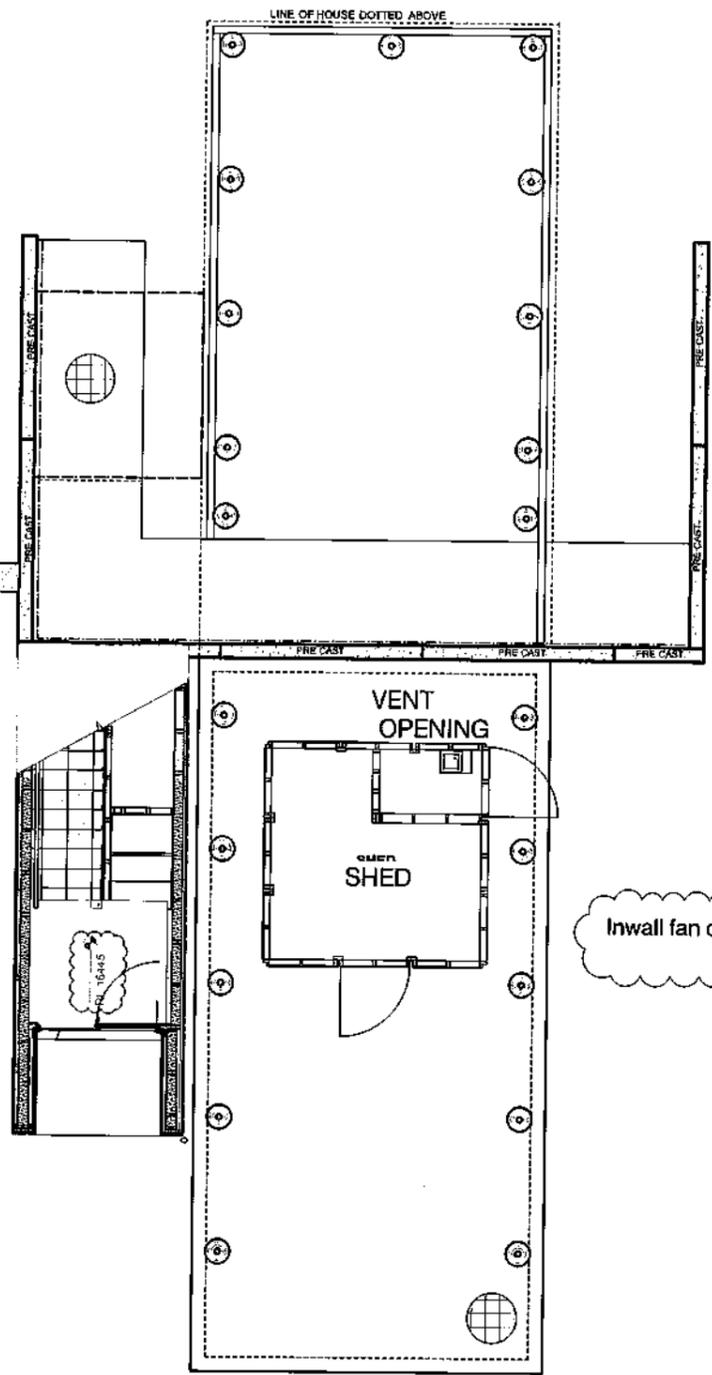
DOWNPIPE CONNECTIONS

61 Drainage 6 Stormwater
Provide in ground drain to all downpipes identified on the plans.
Confirm size of down pipe specified is in accordance with E1/AS1 Table 5.0. Once satisfied design proposed meets the performance requirements of the NZB Install in accordance with E1/AS1

RECEIVED
13 JAN 20
BY:

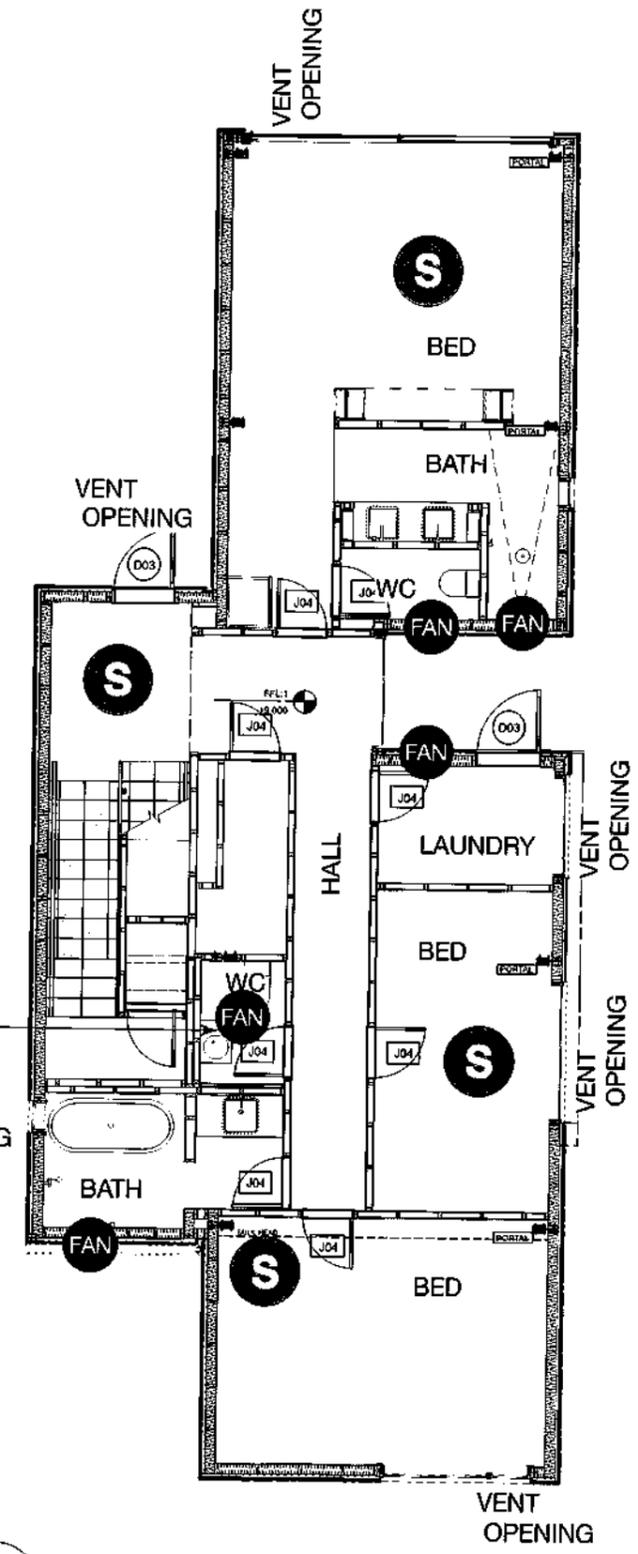
RECEIVED
21 MAR 2014

- S** SMOKE DETECTOR
- H** HEAT DETECTOR
- FAN** IN LINE FAN

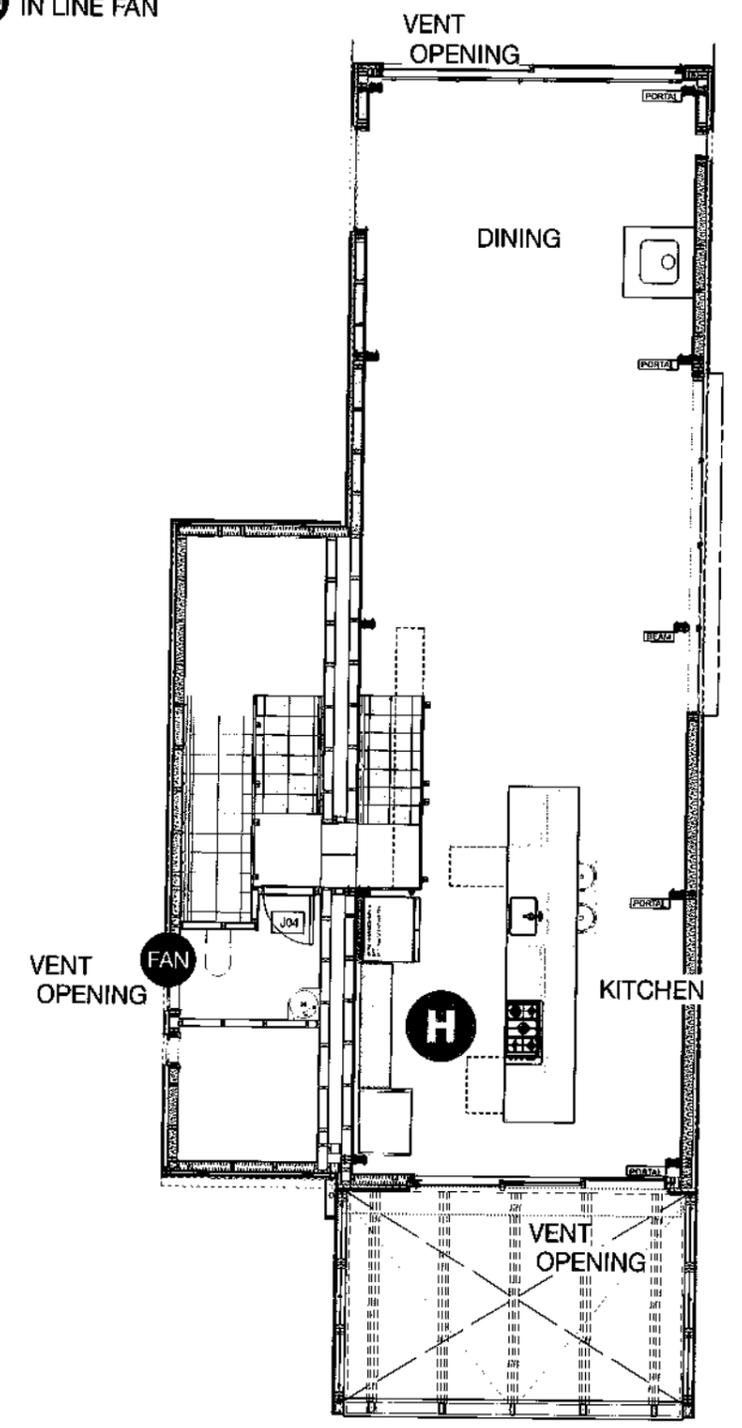


1 GROUND FLOOR
Scale 1:100

Inwall fan ducted and exited through the floor.



2 LEVEL 1
Scale 1:100



3 LEVEL 2
Scale 1:100

1307 O'Brien House 7 Tutere St Waikanae Jill & Shane O'Brien	© COPYRIGHT ASSEMBLY ARCHITECTS LIMITED 233 WILLIS STREET, WELLINGTON 24 ESSEX AVE, ARROWTOWN Justin Wright 021 565 303	B 5/3/14 Ventilation added to internal toilet and external toilet.
	NOT FOR CONSTRUCTION	A 10/12/13 BUILDING CONSENT
PROJECT	DATE NOTE	

ASSEMBLY ARCHITECTS LIMITED

FIRE & VENTILATION PLAN		83.00	B
DRAWING	NUMBER	REV	



INSPIRED VISION
FOR FRAMELESS GLASS

EUROGLASS
65 Carr Rd, Mt Roskill
PO Box 27-116, Auckland 1440
T: (09) 624-1180
F: (09) 624-2280
E: hardware@euroglass.co.nz
W: www.euroglass.co.nz

RECEIVED
21 MAR 2014
BY:

PRODUCER STATEMENT 1 - DESIGN

Expiry date 31 December 2014

Building consent application number (if known)

[Empty box]

Location of building

Anywhere in New Zealand

Issued by (author name)

Greg Yim
Auckland Council producer statement author no 2473

on behalf of Viridian Glass Limited Partnership

in respect of (description of building work)

Euroanchor residential balustrade system

at (site address)

anywhere in New Zealand

We have been requested by

our client

to provide

design services in respect of the requirements of Clauses

B1, B2, F2 & F4

of the Building Regulations 1992 for part of the proposed building work.

The design has been prepared by us in accordance with the following:

Compliance documents issued by the Department of Building and Housing

B1/VM1, B1/AS1, B2/AS1,
F2/AS1, F4/AS1
(verification method / acceptable solution)

The proposed building work covered by this producer statement is described on drawings titled:

Euroanchor Residential Balustrade System

and numbered:

ER-1b, ER-2a, ER-3a, ER-4a, ER-5a, ER-6b, ER-7a & ER-8b

On behalf of Viridian Glass Limited Partnership, and subject to:

RECEIVED
21 MAR 2014
BY:

(i) The following design assumptions

1. Viridian 12mm "Balustrade 100" toughened safety glass and Euroanchors
2. Residential occupancies A and C3
3. Maximum wind pressure as noted on drawings
4. Design and PS 1 for concrete, timber and steel support by others.

(ii) All proprietary products meeting their performance specification requirements.

I believe on reasonable grounds the building work, 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.

I understand that this producer statement, if accepted, will be relied on by the Council for the purposes of establishing compliance with the Building Code.

This producer statement expires on the 31 December 2014.

Signed by: (designer)



Date

14 Nov 2013

Name & Position

Greg Yim
Technical Manager, Glass Systems Design Engineer

Qualifications
(Professional qualifications)

B.Sc. Civil Engineering (Honours) UK

Phone

09 639 2029

Mobile

0274 721292

Fax

09 624 2280

Email

gyim@viridianglass.co.nz

Member of



IPENZ

Registration number

10682 (Viridian)

1008131

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

-all products meeting the required performance specification
 -site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm

- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail

- EUBFSD50 discs and spacers at 600 mm crs for occupancy A, and 400 mm crs for occupancy C3

3. The design of the concrete floor is the responsibility of the client's engineer.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

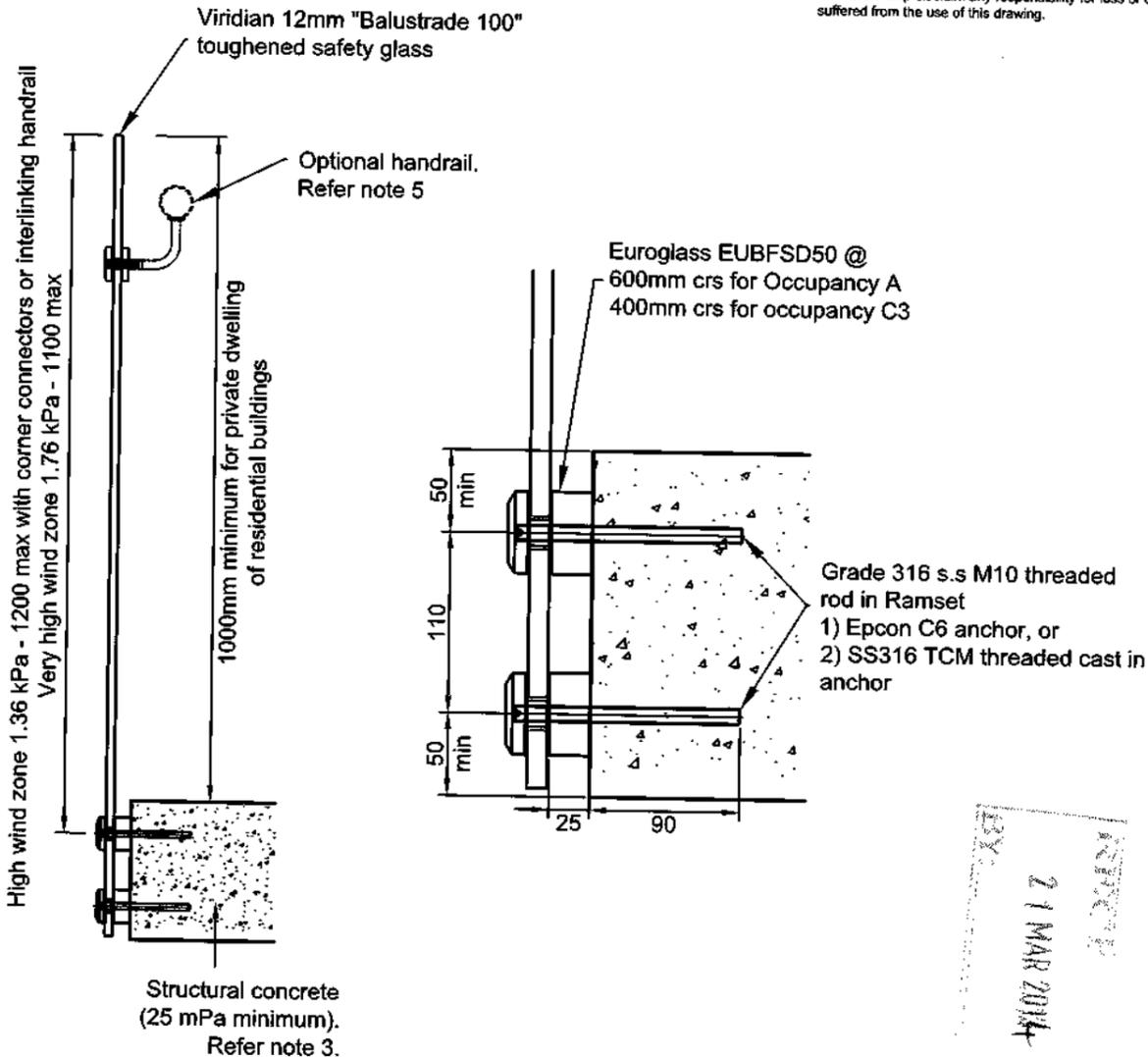
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 300mm for occupancy A and 200mm for occupancy C3.

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 13-11-13
 scale 1:10, 1:4

drawing no ER-1b

A division of Viridian Glass Ltd Partnership

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

-all products meeting the required performance specification
 -site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm

- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail

- EUBFSD50 discs and spacers at 600 mm crs for occupancy A, and 400 mm crs for occupancy C3

3. The design of the timber support is the responsibility of the client's engineer. Timber joints must be strapped.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

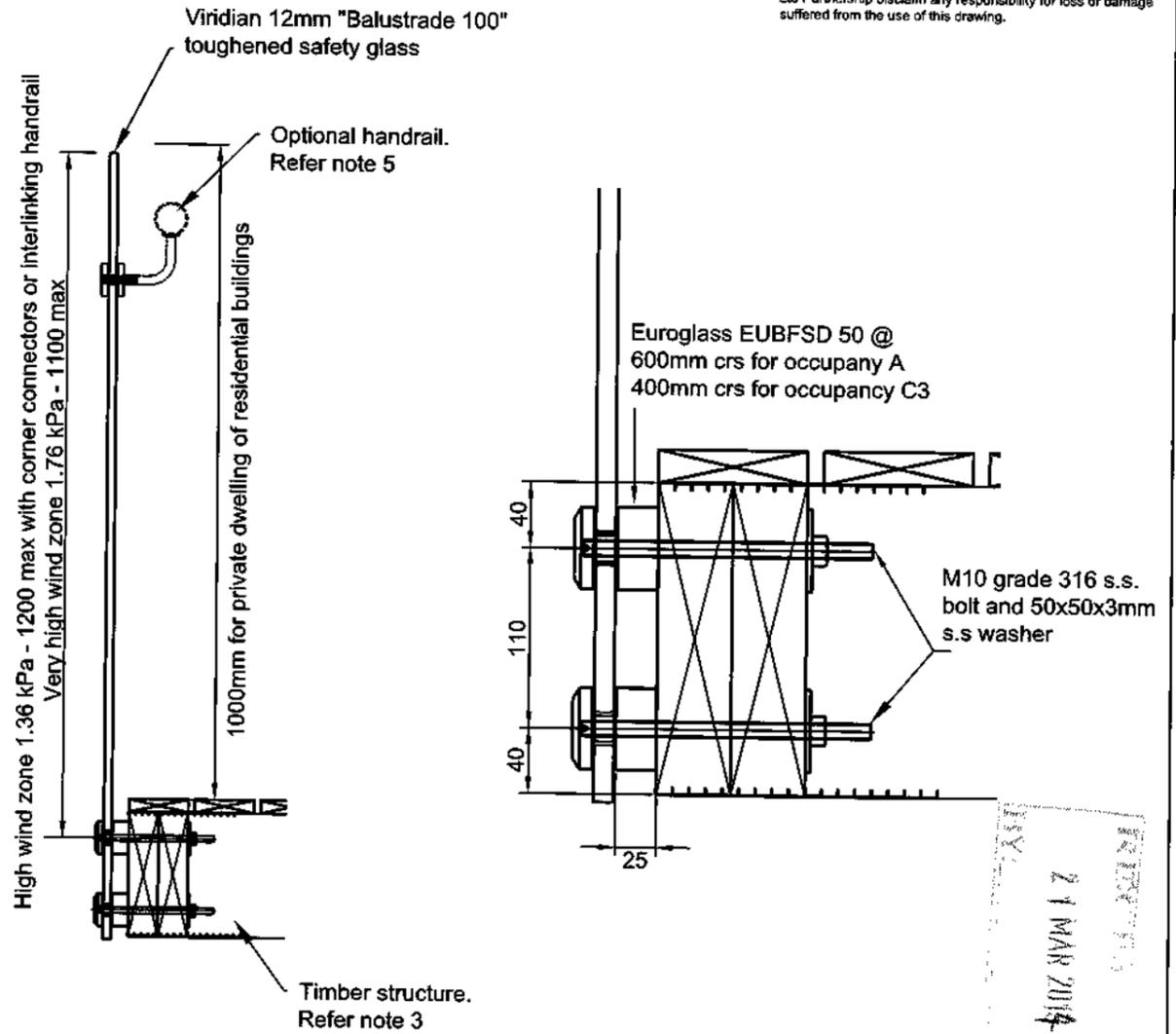
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

8. Maximum distance between side edge of glass to fixings - 300mm for occupancy A and 200mm for occupancy C3.

9. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



21 MAR 2014



A division of Viridian Glass Ltd Partnership

EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 23-7-12

drawing no

scale 1:10, 1:4

ER-2a

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

-all products meeting the required performance specification
 -site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm

- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail

- EUBFSD50 discs and spacers at 400 mm crs for occupancy C3

3. The design of the timber support is the responsibility of the client's engineer. Timber joints must be strapped.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

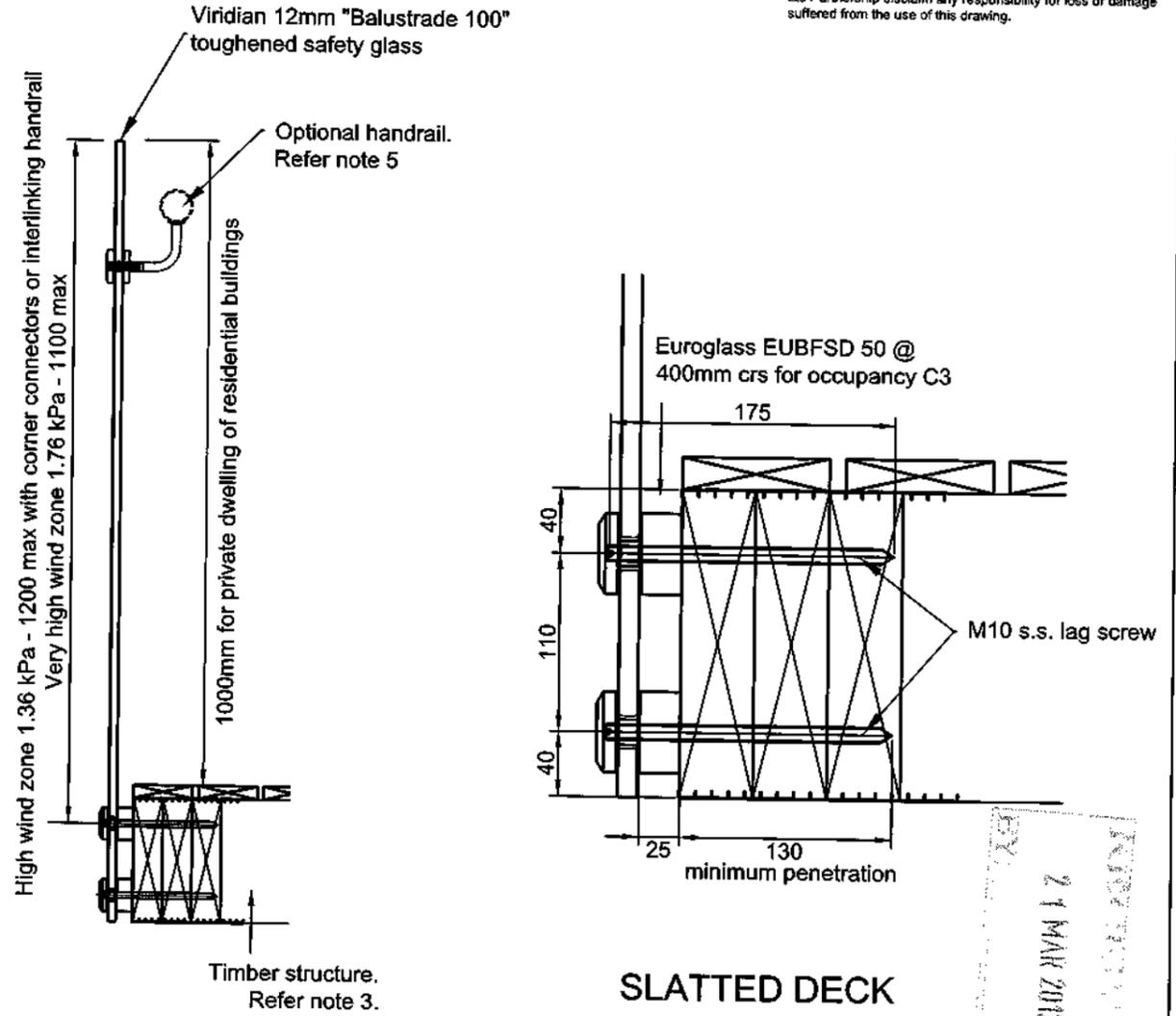
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

8. Maximum distance between side edge of glass to fixings - 200mm for occupancy C3.

9. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



21 MAR 2014



EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 23-7-12

drawing no

scale 1:10, 1:4

ER-3a

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

- all products meeting the required performance specification
- site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm
- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail
- EUBFSD50 discs and spacers at 400 mm crs for occupancy C3

3. The design of the timber structure is the responsibility of the clients' engineer. Timber joints must be strapped.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

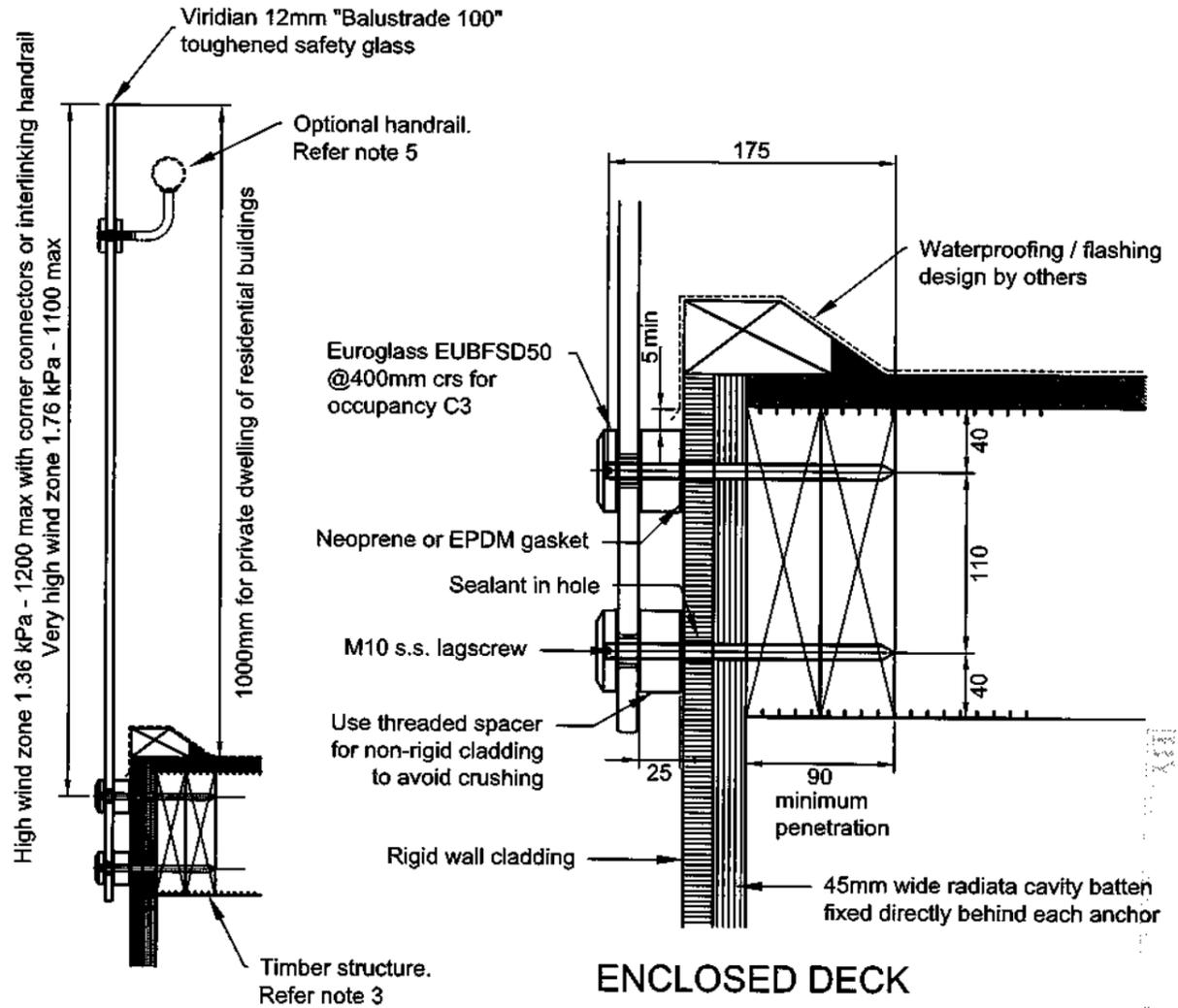
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 200mm for occupancy C3

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 23-7-12 drawing no

scale 1:10, 1:4

ER-4a

A division of Viridian Glass Ltd Partnership

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

-all products meeting the required performance specification
 -site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm

- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail

- EUBFSD50 discs and spacers at 400 mm crs for occupancy C3

3. The design of the timber structure is the responsibility of the clients' engineer. Timber joints must be strapped.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

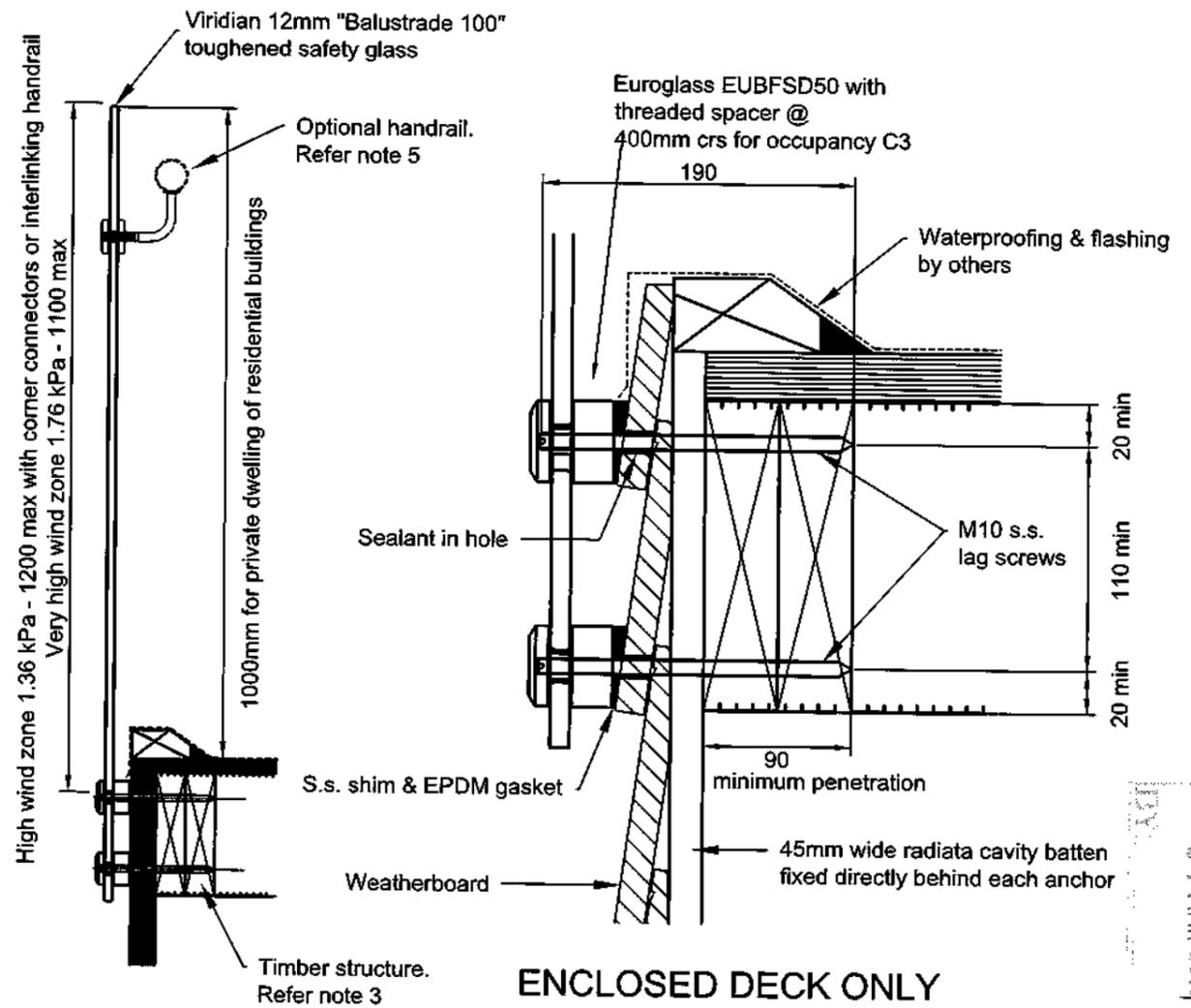
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 200mm for occupancy C3

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



A division of Viridian Glass Ltd Partnership

EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 23-7-12

drawing no

scale 1:10, 1:4

ER-5a

21 MAR 2012

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

- all products meeting the required performance specification
- site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum height of glass above top anchors and anchor spacings for residential occupancy A of Table 3.3 AS/NZS 1170.1 are:

- Up to 1100mm high balustrade measured from top anchors
- EUBFSD50 discs and spacers at 600 mm crs for occupancy A

3. The design of the timber structure is the responsibility of the clients' engineer. Timber joints must be strapped.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

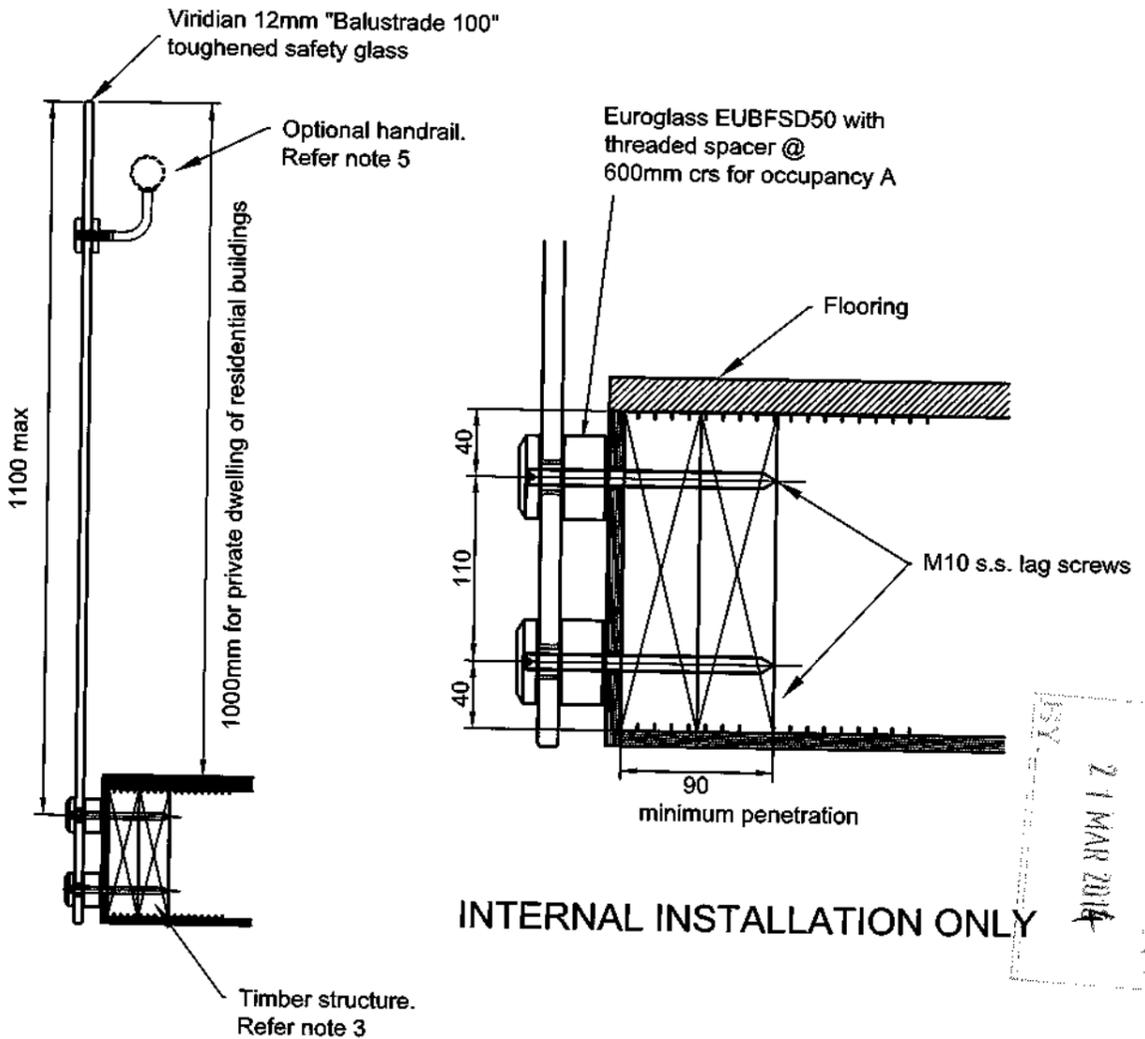
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 300mm for occupancy A

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



BY: 21 MAR 2014



A division of Viridian Glass Ltd Partnership

EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 14-6-13

drawing no

scale 1:10, 1:4

ER-6b

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

-all products meeting the required performance specification
 -site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors for residential occupancies A and C3 of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Very high wind zone 1.76 kPa - 1100mm
- High wind zone 1.36 kPa - 1200mm with corner connectors or interlinking handrail
- EUBFSD50 discs and spacers at 600 mm crs for occupancy A, and 400 mm crs for occupancy C3

3. The design of the steel structure is the responsibility of the clients' engineer.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

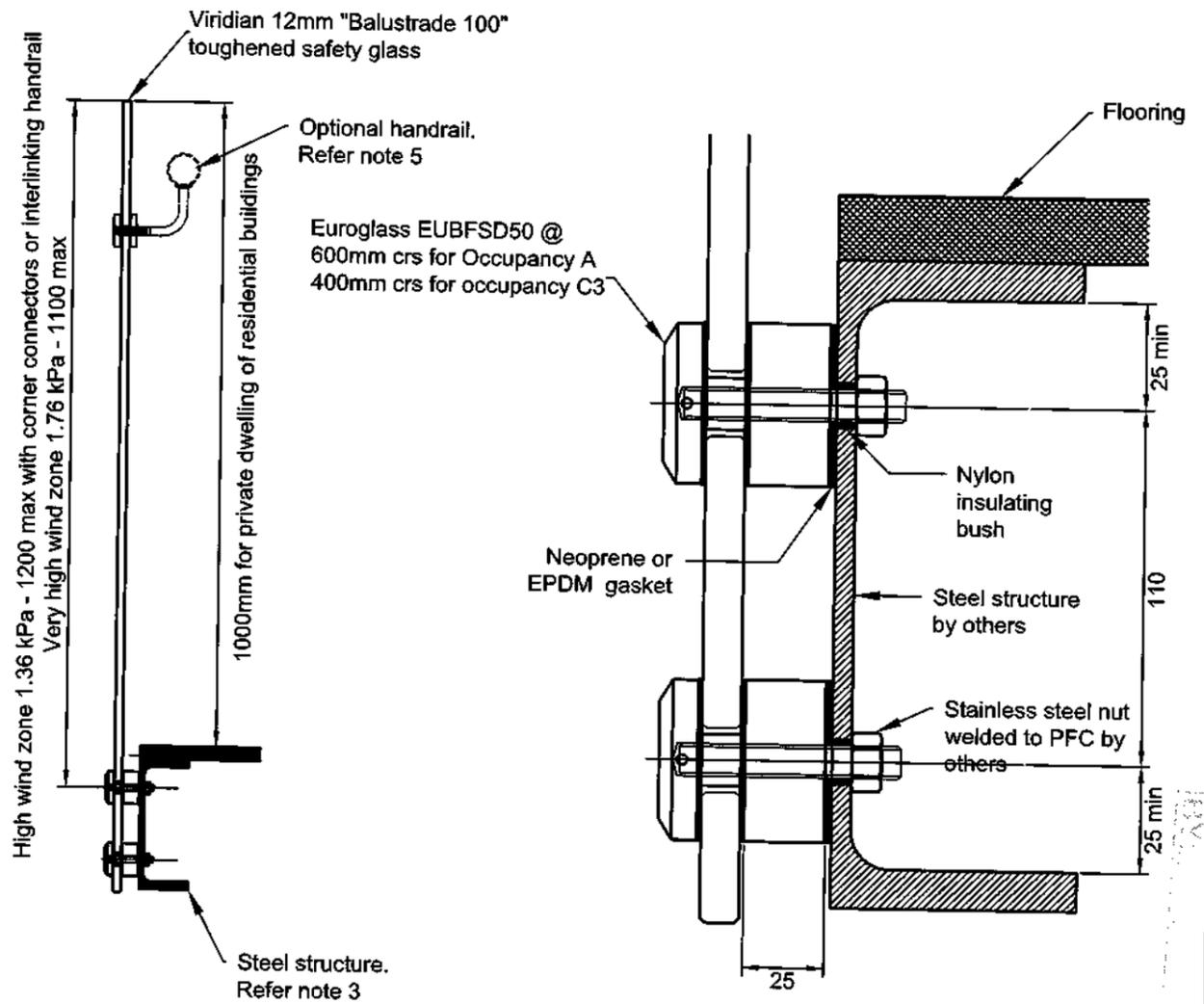
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 300mm for occupancy A, and 200mm for occupancy C3

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



A division of Viridian Glass Ltd Partnership

EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 23-7-12

drawing no

scale 1:10, 1:4

ER-7a

21 MAR 2014

NOTES:

1. This proprietary balustrade system complies with New Zealand Building Code Clauses B1 Structure, F2 Hazardous Building Materials and F4 Safety From Falling Third Edition, subject to:

- all products meeting the required performance specification
- site installation carried out in accordance with intent of this drawing

2. Based on 12mm Viridian "Balustrade 100" toughened safety glass, maximum heights of glass above top anchors and anchor spacings for residential occupancy A of Table 3.3 AS/NZS 1170.1 and anchor spacings are:

- Up to 1100mm high balustrade measured from top anchors
- EUBFSD50 discs and spacers at 600 mm crs for occupancy A

3. The design of the steel structure is the responsibility of the clients' engineer.

4. A handrail of 32-50mm diameter is required for stairs and ramps exceeding 1:20 slope. Refer NZBC D1/AS1.

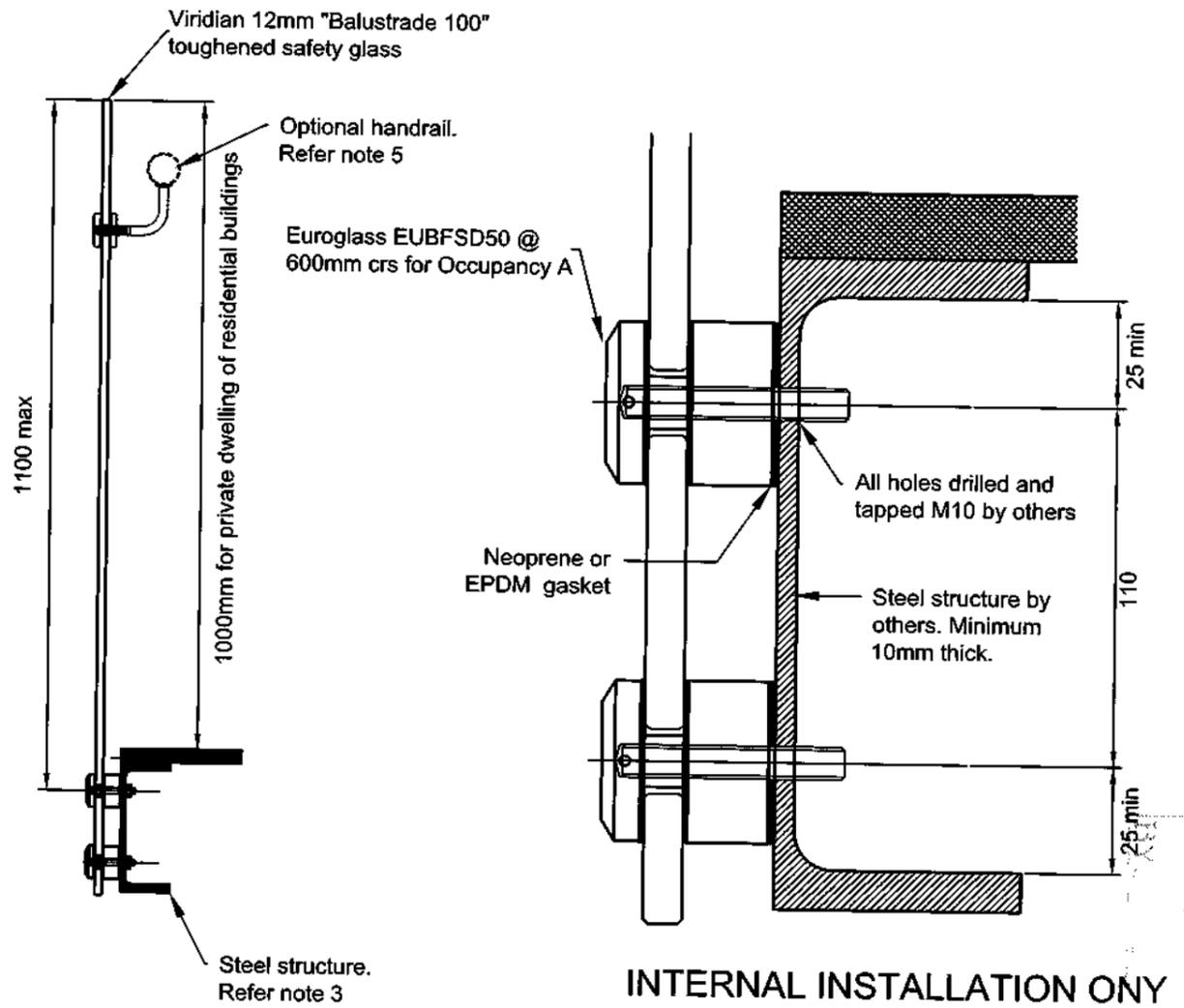
5. The Guidance on Barrier Design published by the Department of Building and Housing states that if any part of the balustrade panel is 5 m or higher than the ground or floor below, an interlinking handrail or laminated toughened glass with a top rail or capping to protect the edge should be provided. Fit handrail 900mm above floor level.

6. Minimum width of glass panel to be 1000mm unless connected by interlinking handrail or mechanical connector to adjacent panels

7. Maximum distance from side edge of glass to fixings - 300mm for occupancy A

8. This system is not suitable for balustrades in areas susceptible to overcrowding such as theatres, cinemas, assembly halls, stadiums etc.

This drawing is provided as a general guide only. Viridian Glass Ltd Partnership disclaim any responsibility for loss or damage suffered from the use of this drawing.



A division of Viridian Glass Ltd Partnership

EUROANCHOR RESIDENTIAL BALUSTRADE SYSTEM

date 14-6-13

drawing no

scale 1:10, 1:4

ER-8b

21 MAR 14



RE: O'Brien House

John Stallard <John.Stallard@waterproofing.co.nz>
To: Andrea Lawrence <andrea@assembly.co.nz>
Cc: Jeff Fitness <Jeff.Fitness@waterproofing.co.nz>

RECEIVED
21 MAR 2014
BY

8 March 2014 16:18

Good afternoon Andrea,

In the attachment is the details covering Hot flue and a external barge board detail. I have included a sketch as requested with regard to the void between the cap flashing and torchon membrane if there is no other alternative but this make the that junction rely on a sealant which in time can be affected by high UV exposure in the summer months.

The bituFLAME manual is being reviewed and updated by BRANZ now and the falls will be 1:30 or 2 degrees for a roof, 1:40 1.5 degrees for a deck and 1:100 or 1.0 degree for a gutter. Russell Clarke at BRANZ advises me that the sign off will be around 1 to 2 weeks out. I have asked that it be treated as very urgent. This is something BRANZ independently works through with all appraisals.

The H3.1 ply cladding will have no affect on the bituFLAME membrane and you can proceed with your cladding. The only thing I can think of is possible bitumen bleed into the plywood but that hasn't happened anywhere as yet it would take extremely hot weather and moisture combined for this to happen.

Regards

John.

John Stallard

Technical Director

NZQA 375/1 Membranes

LPB # BP 103950

Mobile: +64 (0)21 457 953

Auckland Office: +64 (0)9 579 1460

761 The Great South Road, Penrose, Auckland

www.waterproofing.co.nz

From: assemblyandrea@gmail.com [mailto:assemblyandrea@gmail.com] **On Behalf Of** Andrea Lawrence

Sent: Wednesday, 5 March 2014 1:46 p.m.

To: John Stallard

Subject:

Hi John,

Just confirming you received my email in regards to the Bituflame queries we had. I believe you spoke with my boss Justi in regards to the use of H3.1 Ply Cladding to the overlap of the torch on system.

Will await your response on the other queries discussed with Justin.

--

Andrea Lawrence

Assistant Architect

Assembly Architects Limited
PO Box 192 Arrowtown 9351

Mobile 021 1728827

www.assembly.co.nz

News, press, awards and project updates on our Blog

Follow us on Facebook and Twitter

 Hot flue details and barge board detail..pdf
1221K

RECEIVED
21 MAR 2014
BY

Andrea Lawrence <andrea@assembly.co.nz>
To: Justin Wright <justin@assembly.co.nz>

6 March 2014 16:23

FYI
(Quoted text hidden)

 Hot flue details and barge board detail..pdf
1221K

Introductory Information

A building consent from the Local Authorities must be obtained before installing Bosca wood fires and this document can be a supporting document in gaining such consent. It is suggested that the insurance company covering building insurance should be advised of the installation.

All Bosca wood fires and flue systems shall be installed in compliance with AS/NZS2918:2001 and the appropriate requirements of the relevant building code or codes.

National Environmental Standards

All Bosca wood fires distributed in New Zealand comply with National Environmental Standards imposed in 2005. Efficiency of all models is above 65% and maximum emission is below 1.5 g/kg. Refer to Table 1 for details.

Table 1

	Efficiency	Emmission
Firepoint360	74%	0.9 g/kg
Limit380	76%	0.9 g/kg
Spirit550	69%	0.9 g/kg

Regional council have authority to impose its own regional standards which take precedence over National Environmental Standards. Bosca wood fires comply with requirements of most regional councils in New Zealand. For more information on the regulations in your area talk to your local regional council or ask your Bosca dealer.

Installation Clearances and Floor Protector

Minimum clearances are measured in millimeters and shown in Table 2. Firepoint360 and Limit380 can be installed with a rear heat shield (spigot shield) which allows smaller clearances to the wall from the back of the fire (dimension A). If the rear heat shield is not used the fire must be at the dimension D from the wall.

For clearances to non-combustable or insulated walls refer to AS/NZS2918:2001. For Limit380 and Spirit550, side clearances (dimension B) to be no less than 200mm and rear clearance (dimension A) no less than 100mm irrespective of wall material. This is to ensure access to rear of fire for baffle replacement.

Bosca freestanding wood fires do not require an insulating floor protector (hearth) as they comply with the minimum floor protector requirements of AS/NZS2918:2001. The minimum floor protection has to extend forward 300mm (dimension G) from fire box opening, not door outside. It has to extend sideway 200mm (dimension H) from fire box opening, not product side. If any Bosca fire is installed directly onto concrete or non-combustible floor a floor protector is not necessary.

Table 2

Dimension	Firepoint 360	Limit 380	Spirit 550
A	195mm	240mm	230mm
B	340mm	325mm	245mm
C	320mm	250mm	140mm
D	315mm	480mm	N/A
E	313mm	369mm	351mm
F	596mm	558mm	549mm
G	300mm	300mm	300mm
H	200mm	200mm	200mm
I	479mm	478mm	396mm

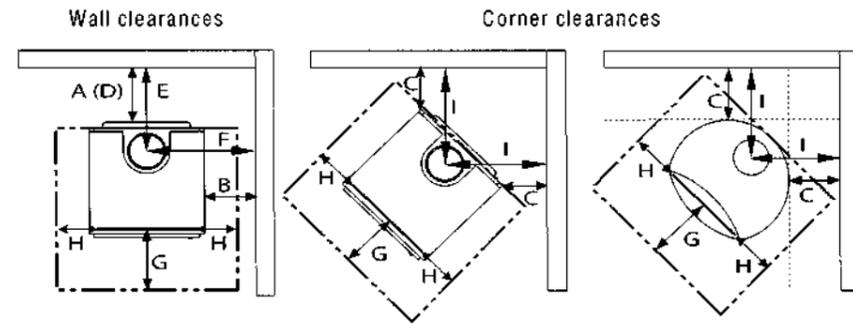
Seismic Restraint

As per NZS 2918, Bosca fires installed in New Zealand are required to have seismic restraint.

This can be achieved in the Limit380 and Firepoint360 by using the two holes provided in the baseplate of the fireplace and using masonry anchors if installing onto a concrete floor, or any suitable fastener for wooden floors.

The Spirit550 is supplied with two seismic restraint brackets welded on each side as it does not have a base plate. By using the two holes in these brackets and using masonry anchors if installing onto a concrete floor, or any suitable fastener for wooden floors.

The fastener must pass through the floor protector if fitted and into the floor and comply with all local council specifications.



RECEIVED
21 MAR 2013

Flue and flue shield installation

All Bosca fires must be installed with a flue system that complies with AS/NZS2918:2001. We recommend the use of the Bosca flue system which does comply with standards and comes complete with installation instructions. A typical installation is shown below and at right. Note this is not an installation instruction and the instructions accompanying the flue kit should be followed at all times.

The Bosca flue shield must be used in all installations where the fire is installed against a combustible wall to the clearances listed above. If the wall behind the fire is a non-combustible ventilated surface as per AS/NZS2918:2001 then clearances can be reduced and the flue shield is not required. Note that there are minimum clearances for the Limit380 and Spirit550 when installing near a non-combustible wall. These are noted above and in the installation instructions.

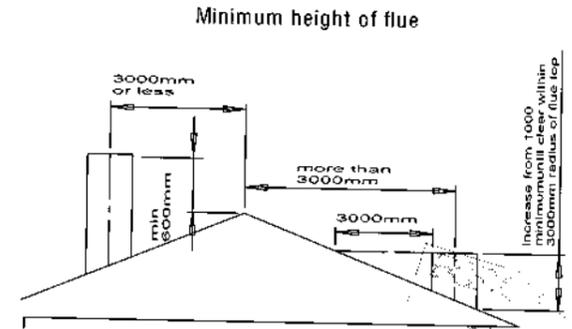
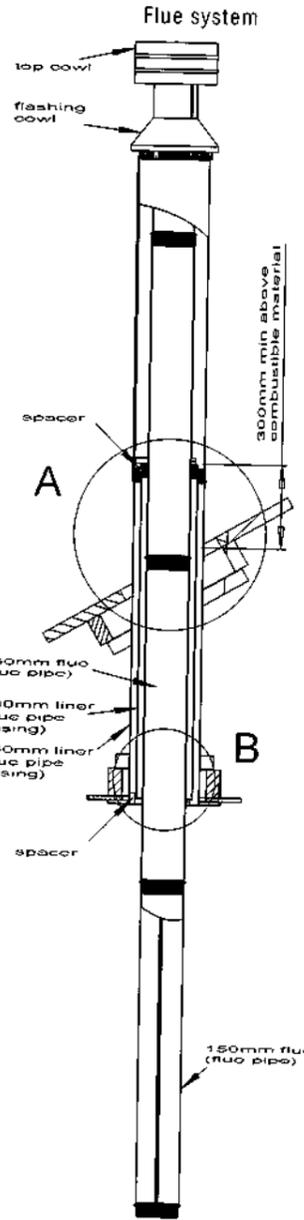
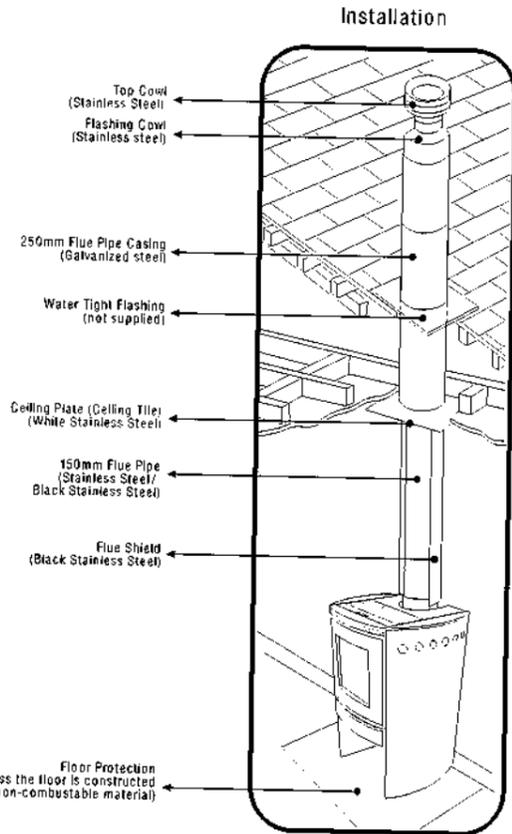
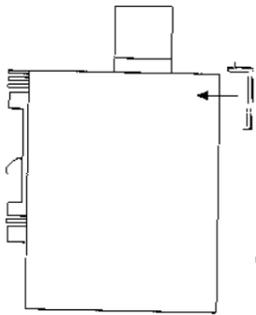
Distributed in New Zealand by:

Escea Ltd
Ph: 03 4788220
Fax: 034788221
Email: info@escea.com

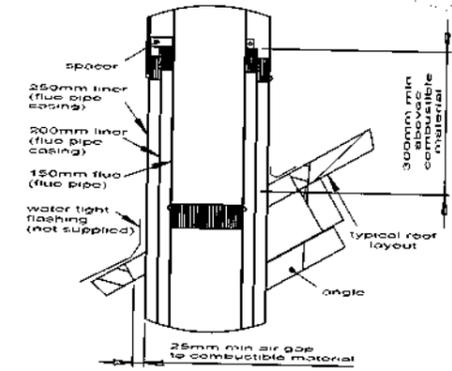
17 Carnforth St
Green Island
Dunedin

Website:
www.bosca.co.nz

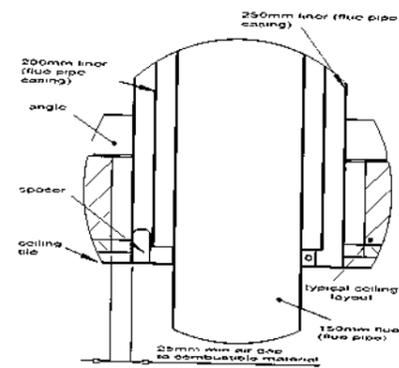
Rear heat shield

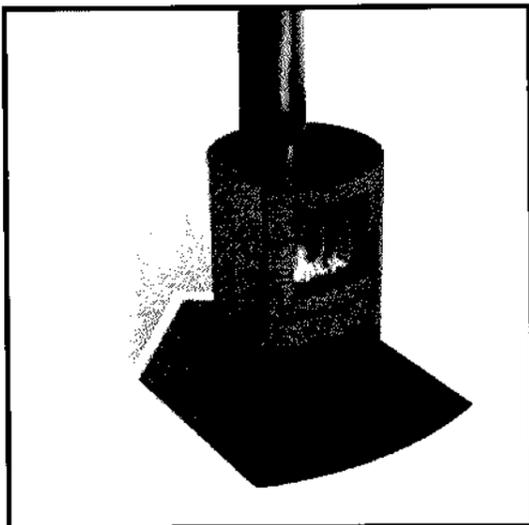


Detail A: Typical roof penetration

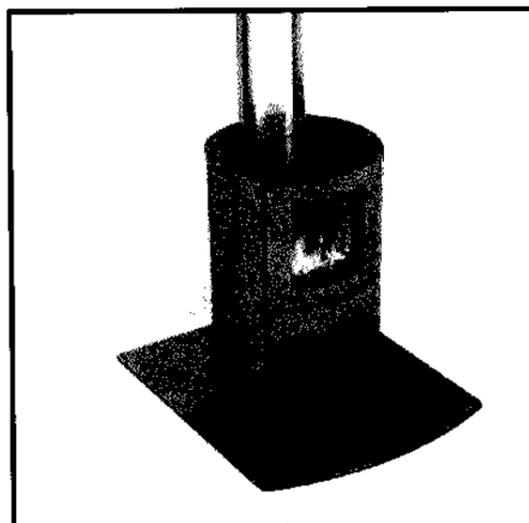


Detail B: Typical ceiling layout





Black Steel Corner Ash Hearth



Smoked Glass Wall Ash Hearth

ASH HEARTHES FOR BOSCA WOOD FIRES

Whilst Bosca wood fires do not require a fully insulated hearth they are still required to have an ash hearth to protect the floor from heat and any material that may fall from the fire when the door is open. Ash hearths also play a key role in keeping the surrounding area of the fire clean and tidy.

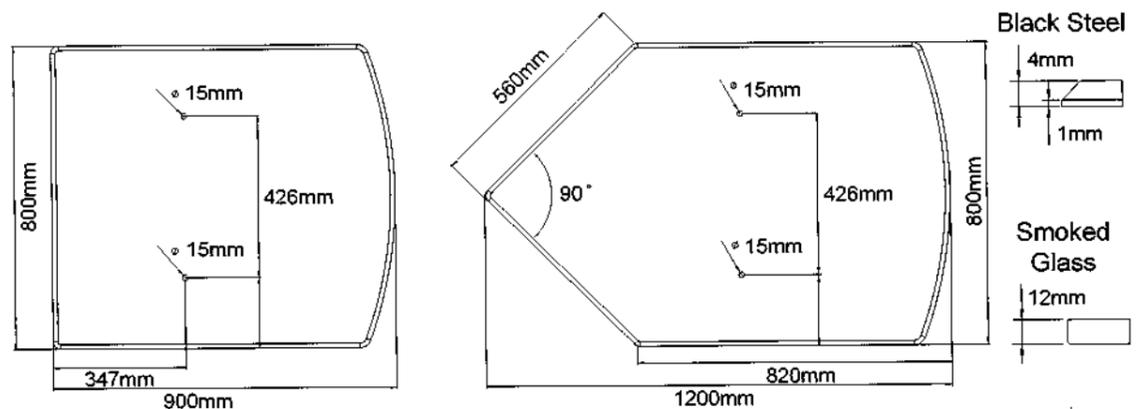
Bosca offers pre made ash hearths for both corner and wall installation, which are available in:

- **Black Steel** - this slim line minimalistic hearth has a thickness of only 4 mm and features a gently curving front edge
- **Smoked Glass** - this 12 mm thick glass hearth allows a smooth transition from any floor thanks to its transparency

All Bosca ash hearths can be placed straight on any floor surface such as vinyl, carpet or timber.

DIMENSIONS

Both steel and glass ash hearth have the same dimensions and only the edge finishing is different.



The floor protector (technical name for ash hearth) must extend forward a minimum of 300mm from the fire box opening and sideways a minimum of 200mm from the fire box opening. The holes in ash hearth are located to comply with these conditions for all Bosca models.

REC 21 MAR 2014 BY

LOCATION OF THE ASH HEARTH

Bosca ash hearths come with predrilled mounting holes for the fire. These holes will ensure the fire will always meet or exceed the minimum clearances to the front and side of the ash hearth.

Correct location of the holes is essential to ensure the fire meets the minimum requirements to the wall. It is the installers responsibility to ensure all minimal wall clearances are met, particularly for non standard installations.

For standard installations to a non-combustable wall, placing the two mounting holes as shown below, will ensure meeting minimum wall clearances.

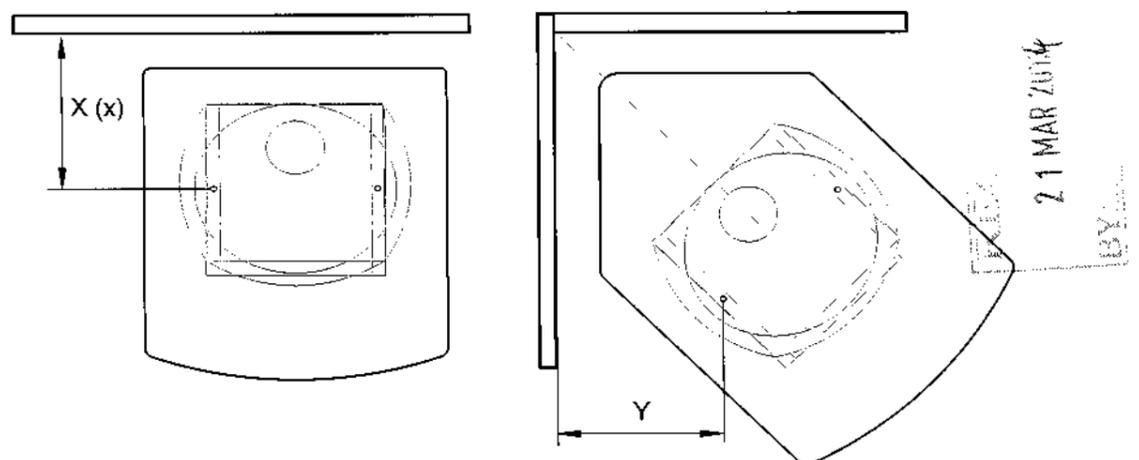
	X	x	Y
Firepoint 360	558mm	438mm	419mm
Limit 380	593mm	488mm	436mm
Spirit 550	478mm	N/A	324mm

Wall Installation:

X - minimal wall clearance without a rear heat shield
 x - minimal wall clearance with a rear heat shield

Corner Installation:

Y - minimal wall clearance with or without a rear heat shield



The distance of the ash hearth from the wall varies with the model of fire installed.

INSTALLING THE ASH HEARTH

1. Prepare and clean the surface for the ash hearth.
2. Place the ash hearth in the appropriate location defined by above minimum distances.
3. Drill holes in the floor. The plastic spacers should be placed into the holes on all glass hearths to protect the glass from fastener damage.
4. Place the Bosca wood fire in the correct position and align with the holes in the ash hearth.

Before proceeding ensure the fire is properly located according to standards and consent.

5. Place fasteners through holes provided in the baseplate (Firepoint 360 and Limit 380) or the seismic restraint brackets (Spirit 550) and through holes in the ash hearth. Screw fasteners firmly into place.

Note: Location of the fire and the ash hearth must comply with local council specification and building standards.

Leon Smith

From: assemblyandrea@gmail.com on behalf of Andrea Lawrence [andrea@assembly.co.nz]

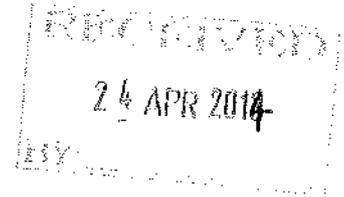
Sent: Thursday, 24 April 2014 11:49 a.m.

To: Jaime Sherlock

Cc: Justin Wright; Leon Smith; Shane O'Brien

Subject: Re: BC140009 New Dwelling & 7 Tutere Street Waikanae Beach

Hi Leon/Jamie



1. Please see attached credentials in regards to the Balustrade system <https://assembly.box.com/s/qg4zy57s3je71dwl837b>

2. Attached Form amended <https://assembly.box.com/s/prn5m81crrowl35f2vod>

4.- 5. Please refer cover letter with attached drawings confirming lintel sizes and stud sizes/centres. <https://assembly.box.com/s/t41skjsxulgi8mldyr26> This was also sent through on 1st April.

6. <https://assembly.box.com/s/qck9kcsdfawt0y6te6gk> This is how the membrane roofing is going to be protected where it is penetrated by the flue, which was sent through last time. If this is not suitable please clarify why.

Andrea

On 7 April 2014 19:59, Leon Smith <leon.smith@kapiticoast.govt.nz> wrote:

Hi Andrea

Please find attached a copy of the follow up for information request.

Regards

Leon Smith

Team Leader Building Approvals
Kaiārahi Whakatū Whare

Kāpiti Coast District Council
Tel 04 296 4635
Mobile 027 5555 773

www.kapiticoast.govt.nz



Kapiti Coast District Council does not guarantee the accuracy or completeness of any information contained in this e-mail or attached files. Internet communications are not secure; therefore the Council does not accept legal responsibility for the contents of this message or attached files. The content of this email may express the view of the author and not the official position of the Council. Kapiti Coast District Council may monitor and store all outgoing and incoming email traffic. This e-mail is subject to copyright. Except in reply to the author, no part of it should be reproduced, adapted or communicated without the written consent of the copywriter owner. If you have received this e-mail in error, please advise the sender immediately by return e-mail, or telephone the author and delete all copies.

This e-mail message has been scanned for Viruses and Content and cleared by MailMarshal
#####

This email has been scrubbed for your protection by SMX. For more information visit smxemail.com

--
Andrea Lawrence
Architectural Assistant

Assembly Architects Limited
PO Box 182 Arrowtown 9351
Mobile 021 1728827

www.assembly.co.nz

News, press, awards and project updates on our [Blog](#)
Follow us on [Facebook](#) and [Twitter](#)



**Dunning
Thornton**
consultants

Ref: 7370 L01

31 March 2014

Kapiti Coast District Council
Private Bag 60 601
PARAPARAUMU 5254

Attention: Leon Smith



Dear Leon

**7 Tutere St, RFI
Building Consent: 140009**

We respond to your Request for Further Information dated 27 February 2014. We apologise for the delay in issuing this advice.

- 11) We confirm the timber balustrade structural aspects for the rear pergola are covered within the scope of our Specific Design.
- 13) Lintel sizes are confirmed for vertical and horizontal actions as per the attached Sketch SK-16 Rev A.
- 14) External studs were detailed in the previous sketches, internal ones are now noted on SK-16. We confirm that the spacing of studs throughout has been reviewed by DTC as part of our specific design.

We attach an updated PS1 and associated calculations A1-A7 to cover the above.

Yours faithfully,

Cristina Soccorsi
DESIGN ENGINEER
140327 AGC



RECEIVED
24 APR 2014
BY:

Building Code Clause(s).....B1.....
PRODUCER STATEMENT – PS1 – DESIGN
(Guidance notes on the use of this form are printed on page 2)

ISSUED BY:.....Dunning Thornton Consultants Ltd.....
(Design Firm)

TO:.....Shane O'Brien.....
(Owner/Developer)

TO BE SUPPLIED TO:.....Kapiti Coast District Council.....
(Building Consent Authority)

IN RESPECT OF:.....Timber Balustrade & Lintels.....
(Description of Building Work)

AT:.....7 Tutere St, Waikanae.....
(Address)
LOT..... DP SO

We have been engaged by the owner/developer referred to above to provide **Structural Design of Specific Elements** in respect of the requirements of Clause(s) **B1 - Structural**.....

(Extent of Engagement)
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...**B1/VM1**.....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 ...**7 Tutere St**.....
.....and numbered**7370**.....
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:

- (i) Site verification of the following design assumptions .. **Suitability of Subgrade**.....
(ii) All proprietary products meeting their performance specification requirements;

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:

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

I, ...**Alistair Cattanach**..... am: CPEng ...**168031**.....#
(Name of Design Professional)
 Reg Arch#

I am a Member of: IPENZ NZIA and hold the following qualifications:.. **BE(Hons)**.....
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 ...**Alistair Cattanach**..... ON BEHALF OF ...**Dunning Thornton Consultants Ltd**.....
(Design Firm)

Date... **27 March 2014**..... (signature).....
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



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: glw@dt@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUZE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7330	CaS	March - 2014	A - 2

RECEIVED
24 APR 2014

BY: _____

J4. 6g. SCREWS

$$\phi R_n = \phi m k R_x$$

$$\phi = 0.7$$

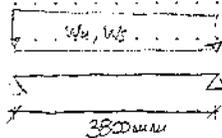
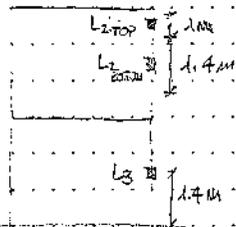
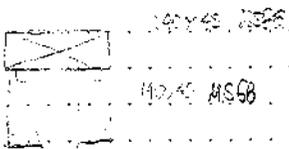
$$k = 1 \text{ wind}$$

$$Q = 1.155 \text{ kN}$$

$$n = \frac{R_n}{\phi k R_x}$$

$n = \frac{17 \text{ kN}}{0.7 \times 1 \times 1.155 \times 12.5} = 21 / 6g \text{ screws. too much} \rightarrow \text{LVL } 36 \text{ mm thick cross-spike}$

L² BOTTOM



$$w_u = 1.31 \text{ kPa} \times 1.4 \text{ m} = 1.8 \text{ kN/m}$$

$$w_b = 0.94 \text{ kPa} \times 1.7 \text{ m} = 1.6 \text{ kN/m}$$

$$M^* = \frac{1.96 \text{ kN/m} \times 3.8^2}{8} = 3.5 \text{ kNm}$$

$$\Delta = \frac{3800}{300} = 12.7 \text{ mm}$$

$$EI = 8000 \text{ Pa} \times \left(\frac{45 \times 140^3}{12} + 2 \times \frac{140 \times 45^3}{12} \right) = 9.9 \times 10^{10} \text{ Nm}^2$$

$$\delta = 2 \times \frac{5}{384} \times \frac{1.3 \text{ kN/m} \times 3800^4 \text{ mm}^4}{9.9 \times 10^{10} \text{ Nm}^2} = 76.7 \text{ mm} \gg \Delta = 13 \text{ mm}$$

using 2 / 140x45 LVL 13 $\delta \approx 28 \text{ mm} \gg \Delta$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dawain@dunningthornton.co.nz



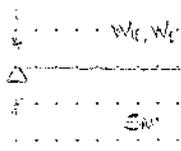
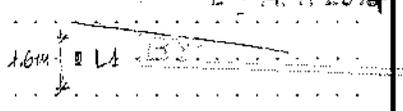
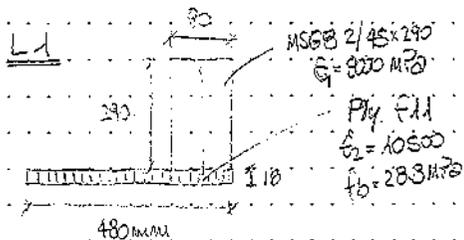
CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	March - 2014	1/1

RECEIVED

24 APR 2014

LINTEL



$$W_{11} = 1.62 \text{ kPa} \times 1.6 \text{ m} = 2.6 \text{ kN/m}$$

$$W_{12} = 1.16 \text{ kPa} \times 1.5 \text{ m} = 1.7 \text{ kN/m}$$

$$M^* = \frac{2.6 \text{ kN/m} \times 1.6^2 \text{ m}^2}{8} = 8 \text{ kNm}$$

$$\Delta = \frac{5000}{250} = 16.7 \text{ mm}$$

$$I_{pl} = I_{pl} + I_{pl} + I_{pl} + I_{pl}$$

$$I = \frac{18 \times 180^3}{12} = 691200 \text{ mm}^4$$

$$S_x = 1.35 \frac{691200}{180} = 5184 \text{ mm}^3$$

$$f_b = 22.5 \text{ MPa}$$

$$M_{pl} = \frac{2.8 \times 2.62 \times 292120}{100000} \times 691200 = 10.4 \text{ kNm}$$

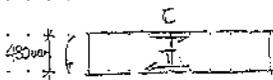
$$k_g = 0.62$$

$$> M^* \text{ OK}$$

$$EI = EI_1 + EI_2 = 80700 \text{ MPa} \times \frac{2 \times 292120^3}{12} + 10500 \text{ MPa} \times \frac{18 \times 180^3}{12} = 1.78 \times 10^{12} \text{ Nmm}^2$$

$$C = k_g \times \frac{S_x}{EI} \times \frac{M^*}{EI} = \frac{2 \times 5 \times 1.7 \text{ kNm}}{394 \times 1.78 \times 10^{12} \text{ Nmm}^2} = 17.3 \text{ mm}$$

QUITE CLOSE



$$M^* = 8 \text{ kNm}$$

$$T \approx C = \frac{8 \text{ kNm}}{0.18 \text{ m}} = 17 \text{ kN}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dto@dm@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	March - 2014	A - 3

02y. using 2/140x45 LVL13 + 130x6 steel plate 1y = 25018

$$EI = \frac{13200 \text{ N}^2 \times 2 \times 45 \times 140^3}{12} + \frac{200000 \text{ N}^2 \times 5 \times 130^3}{12} = 4.91 \times 10^{11} \text{ Nmm}^2$$

$$f = 14.3 \text{ mm} > 13 \text{ mm} \quad \text{QUITE CLOSE}$$

$$\phi M_u = 0.8 \times 45 \text{ kPa} \times \frac{2 \times 45 \times 140^2 \text{ mm}^3}{6} = 11.3 \text{ kNm} > 3.5 \text{ kNm} \quad \text{OK}$$

RECEIVED

26 APR 2014

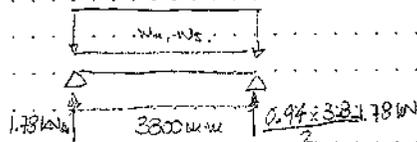
L2 TOP



3/140x45 LVL13

$$W_u = 1.31 \text{ kPa} \times 1 \text{ m} = 1.31 \text{ kN/m}$$

$$W_s = 0.94 \text{ kPa} \times 1 \text{ m} = 0.94 \text{ kN/m}$$



$$M^* = \frac{1.31 \text{ kN/m} \times 3.3^2 \text{ m}}{8} = 2.4 \text{ kNm}$$

$$\Delta = 12.7 \text{ mm}$$

$$EI = 2 \times \frac{5}{384} \times \frac{0.94 \text{ kN/m} \times 3300^2 \text{ mm}}{12 \text{ mm}} = 4.2 \times 10^{11} \text{ Nmm}^2$$

$$3/140 \times 45 \text{ LVL13} \rightarrow EI = \frac{13200 \text{ kPa} \times 3 \times 45 \times 140^3}{12} = 4.1 \times 10^{11} \text{ Nmm}^2$$

03 2/140x45 LVL13 + 130x6 steel plate (L2)





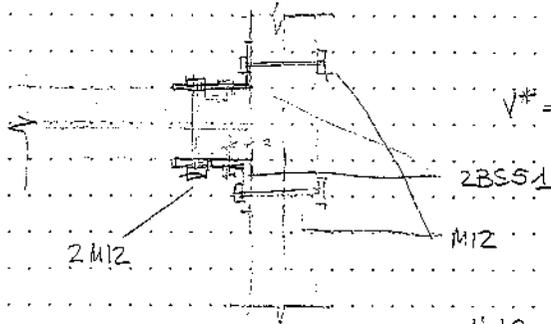
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtdwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CaS	DATE:	PAGE NO.
730		March - 2014	A-4



$$V^* = 1.31 \frac{21}{2} \times \frac{3.3 \text{ kN}}{2} = 2.5 \text{ kN}$$

RECEIVED
24 APR 2014
BY

M12 $b_e = 45 \text{ mm}$

LINTEL 2
CONNECTION

$$R_{kl} = 9.74 \text{ kN}$$

$$R_{skl} = 2 R_{kl} = 2 \times 9.74 \text{ kN} = 19.4 \text{ kN}$$

$$R_u = k_1 k_2 k_3 R_{skl}$$

$$k_1 = 1$$

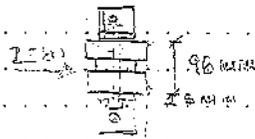
$$k_2 = 0.7 \text{ JS}$$

$$k_3 = 1 \text{ 1 element}$$

$$R_{skl} = R_{skl}$$

$$\phi R_u = 0.7 \times 1 \times 1 \times 0.7 \times 19.4 \text{ kN} = 9.5 \text{ kN}$$

DU 2 NUTIGRIP 6 kN/pac > 9.5 kN
OK

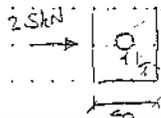


$$M^* = 2.4 \text{ kNm}$$

$$= \frac{2.4 \text{ kNm}}{0.096 \text{ m}} = 25 \text{ kN}$$

$$M_{bolt} = \frac{25 \text{ kN}}{3} = 8.3 \text{ kN} \rightarrow 3 \text{ bolts} \rightarrow 3 \times 300 \text{ mm} = \text{M12 bolt @ 1 m}$$

M10 @ 600



$$V_w = \phi 0.6 f_y A_w = \phi$$

$$A_w = \frac{2500 \text{ N}}{0.9 \times 0.6 \times 250 \text{ MPa}} = 18 \text{ mm}^2$$

5 mm thick



**Dunning
Thornton**
consultants

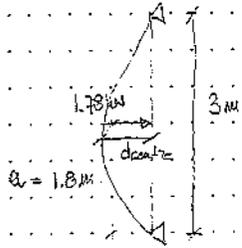
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dwtgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	March - 2014	A-5

STUDS



$$d_{centre} = \frac{PL^3}{48EI} \left[\frac{3a}{L} - \frac{4a^3}{L^3} \right]$$

$$\Delta = \frac{3000}{300} = 10 \text{ mm}$$

$$EI = \frac{1.78 \text{ kN} \times 3000^3}{48 \times 10 \text{ mm}} \times \left[\frac{3 \times 1800}{3000} - \frac{4 \times (1800)^3}{3000^3} \right] = 9.4 \times 10^{10}$$

$$2 / 140 \times 45 \text{ MSG8} \quad EI = \frac{8000 \text{ MPa} \times 2 \times 45 \times 140^3}{12} = 1.64 \times 10^{11} > EI \text{ ok}$$

$$M^* = \frac{1.78 \text{ kN} \times (1.8 \times 1.2) \text{ m}^2}{3 \text{ m}} = 1.28 \text{ kNm}$$

$$d M_u = \frac{0.8 \times 14 \text{ MPa} \times 2 \times 45 \times 140^3}{6} \text{ mm}^3 = 3.3 \text{ kNm} > M^* \text{ ok}$$

RECEIVED
24 APR 2014



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtw@tdunnithornton.co.nz



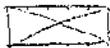
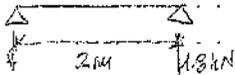
CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	March - 2014	2 - 6

L3

$$w_u = 1.3 \text{ kN/m}$$

$$w_s = 1.31 \text{ kN/m}$$



140 x 45 MSEE

RECEIVED

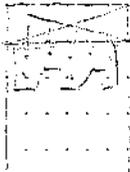
24 APR 2014

BY:

$$EI = \frac{3000 \text{ N/mm}^2 \times 45 \times 140^3}{12} = 3.2 \times 10^{10} \text{ Nmm}^2$$

$$d = 2 \times \frac{5 \times 1.31 \text{ N/mm} \times 2000^4 \text{ mm}^4}{33 \times 3.2 \times 10^{10} \text{ Nmm}^2} = 6.6 \text{ mm}, \quad \Delta = \frac{2000}{330} = 6.7 \text{ mm}$$

$$V^* = \frac{1.8 \text{ kN/m} \times 2 \text{ m}}{2} = 1.8 \text{ kN}$$



MULTIPLIER $\frac{6 \text{ kN/point}}{2} = 3 \text{ kN} > 1.8 \text{ kN OK}$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtc@dn@dunningthornton.co.nz

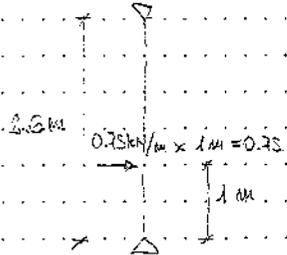


CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CAS	March - 2014	7-7

BALUSTRANE

24 APR 2014

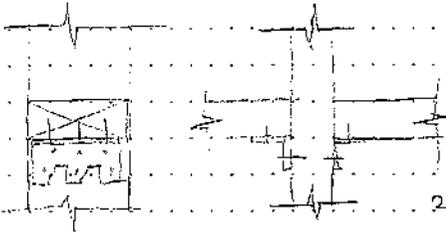


$$d_{max} = \frac{Pl^3}{48EI} - \frac{3q}{4L} \left(\frac{l^3}{L} \right)$$

$$EI = \frac{150 \times 2600^3}{48 \times 86 \text{ mm}} \times \frac{3 \times 1000}{2600} = 4 \left(\frac{1000}{2600} \right)^3 I = 2.9 \times 10^{10}$$

140x45
MSG8

$$EI = 8.23 \times 10^{10} > 2.9 \times 10^{10} \text{ ok}$$



2 Multigrip

LINTEL / BALUSTRADE



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dthornton@dunningthornton.co.nz

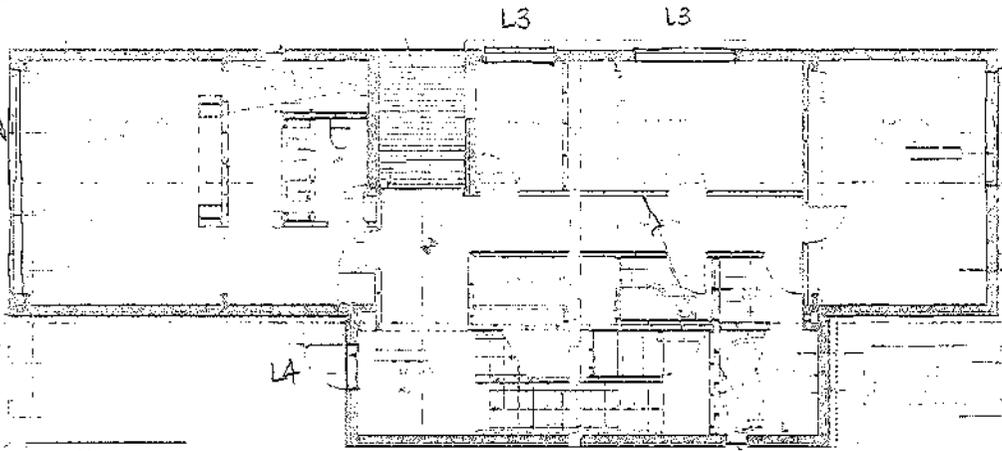


SKETCH

JOB NAME:	7 TUTERE ST.		
JOB NO:	7370	DRAWN BY:	CaS
DATE:	03-2014	SKT NO:	SK - 16

Revision : A

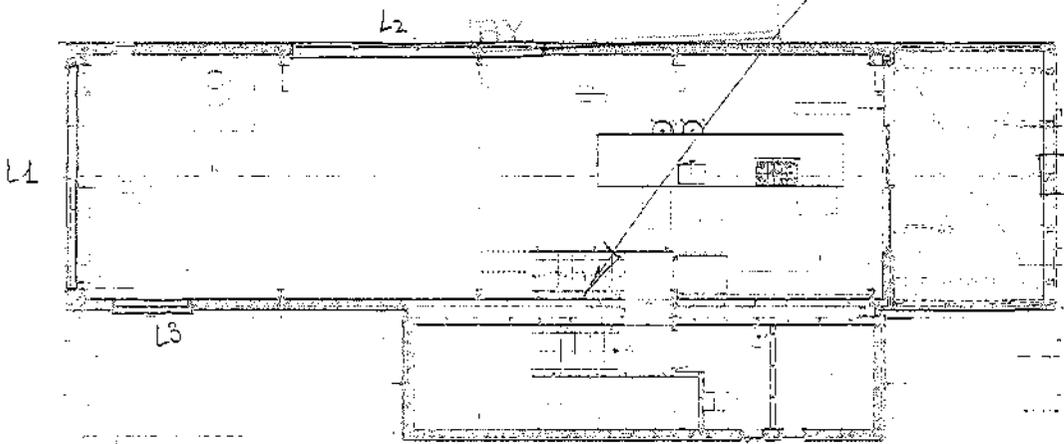
REFER TO SK-12



RECEIVED

24 APR 2014

INTERNAL STUDS.
90x45 @ 600 N/E



double stud
140x45
each end
for L2 & L3

L1

2/290x45

140x45 @ 200mm

3G LVL 11
CROSS-SANDED

MULTIGRIP

MULTIGRIP

L2

2/140x45 LVL13
130x6 steel plate

M10 rebate @ 500 c

BALUSTRADE

L3

140x45
MSG8

MULTIGRIP

2 MULTIGRIP
STUDS
140x45 @ 200

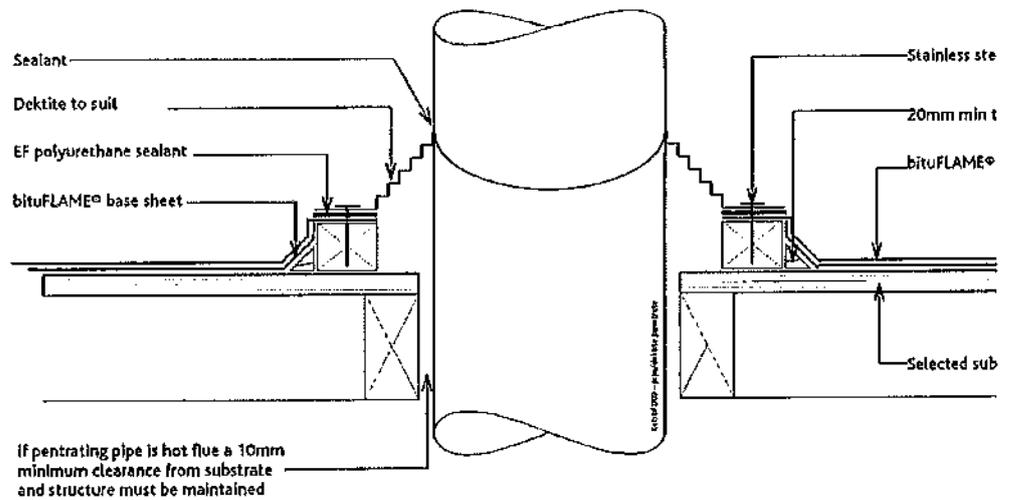
2 MULTIGRIP

140x45 @ 1000 c/s

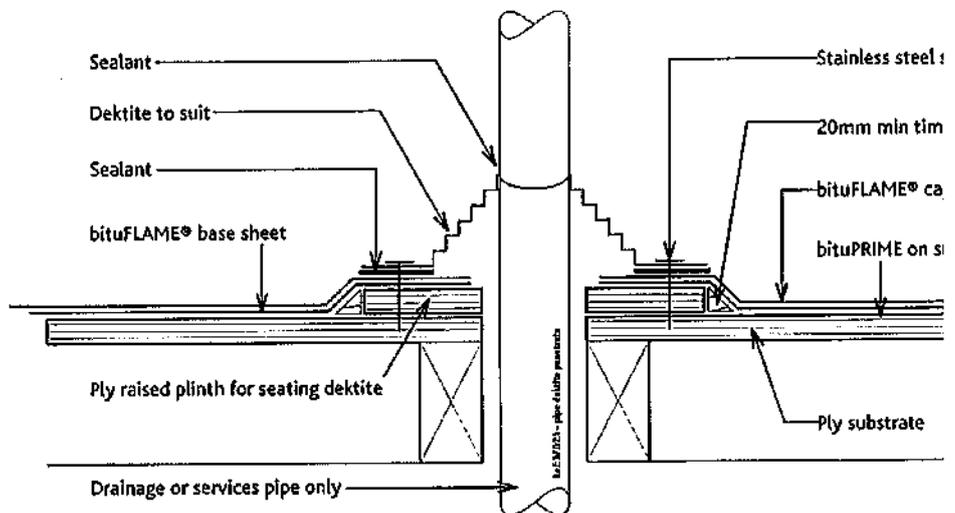
Detail Drawings

DOUBLE LAYER DETAILING

RECEIVED
24 APR 2014
11:17



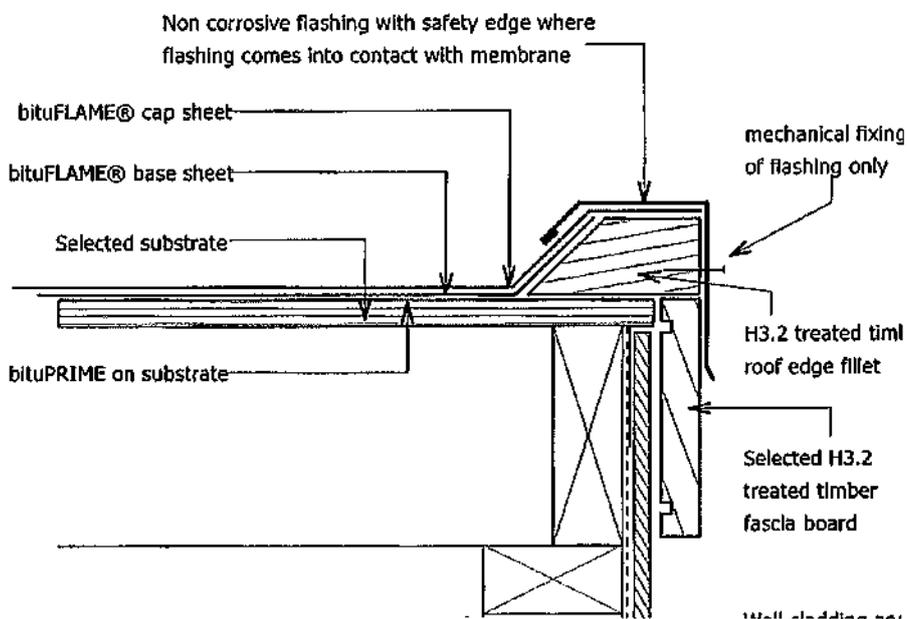
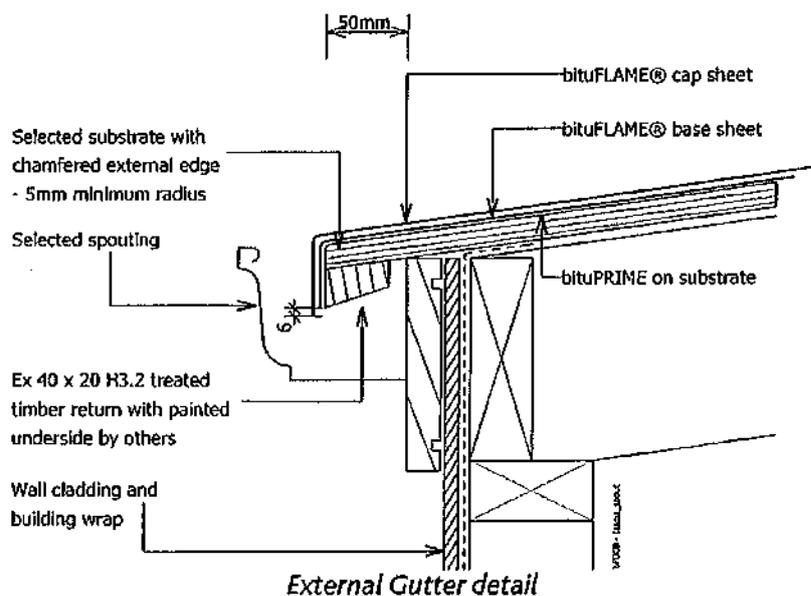
Hot Flue Penetration



Service/Vent Pipe Penetration

REVISION
24 APR 2014
BY: _____

DOUBLE LAYER DETAILING



25 APR 2014

Date:

6/4/2014.

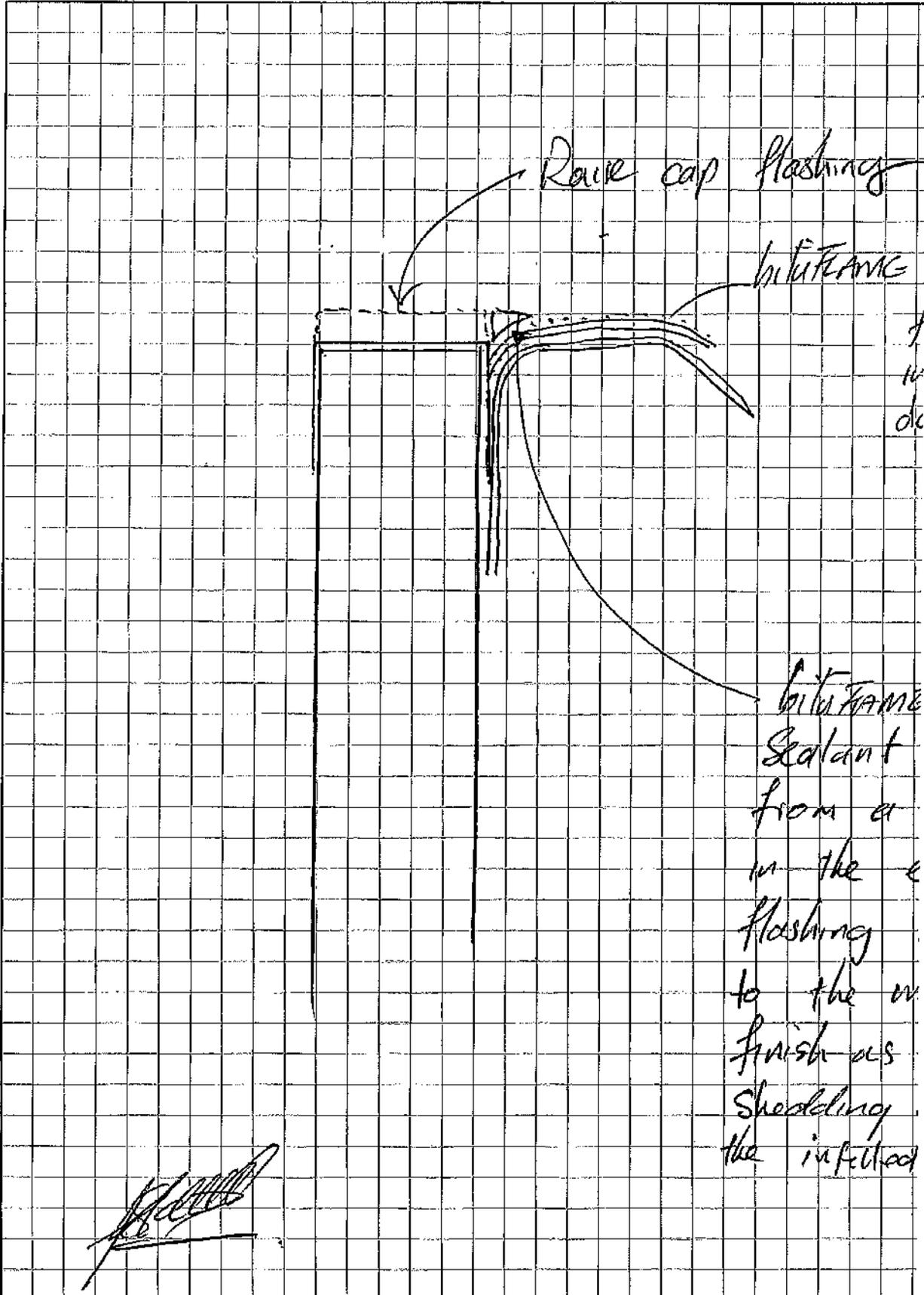
Ref:

BituFLAME externa



waterproofing

Cladding Section KEEP!





11 April 2011

Greg Yin
Technical Manager
Viridian CSR (NZ) Ltd
PO Box 14-601 Panmure
Auckland

RECEIVED
26 APR 2014
BY

Hi Greg

GANZ is happy to supply this letter in support of any application you may need to make for registration with a Building Consent Authority as an author of glass related Producer Statements.

This notes confirms that Greg Yin is a member of the Technical Working Group of the Glass Association of New Zealand and is familiar with NZS 4223:Part 3:1999, NZS 4223:Part 1:2008, and NZS 4223:4:2008, as well as Clauses B1, F2 and F4 of the Building Code inasmuch as they relate to glass and glazing.

Yours faithfully

Stewart Knowles
Executive Director

Glass Association of New Zealand

PO Box 11 464, Manners Street, Wellington. Phone +64 4 528 8061, Fax +64 4 528 8061, Email window.assn@xtra.co.nz

While all statements are made in good faith, neither the Glass Association of New Zealand nor its officers, nor any associated group, can accept any liability for actions made in reliance on such statements.

GIM 11

RECEIVED
24 APR 2014
BY

1307 Euroglass PS1

Andrea Lawrence <andrea@assembly.co.nz>
To: greg.yim@euroglass.co.nz

8 April 2014 09:31

Hi Greg,

Just spoke to you about the Ps1 for the Euroanchor Balustrades

The council asks us:

The Engineer who has signed the producer statement (PS1) supplied for the glazed Balustrade system doesn't appear to be a current registered Chartered Professional Engineer. Please supply a Ps2 from a Chartered Professional Engineer covering the balustrade design

So to confirm, do we need to get a PS2 from our engineer?

Andrea Lawrence
Architect/Engineer

Assembly Euro Glass Limited
P.O. Box 100
Whangarei 0108

Mobile: 09 425 4511
09 425 4511

Yim, Greg <GYim@vinid@euroglass.co.nz>
To: Andrea Lawrence <andrea@assembly.co.nz>

8 April 2014 10:15

Hi Andrea

CPEng is not required for non-complex design provided that the BCA is satisfied that the designer is competent - refer extract from page 2 of DBH Practice Advisory

Building consent authorities (BCAs) may still accept, for example, non-complex designs prepared without the involvement of a CPEng. In such a case, the BCA will need to be satisfied, based on the complexity of the design and their previous knowledge of the designer's work, that the designer is competent to use the VM on a particular project.

Based on this and my experience and competency, Auckland Council and the Southern Building Controls Group (SBCG) have accepted me as an author for PS1 covering B1, B2, L1 and L2 - refer letter of acceptance attached.

Also attached is my CV. I am a member of the Glass Association of New Zealand (GANZ) and have 25 years NZ experience in glass. I have also attached a letter from GANZ.

You will need to get a Ps 2 if the council is still unsatisfied with the above

Regards

Greg Yim



145-150/151-152/153/154/155/156/157/158/159/160/161/162/163/164/165/166/167/168/169/170/171/172/173/174/175/176/177/178/179/180/181/182/183/184/185/186/187/188/189/190/191/192/193/194/195/196/197/198/199/200/201/202/203/204/205/206/207/208/209/210/211/212/213/214/215/216/217/218/219/220/221/222/223/224/225/226/227/228/229/230/231/232/233/234/235/236/237/238/239/240/241/242/243/244/245/246/247/248/249/250/251/252/253/254/255/256/257/258/259/260/261/262/263/264/265/266/267/268/269/270/271/272/273/274/275/276/277/278/279/280/281/282/283/284/285/286/287/288/289/290/291/292/293/294/295/296/297/298/299/300/301/302/303/304/305/306/307/308/309/310/311/312/313/314/315/316/317/318/319/320/321/322/323/324/325/326/327/328/329/330/331/332/333/334/335/336/337/338/339/340/341/342/343/344/345/346/347/348/349/350/351/352/353/354/355/356/357/358/359/360/361/362/363/364/365/366/367/368/369/370/371/372/373/374/375/376/377/378/379/380/381/382/383/384/385/386/387/388/389/390/391/392/393/394/395/396/397/398/399/400/401/402/403/404/405/406/407/408/409/410/411/412/413/414/415/416/417/418/419/420/421/422/423/424/425/426/427/428/429/430/431/432/433/434/435/436/437/438/439/440/441/442/443/444/445/446/447/448/449/450/451/452/453/454/455/456/457/458/459/460/461/462/463/464/465/466/467/468/469/470/471/472/473/474/475/476/477/478/479/480/481/482/483/484/485/486/487/488/489/490/491/492/493/494/495/496/497/498/499/500/501/502/503/504/505/506/507/508/509/510/511/512/513/514/515/516/517/518/519/520/521/522/523/524/525/526/527/528/529/530/531/532/533/534/535/536/537/538/539/540/541/542/543/544/545/546/547/548/549/550/551/552/553/554/555/556/557/558/559/560/561/562/563/564/565/566/567/568/569/570/571/572/573/574/575/576/577/578/579/580/581/582/583/584/585/586/587/588/589/590/591/592/593/594/595/596/597/598/599/600/601/602/603/604/605/606/607/608/609/610/611/612/613/614/615/616/617/618/619/620/621/622/623/624/625/626/627/628/629/630/631/632/633/634/635/636/637/638/639/640/641/642/643/644/645/646/647/648/649/650/651/652/653/654/655/656/657/658/659/660/661/662/663/664/665/666/667/668/669/670/671/672/673/674/675/676/677/678/679/680/681/682/683/684/685/686/687/688/689/690/691/692/693/694/695/696/697/698/699/700/701/702/703/704/705/706/707/708/709/710/711/712/713/714/715/716/717/718/719/720/721/722/723/724/725/726/727/728/729/730/731/732/733/734/735/736/737/738/739/740/741/742/743/744/745/746/747/748/749/750/751/752/753/754/755/756/757/758/759/760/761/762/763/764/765/766/767/768/769/770/771/772/773/774/775/776/777/778/779/780/781/782/783/784/785/786/787/788/789/790/791/792/793/794/795/796/797/798/799/800/801/802/803/804/805/806/807/808/809/810/811/812/813/814/815/816/817/818/819/820/821/822/823/824/825/826/827/828/829/830/831/832/833/834/835/836/837/838/839/840/841/842/843/844/845/846/847/848/849/850/851/852/853/854/855/856/857/858/859/860/861/862/863/864/865/866/867/868/869/870/871/872/873/874/875/876/877/878/879/880/881/882/883/884/885/886/887/888/889/890/891/892/893/894/895/896/897/898/899/900/901/902/903/904/905/906/907/908/909/910/911/912/913/914/915/916/917/918/919/920/921/922/923/924/925/926/927/928/929/930/931/932/933/934/935/936/937/938/939/940/941/942/943/944/945/946/947/948/949/950/951/952/953/954/955/956/957/958/959/960/961/962/963/964/965/966/967/968/969/970/971/972/973/974/975/976/977/978/979/980/981/982/983/984/985/986/987/988/989/990/991/992/993/994/995/996/997/998/999/1000

From: assembly@euroglass.co.nz (mailto:assembly@euroglass.co.nz) On Behalf Of Andrea Lawrence
Sent: Tuesday, 8 April 2014 9:32 AM
To: Yim, Greg
Subject: 1307 Euroglass PS1

[Quoted text hidden]

\$ attachments

- practice-advisory-08.pdf 92K
- Successful application letter from Auckland Council.pdf 773K
- Acceptance on SBCG register 18 Feb 2014.pdf 113K
- CV Dec 2013.pdf 41K
- Letter from GANZ.pdf 227K

Andrea Lawrence <andrea@assembly.co.nz>
To: Justin Wright <justin@assembly.co.nz>

8 April 2014 10:59

FYI...

[Quoted text hidden]

\$ attachments

- practice-advisory-09.pdf 92K
- Successful application letter from Auckland Council.pdf 773K
- Acceptance on SBCG register 18 Feb 2014.pdf

REC-11
25 APR 2014
BY: [Signature]



29 August 2012

Mr G Yim
Viridian Glass Limited Partnership
P O Box 27 337
Mt Roskill
Auckland 1440

Dear Greg

Successful application to become a producer statement author

This letter is to advise you that your application to become an approved author has been successful. The information provided demonstrates that you have the experience and qualifications to satisfy Council that you have the competence to issue producer statements.

Please note that Council has accepted the information provided in good faith and will rely upon any producer statements you might issue to demonstrate compliance with the New Zealand Building Code subject to the limitations set out in Table 1.

Table 1:

Author's registration number:	2473							
Code clauses approved for:	B1	B2	C1	C2	C3	C4	D1	
	D2	E1	E2	E3	F1	F2	F3	
	F4	F5	F6	F7	F8	G1	G2	
	G3	G4	G5	G6	G7	G8	G9	
	G10	G11	G12	G13	G14	H1		
Type of statement approved to issue:	<input checked="" type="checkbox"/> PS1 <input checked="" type="checkbox"/> PS2 <input type="checkbox"/> PS3 <input checked="" type="checkbox"/> PS4							
Building complexity:	Low and medium risk buildings only (refer Table 2)							
Scope of works:	<input type="checkbox"/> Acoustic <input type="checkbox"/> Civil <input type="checkbox"/> Electrical <input type="checkbox"/> Facade <input type="checkbox"/> Fire <input type="checkbox"/> Geotechnical <input type="checkbox"/> Mechanical <input type="checkbox"/> Plaster coating <input type="checkbox"/> Waterproofing <input checked="" type="checkbox"/> Glazing - Structural							

Table 2:

Building complexity / risk	Design element	Approach
Low	Simple structural elements ¹ such as post and beam components, raft floors, joists, etc	PS1 provided by approved author
	Lightweight commercial buildings with low	Document check only

¹ Typically involves residential construction up to three stories in height; design of the building is largely within the scope of NZS3604 but has some elements of specific design

RECEIVED
28 APR 2014
BY

	occupancies (workshops, garages, warehouses with office accommodation) Geotechnical reports; on-site waste water disposal	
--	--	--

Building complexity / risk	Design element	Approach
Medium	Complex residential units, large commercial buildings such as Bunnings, Mitre 10, etc where large crowds of people are expected or alternative designs are proposed	PS2 provided by approved author Document check only
High	Specific engineer design ² Designs of an intricate or complex nature or alternative designs proposed Convention centres, casinos, hotels, large shopping complex's, universities, where large crowds expected	PS2 required, however Council must agree to the author first, or Regulatory Review conducted

Conditions of approval:

- All producer statements must be issued in Council format and completed in full
- Authors must abide by the Auckland Council Producer Statement Policy
- Authors must agree to disclose any potential conflicts of interest
- Authors must provide evidence of on-going professional development and proof of insurance on an annual basis

Auckland Council reserves the right at any time to reconsider and deem unsuitable any person for any good and proper reason. Approvals are subject to a review after 3 years of the date entered onto the register.

If you have any further queries regarding this matter, please contact Wendy Kennedy on (09) 353 9262.

Yours faithfully
Auckland Council



Bob de Leur
Manager Building Policy, Training and Resolutions

² Three or more storeys or specifically designed buildings or building work and complex structures or fire designs



Licence Number:
Doc # 01676035.doc

18 February 2014



Greg Yim
PO Box 14601
Panmure
AUCKLAND 1741

Dear Greg,

PRODUCER STATEMENT AUTHOR – Acceptance on the SBCG register

Your application for acceptance onto the Southern Building Controls Group (SBCG) Producer Statement Register has been accepted for:

- PS1 - Producer Statement Design
- B1 - Structure
- B2 - Durability
- E2 - External Moisture
- F4 - Safety from Falling

Your Producer Statement Author number is PSA/2011/28 and should be quoted on all producer statement documentation that you submit. Your expiry date is 18 February 2015.

One month prior to your expiry date, you will receive a renewal letter from the Invercargill City Council. If you wish to remain on the producer statement register, please complete and return this form to Council prior to the expiry date. You will also need to provide details of further training undertaken, and any additional information that may support or affect your renewal application e.g. information on any claims against the author.

Please note that if you wish to apply for a different producer statement type or add to your area of expertise a complete new application will be required.

If you have any enquiries regarding this please contact Michael Hartstonge (SBCG Register Maintenance Officer) on (03) 211 1674.

Yours faithfully

**ICC BUILDING SERVICES TEAM
(On behalf of the SBCG)**



Viridian Glass Limited Partnership
65 Carr Road, Mt Roskill
P.O. Box 27 116
T 64 9 624 1180
F 64 9 624 2280
viridianglass.com



18 December 2013

SECTION B:

Qualifications and Experience of Greg Yim (Soo Win)

Technical Manager - National

Qualifications:

B Sc (Honours) in Civil Engineering UK

Membership of professional body:

Graduate member of IPENZ. Membership number 100831

NZ experience

25 years in glass and glazing - Winstone Glass, Pilkington and Viridian.

Viridian is a member of the Glass Association of New Zealand (GANZ)

Current position in Viridian Glass Ltd Partnership

National Technical Manager and Glazing Systems Design Engineer.

I am well versed with clause F2 as glass is a hazardous building material.

I was a member of Standards New Zealand committee on NZS 4223.1:2008 and NZS 4223.4:2008 Glazing in Buildings. These standards are cited in Clause B1 of the Building Code. The tables for sloped glazing were prepared by me using NZS 1170 and Finite Element analysis (FEA).

I am a member of Glass Association of New Zealand (GANZ) technical committee. We are currently working on the revised NZS 4223.3:2011 Glazing in Buildings – Human Impact requirements. Using loads from NZS 1170, I have prepared glass selection tables for shopfront, internal partition and low level glazing with help from the Technical Adviser of GANZ, Allan Sage.

I have also prepared glass balustrade selection tables for GANZ using B1 and F2 using Finite Element Analysis (FEA). These tables were checked and verified by an independent CPEng engineer. These tables are used in the Guidance on Barrier Design published by MBIE in November 2011.

I was a member of the Department of Building and Housing (DBH) working group on Guidance on Barrier Design. This guidance document was published to assist territorial authorities, designers and installers to achieve compliance with clauses B1, B2, E2, F2 and F4. Balustrade selection tables prepared for GANZ are included in this document.

I am also familiar with the durability requirements of clause B2 in relation to glazing. For glazing, we ensure the gaskets selections are able to provide at least a durability of 15 years as per Acceptable Solution B2/AS1.

I have designed proprietary balustrade systems for Viridian and these have been designed to B1, B2, F2 and F4. A number of these systems have been tested to AS/NZS 1170 by Auckland UniServices Ltd of Auckland University.

I am familiar with the requirements of Clause F4 Safety from Falling as we often provide design and installation services for glass barriers protecting a fall of one metre or more.

Written Reference:

References from the attached are attached.

1. JNG Engineers
2. Stewart Knowles, president of Glass Association of New Zealand
3. Murray Clark, Managing Director of Glass Projects



Other Reference:

David Ragg of DBH for confirmation of my involvement for the Barrier Design Guide

Bill Vautier senior structural engineer of Auckland Council. I have provided him with balustrade design tables and FEA stress diagrams.

List Completed Projects:

Some of my completed projects are:

1. Deloitte canopy Auckland
2. Wanganui Visitors Information Centre balustrade
3. Cashmere Girls High School balustrade
4. Kawarau Falls balustrade
5. Pleasure Palace balustrade

Water Demand Management Declaration of Compliance



This form is to be submitted with all applications for a Project Information Memorandum/Building Consent for new or relocated dwellings on land zoned residential.

Address: 7 Tutere Street
Waikanae

Number of dwellings: One

Building Consent Number: 140009
(Office Use Only)

Water Demand Management solution

1. All dwellings the subject of this development will use one of the following water demand management solutions in accordance with the District Plan (please tick one box):

- Rainwater storage tanks with a total storage volume of not less than 10,000 litres (does not include air cavity between the lid and overflow), for each house in the development
- Rainwater storage tanks with a total storage volume of not less than 4,000 litres (does not include air cavity between the lid and overflow), for each house in the development, and a complying greywater diversion device
- The application is made with an alternative solution (note that resource consent will be required)
- The application is made without provision for water demand management (note that resource consent will be required)

2. For all applications where Water Demand Management will be provided:

a. Volume of rainwater storage tanks: 10,000 litres

b. I confirm all the following:

- That the rain water tank volume complies with selected water demand management option and have provided a **certificate from the manufacturer** demonstrating the tank volume
- That there will be no direct connection from the reticulated water supply to any outside taps
- That there will be a direct connection from the rainwater storage tanks to all internal toilet cisterns and any external taps
- That there will be no direct connection from the reticulated water supply to any toilet cistern
- I understand that the toby or manifold may have to be modified at my expense

Greywater Irrigation Calculation Sheet

This sheet will help determine whether there is sufficient area available to reuse greywater for irrigation. Remember that greywater should be diverted to sewer and only used for garden irrigation when needed.

This will help avoid any ponding nuisance in winter months.

Greywater irrigation will not be suitable for your proposed dwelling, if it is in area where:

- soils are too slow draining,
- are too steep,
- have high water tables less than a meter below the surface, or
- is within 20m of a drain, wetland, pond, river or other water body.

If greywater is unsuitable, you will need to install a minimum of 10 000 litre of rainwater storage.

The following will help establish if your site is suitable for greywater irrigation.

Greywater Diversion Device

Model

Waterlilla or similar

(Watermate for instance)
www.watermate.co.nz

Irrigation method

Pod - subsurface

1. Is the area being irrigated at least 20m away from a waterbody?

Yes/No

2. Area available for irrigation.

Calculate the area you have available for outdoor irrigation.

577 m²

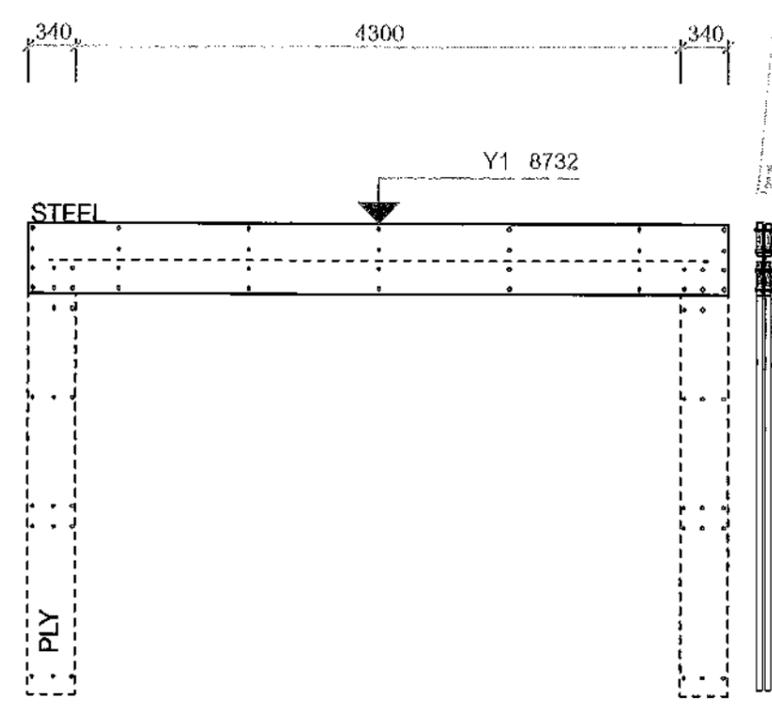
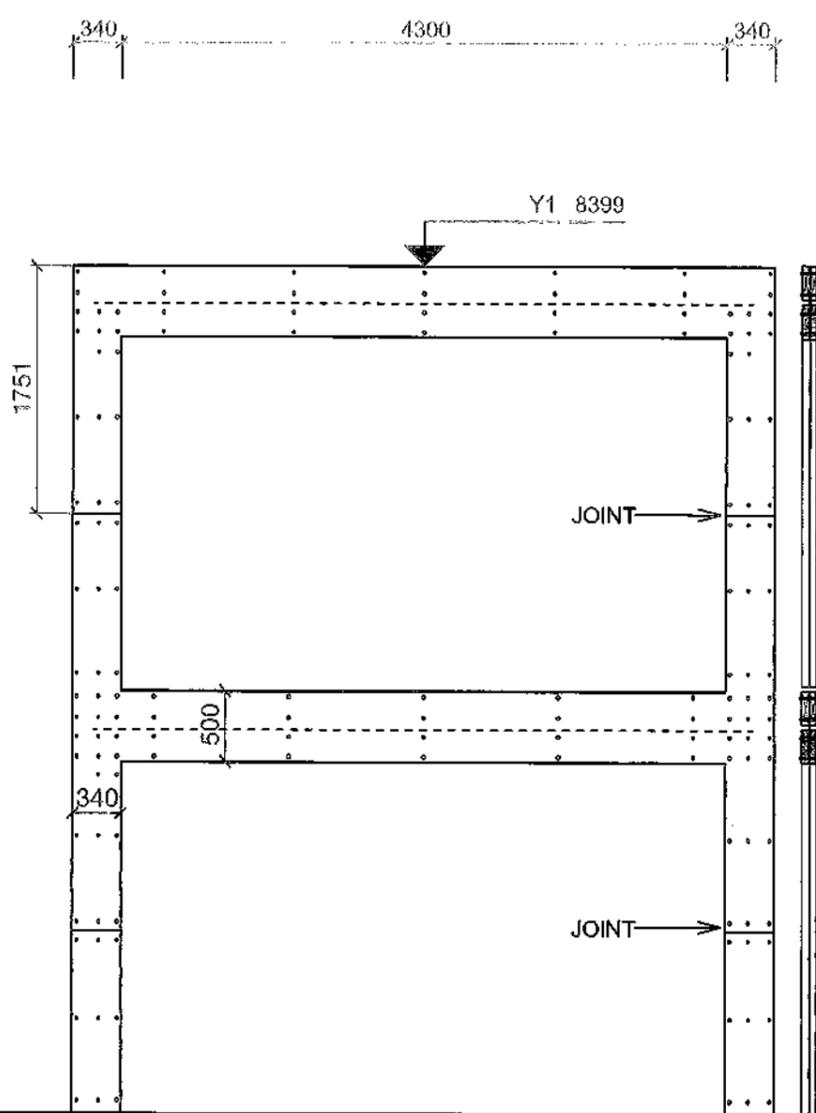
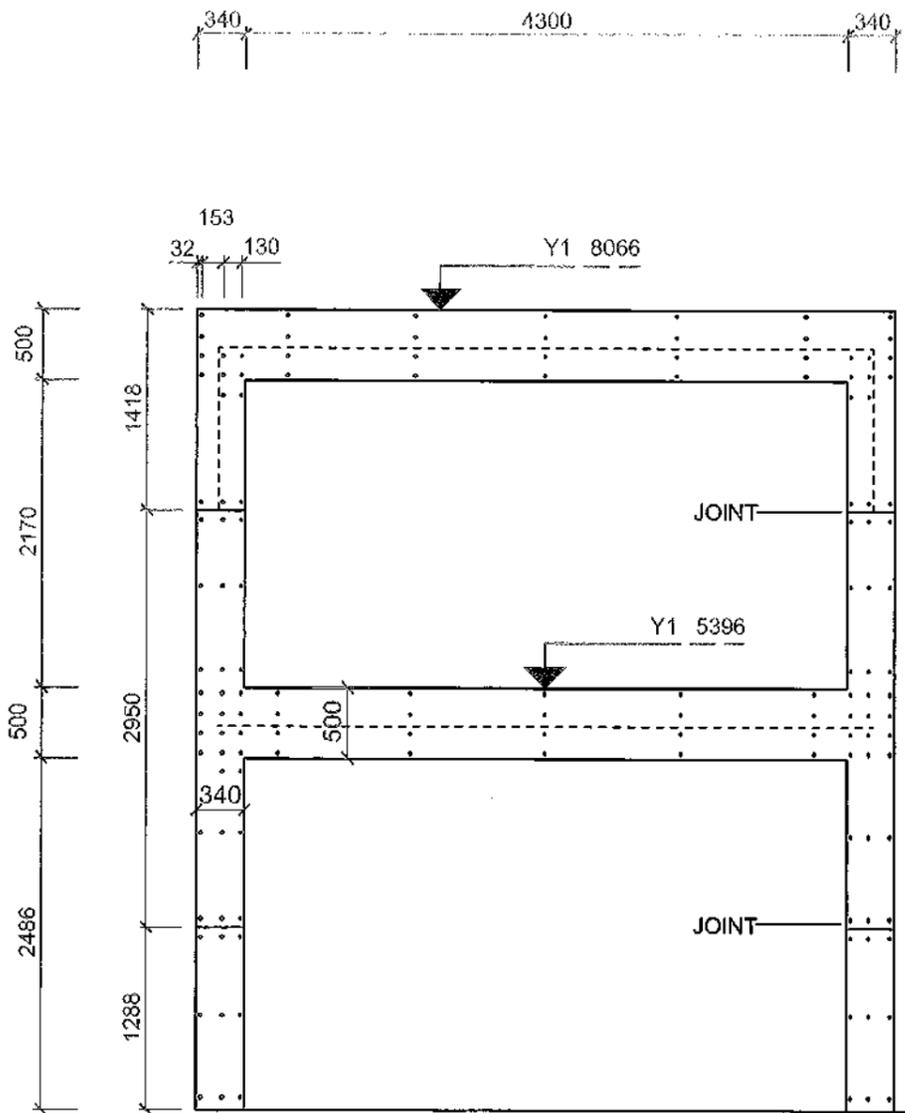
697m² less house 120m².

3. Greywater volume

Calculate how much water your home could generate. As the number of people will vary over the life of the house, use the following calculation to estimate greywater volume.

40 litres	+	60 litres	=	100 litres	*	5	*	7 days	=	3500 litres
Laundry usage		Bathroom usage		Total daily usage		Occupancy (depends on number of bedrooms)		Days per week		The amount of greywater produced each week

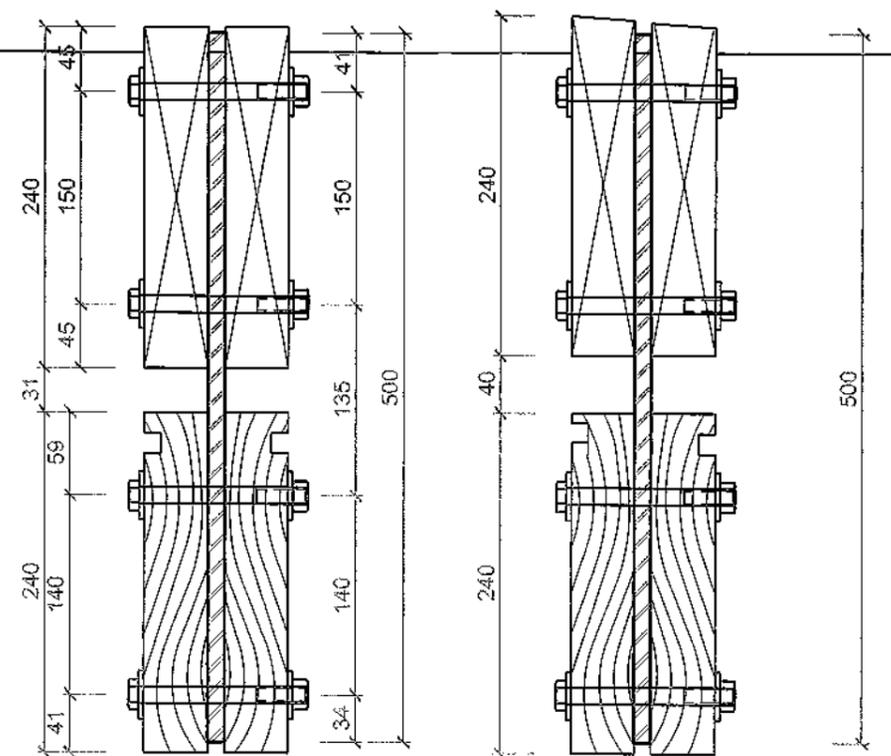
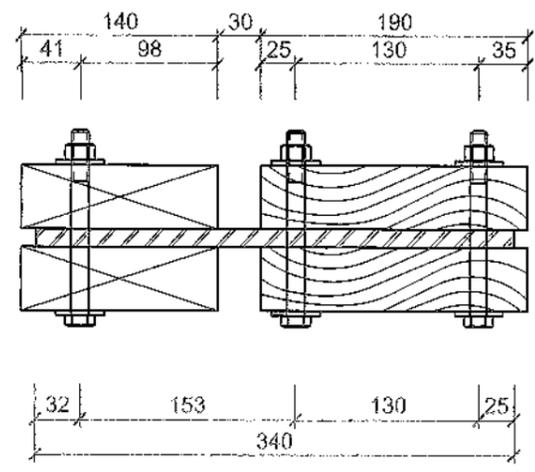
Bedroom numbers in home	Occupancy for design purposes
1	2
2	4
3	5
4	6
5	8
6	9



Y4 FLITCH
Scale: 1:50

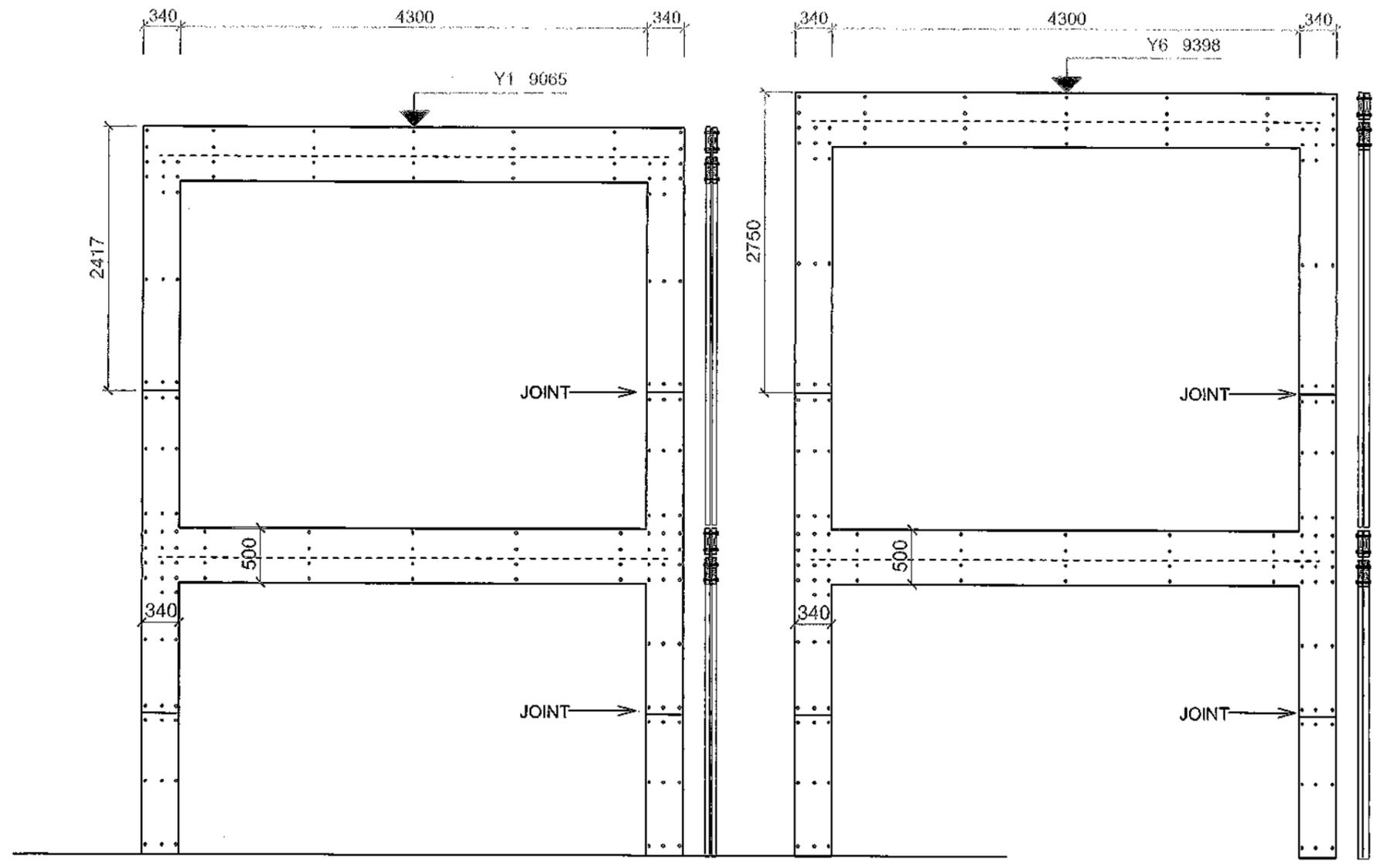
Y2 FLITCH Y2
Scale: 1:50

Y3 FLITCH
Scale: 1:50



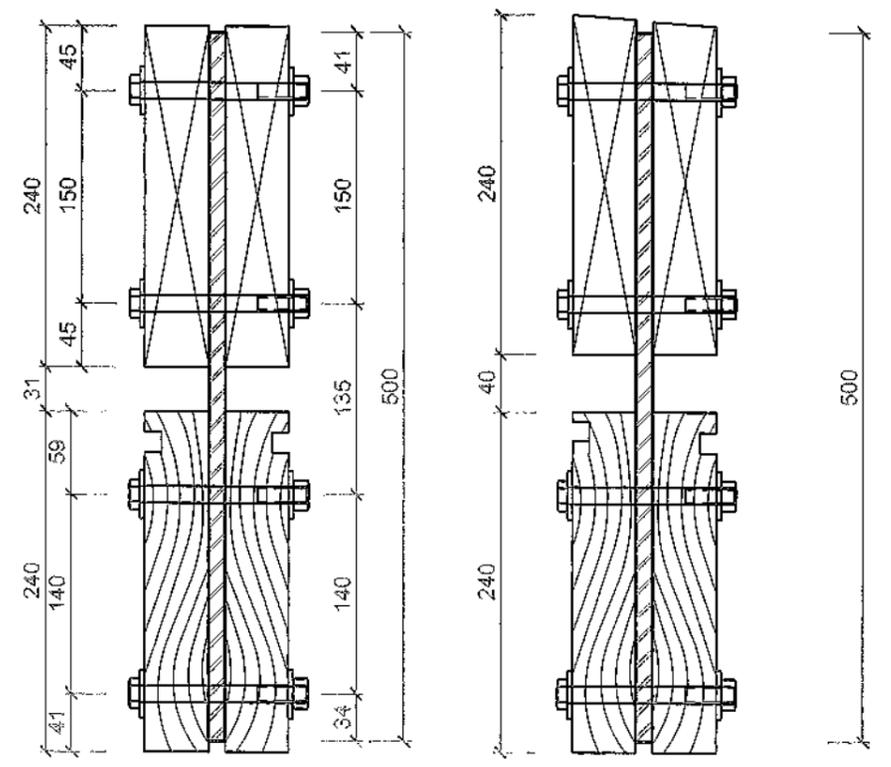
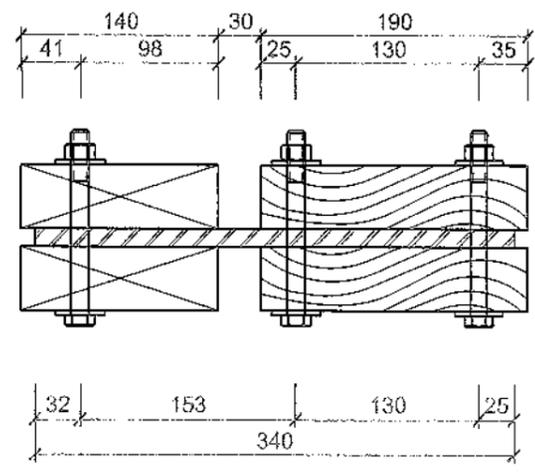
880075

13 JAN 2014



Y5 FLITCH Scale: 1:50

Y6 FLITCH Scale: 1:50



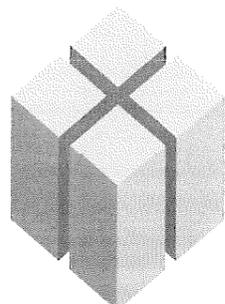
RECEIVED
13 JAN 2014
BY: SH

000073

SKETCHES & SPECIFICATION

**NEW HOUSE AT
7 Tutere St, Waikanae
For
Shane O'Brien**

RBW



**Dunning
Thornton**
consultants

Dunning Thornton Consultants Ltd
Consulting Structural Engineers
Project & Construction Consultants



Dunning Thornton Consultants Ltd

Job No.7370 Date Dec-13

DOMESTIC SPECIFICATION [STRUCTURAL] - DOM

DOM.1 GENERAL

Refer also to the Architects Specification.

All work that is not covered by specific design shall be in accordance with NZS 3604.

DOM.2 CONCRETE

Concrete shall be grade N = 25. (25MPa). Precast concrete shall be N40.

Concrete construction shall be in accordance with NZS 3109.

Reinforcing bars shall be as follows;
H deformed grade 500 E
R round grade 300 E

Cover to steel shall be as follows; (U.N.O.)
Footings cast against the ground - 75mm
Side cover to formwork: 50mm

Reinforcing to be wired in place on plastic chairs or proprietary high strength concrete spacers. Broken concrete or mortar pieces shall **not** be used.

Reinforcing bars shall conform to AS/NZS 4671 unless otherwise approved by the Engineer. All reinforcing shall be manufactured by Pacific Steel. **All reinforcing steel shall be manufactured by the Micro Alloy process.**

Mesh reinforcement and workmanship including laps, cover, bending radii and tolerances shall conform to the requirements of NZS 3109:1997, Section 3, except as specified herein or as instructed by the Engineer.

DOM.3 PILE TYPE

The piles supporting the main foundation beam shall be driven TTT Unilog H5 Multipoles with a geotechnical ultimate capacity of 75kN for vertical loads.

DOM.4 MATERIALS & WORKMANSHIP

Materials and workmanship shall conform with the requirements of the NZBC-VM4 and AS 2159:1995 Piling - Design and Installation, modified to comply with New Zealand Standards where appropriate.

Timber piles shall be to NZS 3605: 2001 treated H5 to NZS 3640:2003.

DOM.5 SETTING OUT

The piling contractor shall be responsible for the setting out of the pile positions in locations shown on plans and details.

DOM.6 TOLERANCES

Pile position at top : ± 50 mm in any direction
Pile verticality : 75 mm within 3 metres depth

DOM.7 FOUNDING DEPTHS

The founding depths will be determined by the piling contractor.
A penetrometer probe investigation has been undertaken on site. This has suggested a pile length of approximately 2m. A minimum of 1.5m is required for the bracing design.



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwqtr@dunningthornton.co.nz



SPECIFICATION

JOB NAME:	7 Tutere Street		
JOB NO:	DRAWN BY:	DATE:	SPEC
7370	CS	Dec 13	Page 1

DOM.8 INFORMATION TO BE SUPPLIED WITH TENDER

Each tenderer shall supply with the tender the following information:

- Recognised pile driving formula and the proposed method of achieving the required set.

DOM.9 INSPECTION & PROVING

The Contractor shall keep a driving record of each pile for forwarding to the Engineer at the completion of the piling.

Engineer is to be provided with relevant information to justify the required set and shall be given reasonable notice to witness the first piles being driven.

DOM.10 STRUCTURAL STEELWORK

All steelwork to be in accordance with NZS 3404.

All welding to be carried out by certified welders in accordance with AS/NZS 1554.

Structural steelwork shall be to Grade BHP 300-PLUS except for RHS sections which shall be Grade 350.

All exposed steelwork and bolts must be galvanised and epoxy-painted, (or G304 Stainless steel bolts) unless otherwise noted on the Engineering drawings. Other steelwork shall be zinc-rich primed and top coated as per the architect's specifications.

Epoxy must be "Ramset Epcon C6" unless otherwise noted on the Engineering drawings. Alternative shall be approved by the Engineer prior to use.

Neoprene or nylon separation bushes to prevent bimetallic corrosion of dissimilar metals shall be provided where necessary.

DOM.11 STRUCTURAL TIMBER and TIMBER FIXINGS

All timber shall be well seasoned and/or kiln dried before being brought onto the site. Framing timbers will be required to sustain an equilibrium moisture content of 12% before sheathings and finishings are fixed.

All structural timber must be a minimum Grade MSG8 or VSG8 unless noted otherwise on the drawings. Refer to the durability requirements of NZS 3604 for timber treatment.

LVL timber must be Grade LVL11 for 45mm LVL9.9 for 90mm. Carter Holt Harvey HTJOIST shall be used unless alternatives are specifically permitted by the Engineer in writing.

All external timber must be H3.2 treated.

External timber fixings and brackets shall be stainless steel unless noted otherwise on Engineering drawings. Refer also the specific durability requirements of NZS3604.

Various trade names have been specified for timber connectors such as "Lumberlok". Alternative brands from those specified shall be approved by the Engineer prior to use.

Bolts shall be to the sizes and positions as shown on the drawings. Allow for countersunk bolt heads and nuts as necessary to clear linings.

Every bolt head of nut shall be provided with a washer not less than:



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgtn@dunningthornton.co.nz



SPECIFICATION

JOB NAME:	7 Tutere St		
JOB NO:	DRAWN BY:	DATE:	SPEC
7370	CS	Dec 13	Page 2

50 x 50 x 3mm for bolts not exceeding 12mm diameter,
or 65 x 65 x 5mm for bolts not exceeding 20mm diameter.

DOM.12 WALL BRACING

Wall bracing elements shall be constructed in accordance with NZS 3604 requirements and manufactures' details and specifications including sheet thickness, dimensions, fixings size and spacing, and hold downs to ends of elements.

DOM.13 SCHEDULE OF SITE INSPECTIONS

The Engineer is to be provided with reasonable notification of the following construction stages:

- Pilke Driving
- Casting of precast walls
- Pre footing/foundation pour
- Erection of first lift of portal frames
- Pre lining

END OF SPECIFICATION



**Dunning
Thornton**
consultants

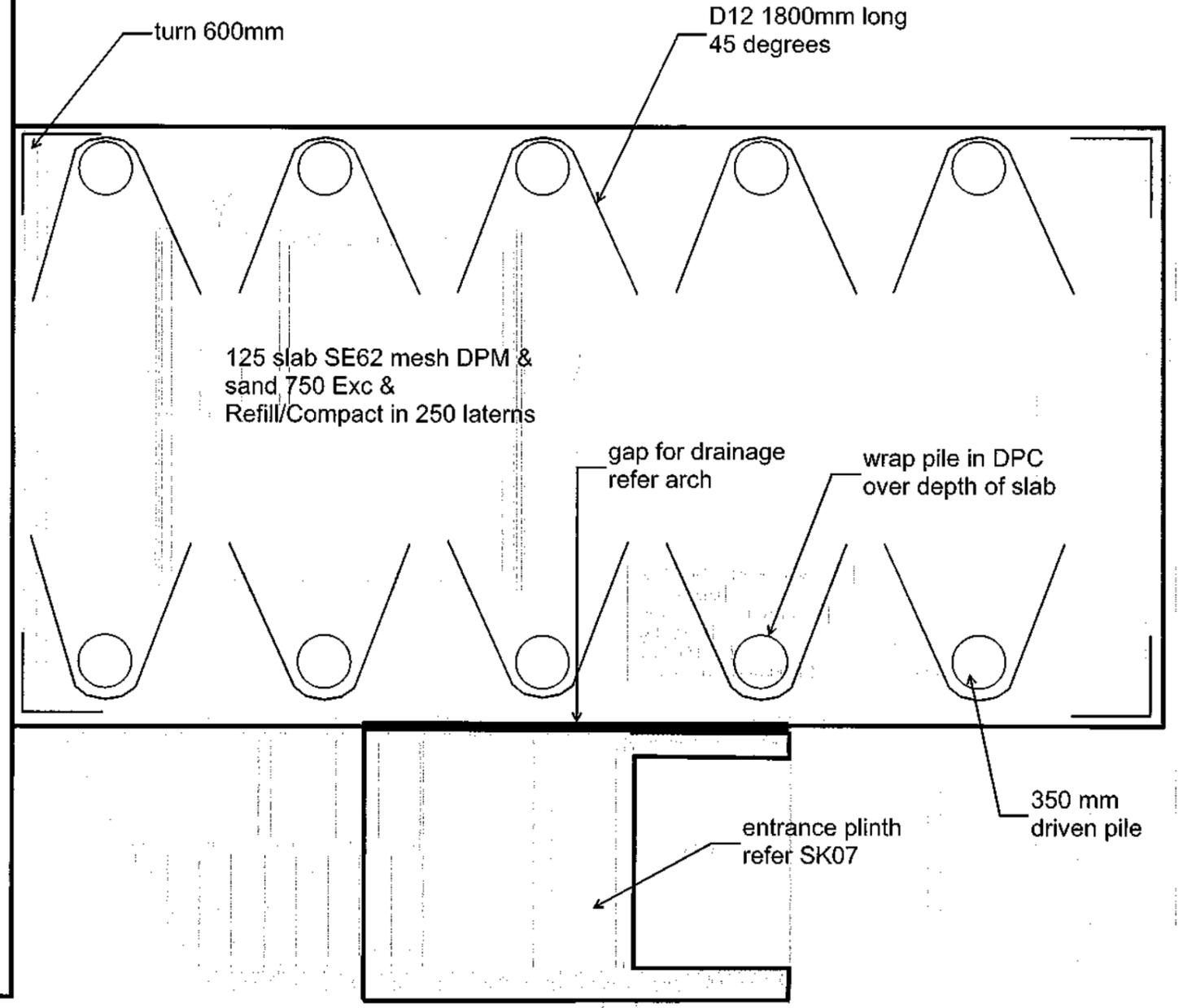
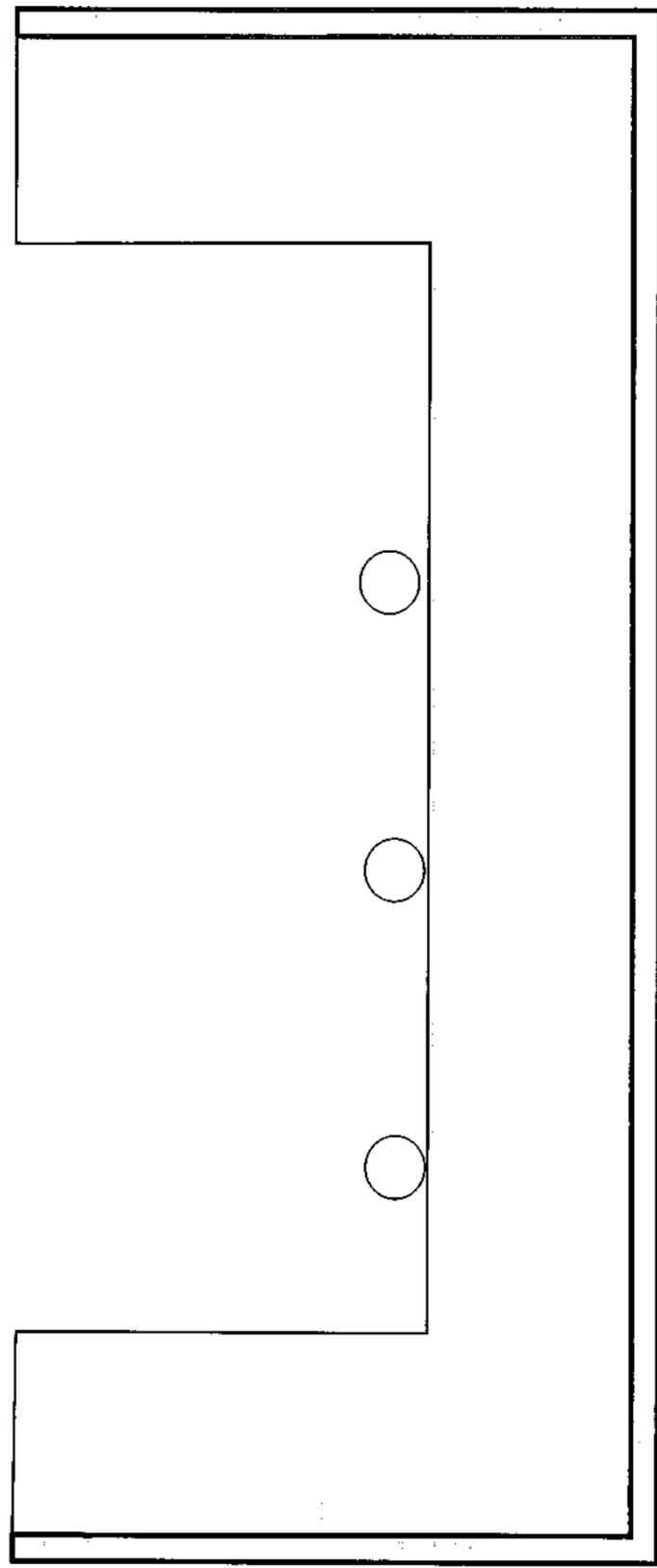
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwatn@dunningthornton.co.nz



SKETCH

JOB NAME:		7 TUTERE ST.		
JOB NO:	DRAWN BY:	DATE:	SKT NO:	
7370	CaS	11-2013	SK - 01	

Revision : A



FOUNDATION PLAN



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dtcwgt@DunningThornton.co.nz

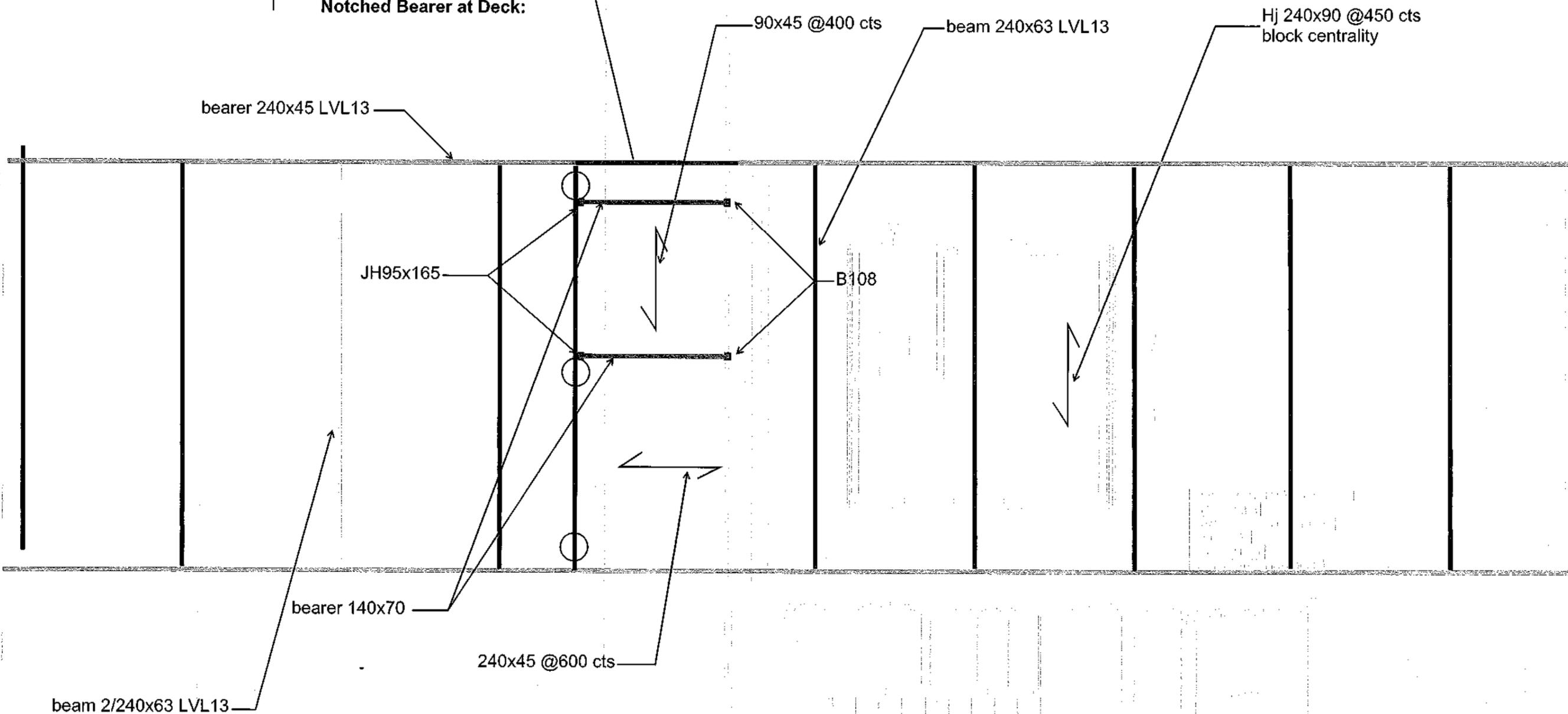
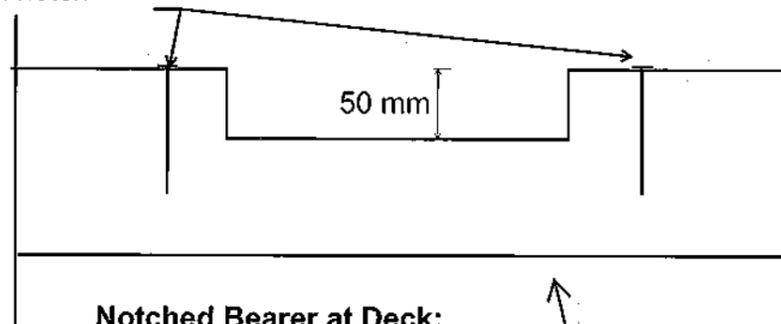


SKETCH

JOB NAME:		7 TUTERE ST.	
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 02

Revision : A

14gx100 mm, 50mm
back from notch



GROUND FLOOR PLAN



**Dunning
Thornton**
consultants

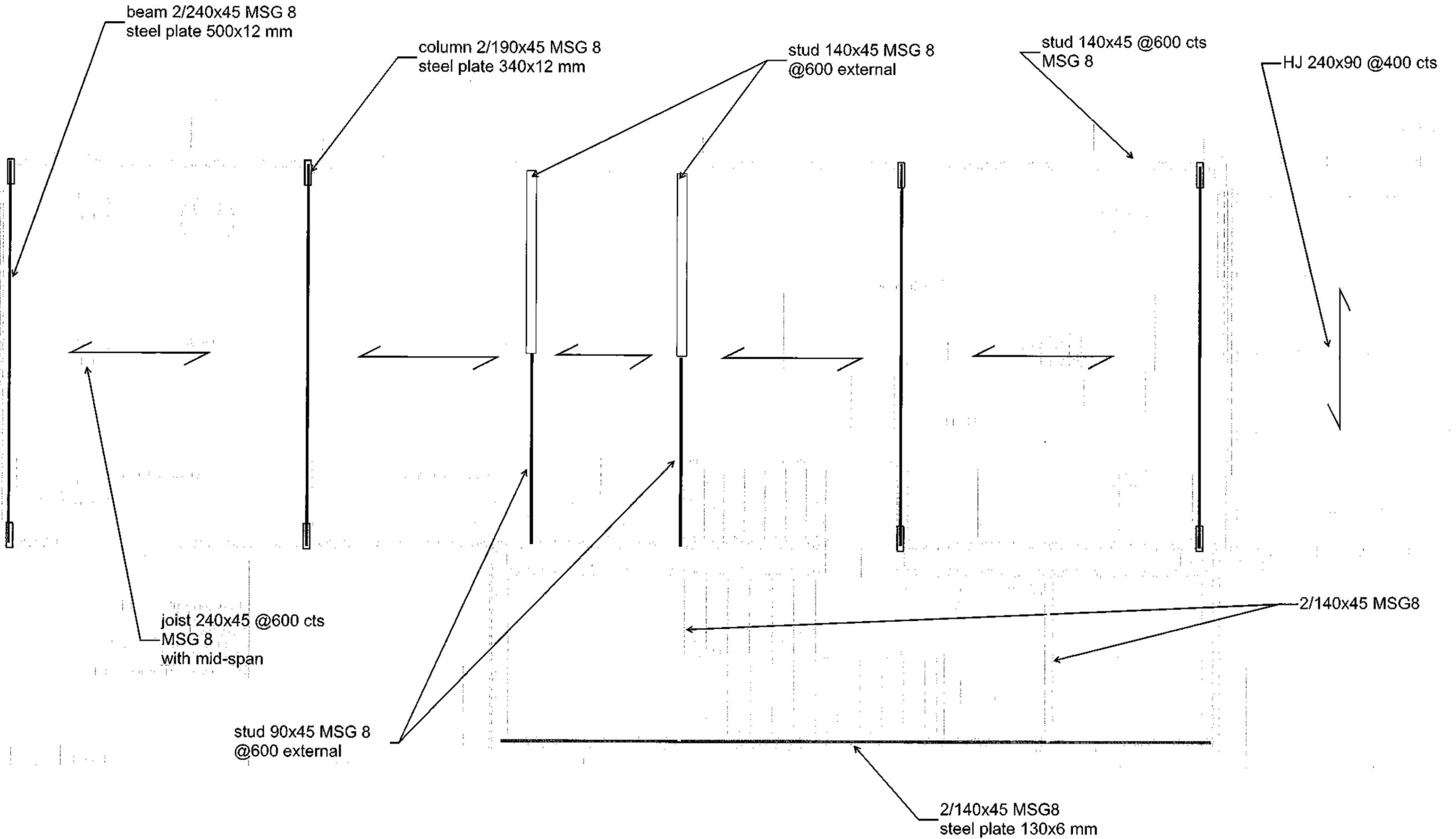
Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dlcwgtn@dunningthornton.co.nz



SKETCH

JOB NAME:		7 TUTERE ST.		
JOB NO:	DRAWN BY:	DATE:	SKT NO:	
7370	CaS	11- 2013	SK - 03	

Revision : A



FIRST FLOOR PLAN



**Dunning
Thornton**
consultants

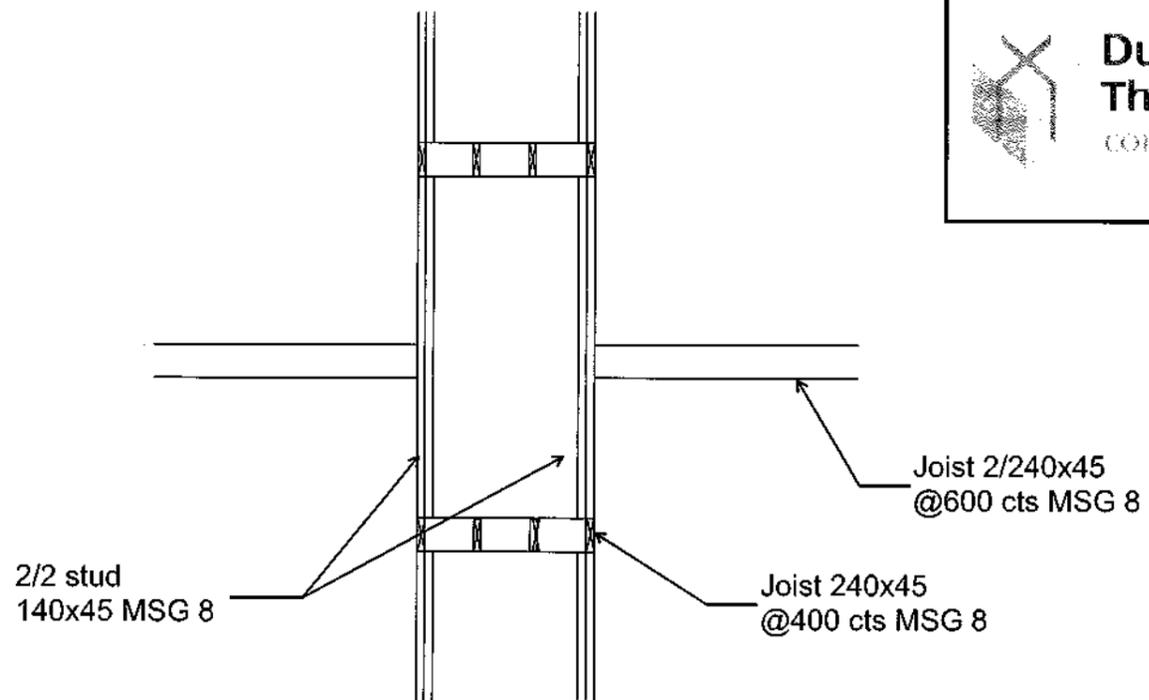
Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dtcwgt@DunningThornton.co.nz



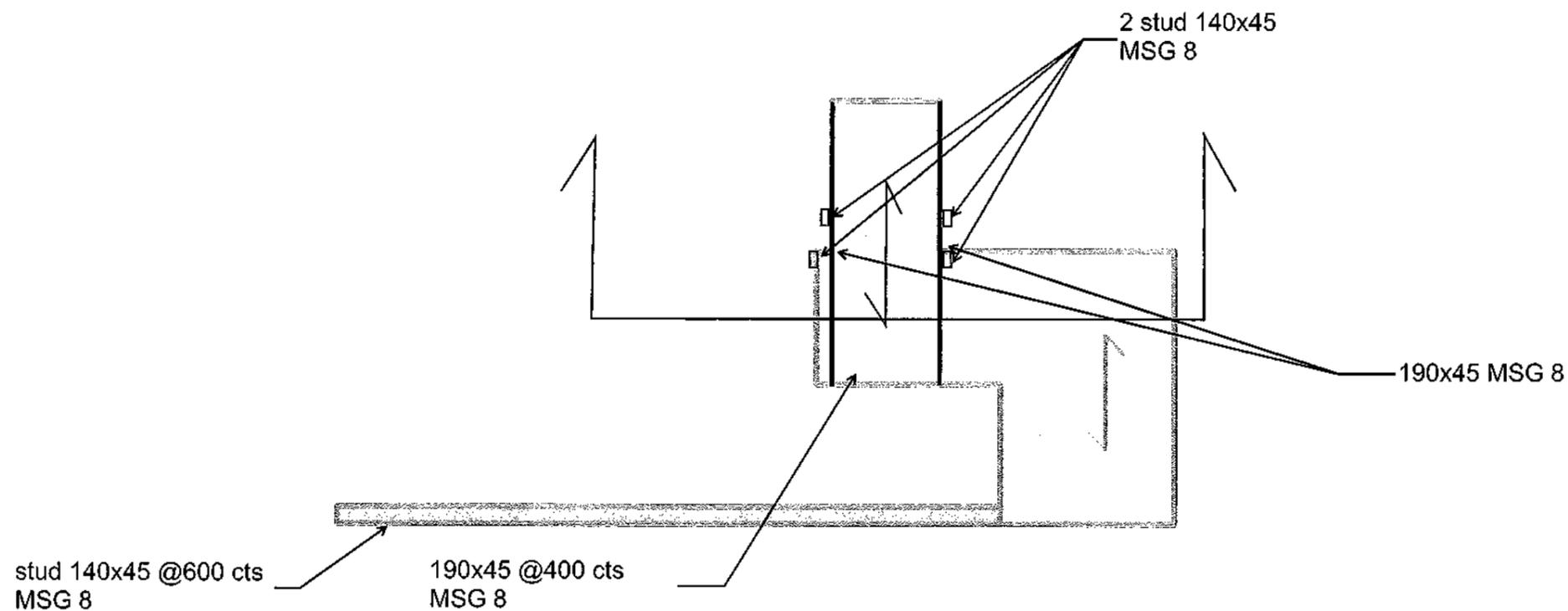
SKETCH

JOB NAME:		7 TUTERE ST.	
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 03a

Revision : A



MIDDLE FLOOR PLAN





**Dunning
Thornton**
consultants

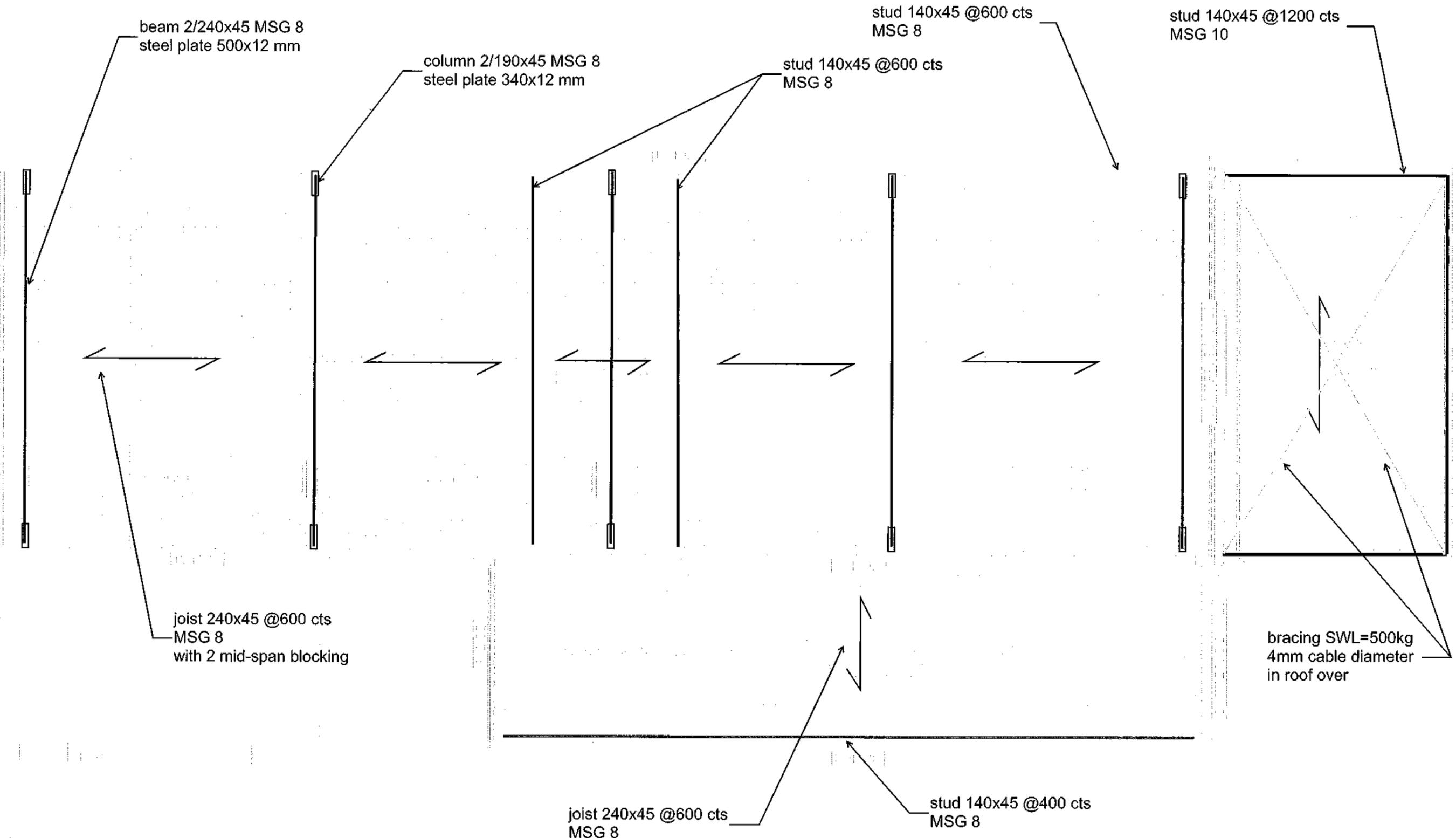
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcw@dn.dunningthornton.co.nz



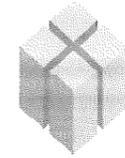
SKETCH

JOB NAME:		7 TUTERE ST.	
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 04

Revision : A



ROOF PLAN



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwqtn@dunningthornton.co.nz



SKETCH

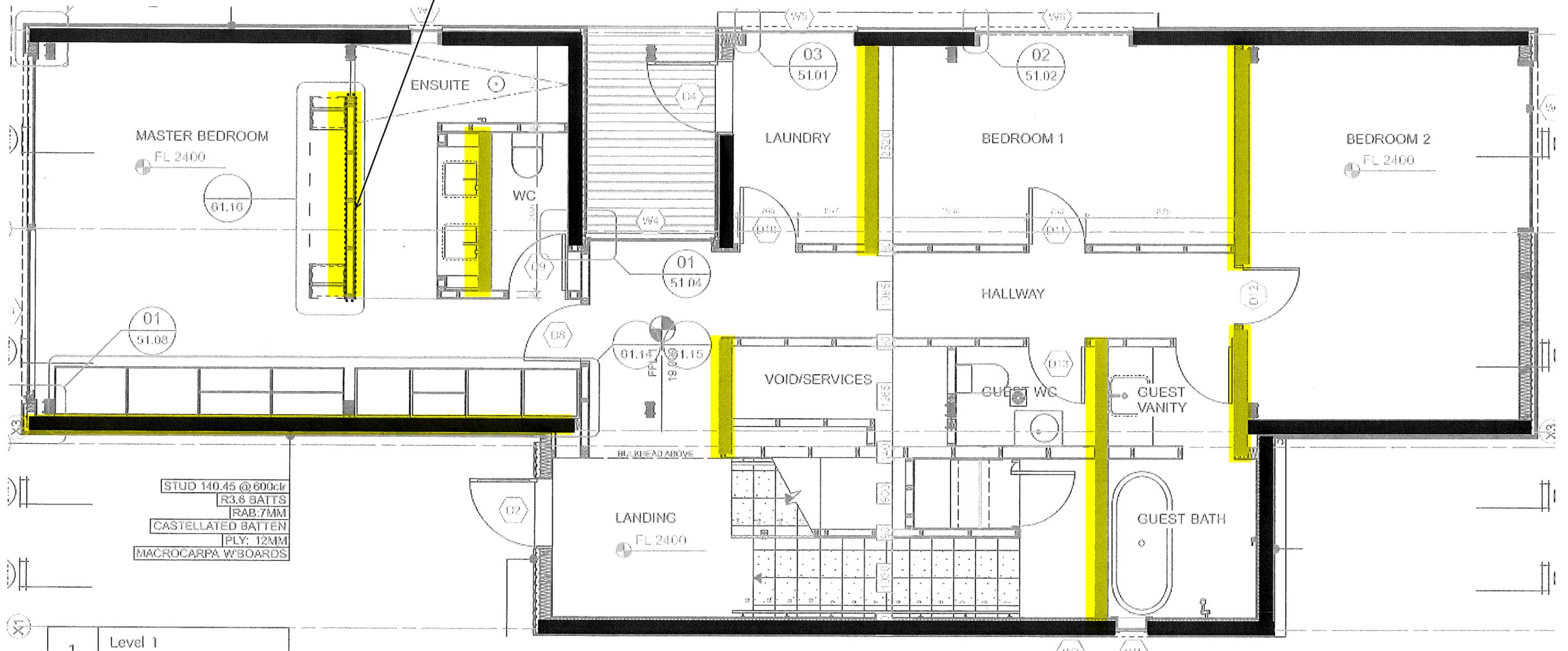
JOB NAME:	7 TUTERE ST.		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 05

Revision : A

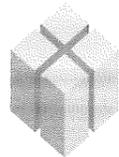
EP1 (plyrab)

BL1-H

2.5 nails @ 50mm /1ply
2.5 nails @ 50mm /2ply (both sides)



BRACING WALLS GROUND FLOOR 1/2



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dtcwgt@DunningThornton.co.nz

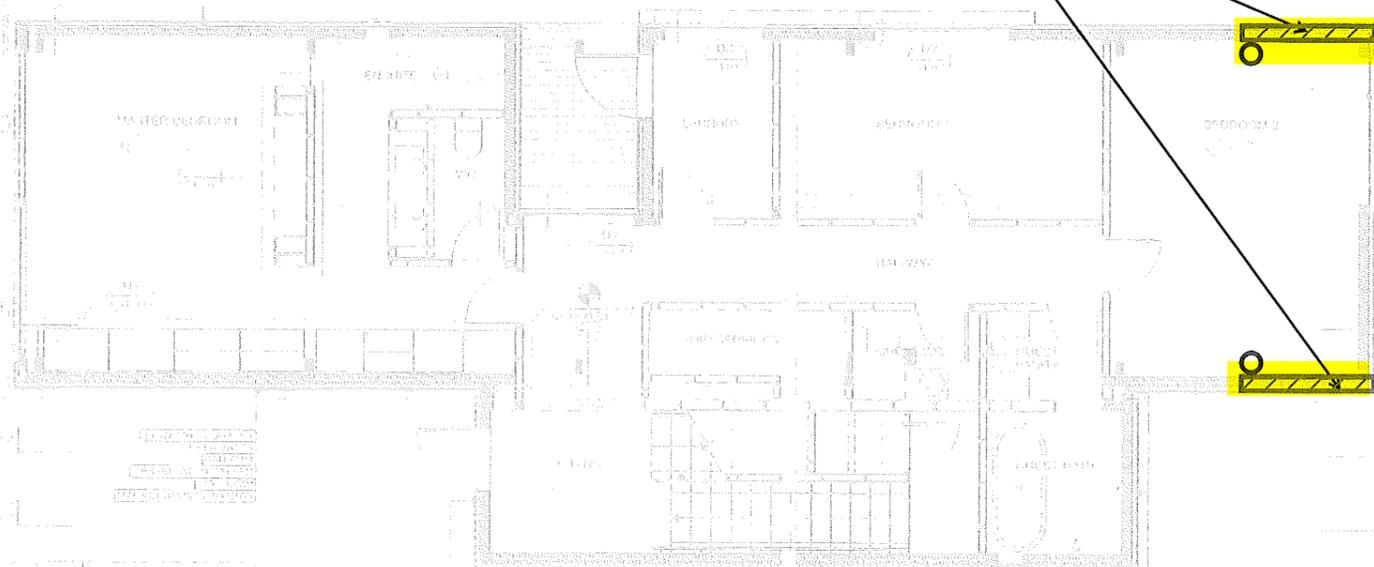


SKETCH

JOB NAME:		7 TUTERE ST.	
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 05a

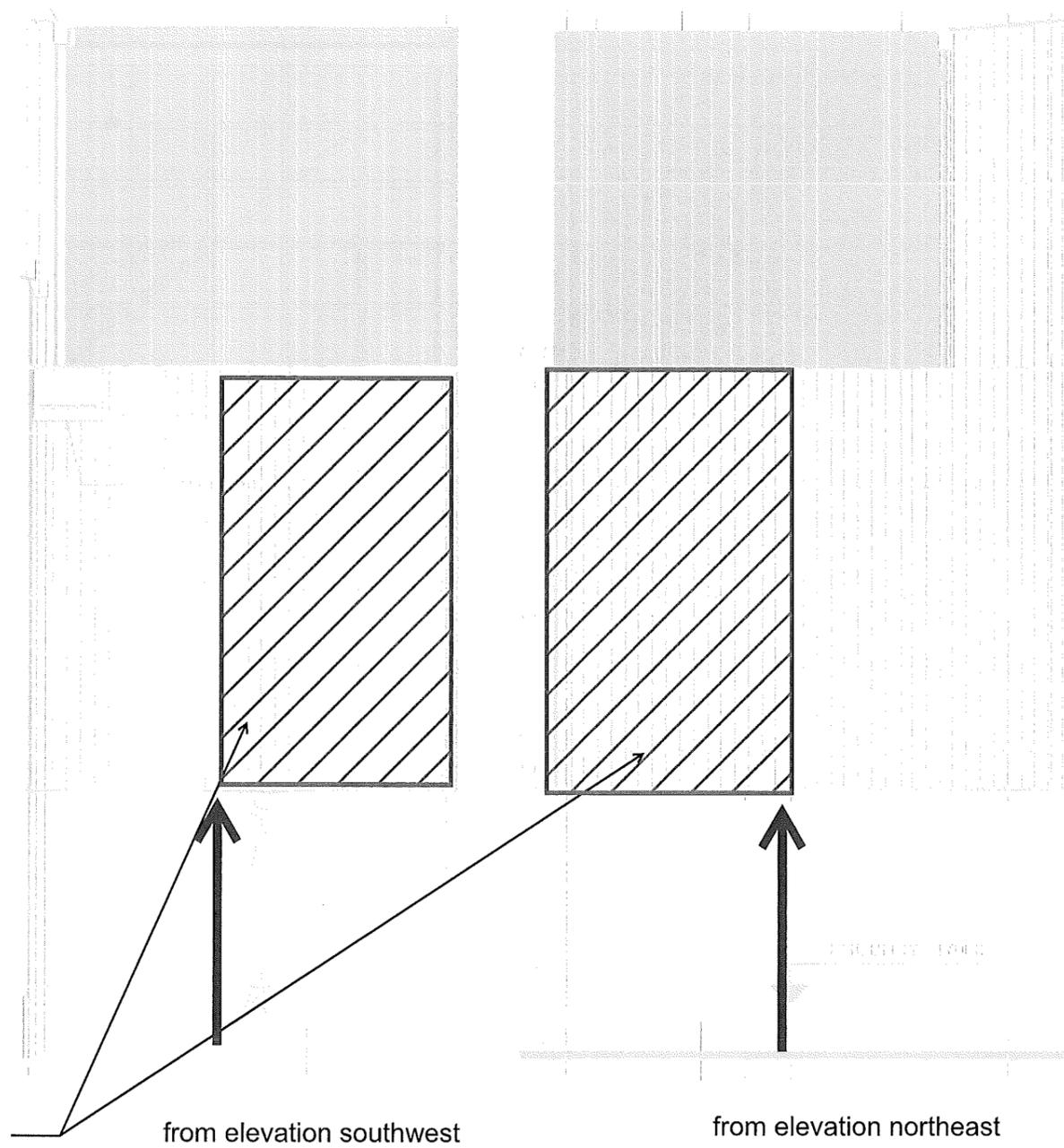
Revision : A

glued from the exterior of the pile



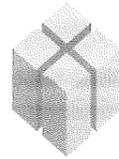
BRACING WALLS GROUND FLOOR 2/2

glued from the exterior of the pile



from elevation southwest

from elevation northeast



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dunningthornton@dtcwgtn.co.nz

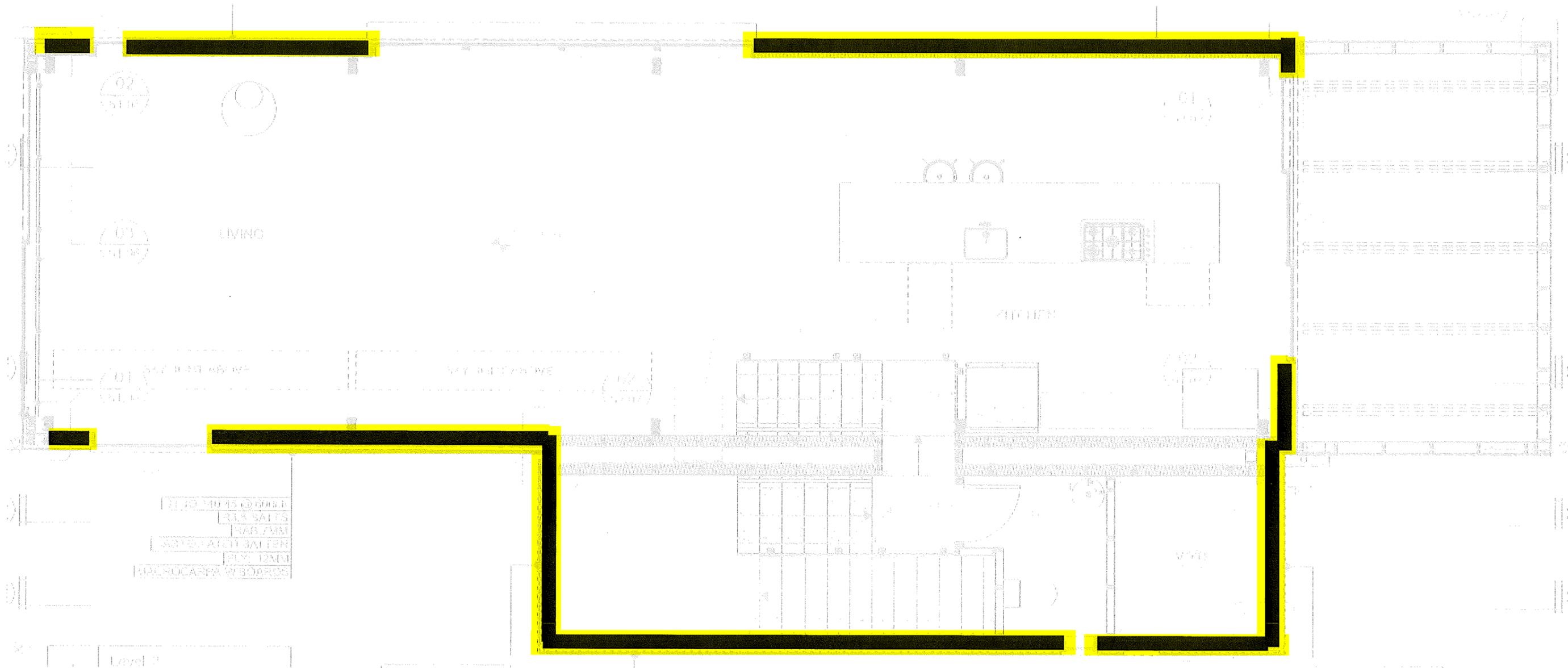


SKETCH

JOB NAME:		7 TUTERE ST.		
JOB NO:	DRAWN BY:	DATE:	SKT NO:	
7370	CaS	11-2013	SK - 05b	

Revision : A

EP1 (plyrab)



BRACING FIRST FLOOR



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgn@dunningthornton.co.nz

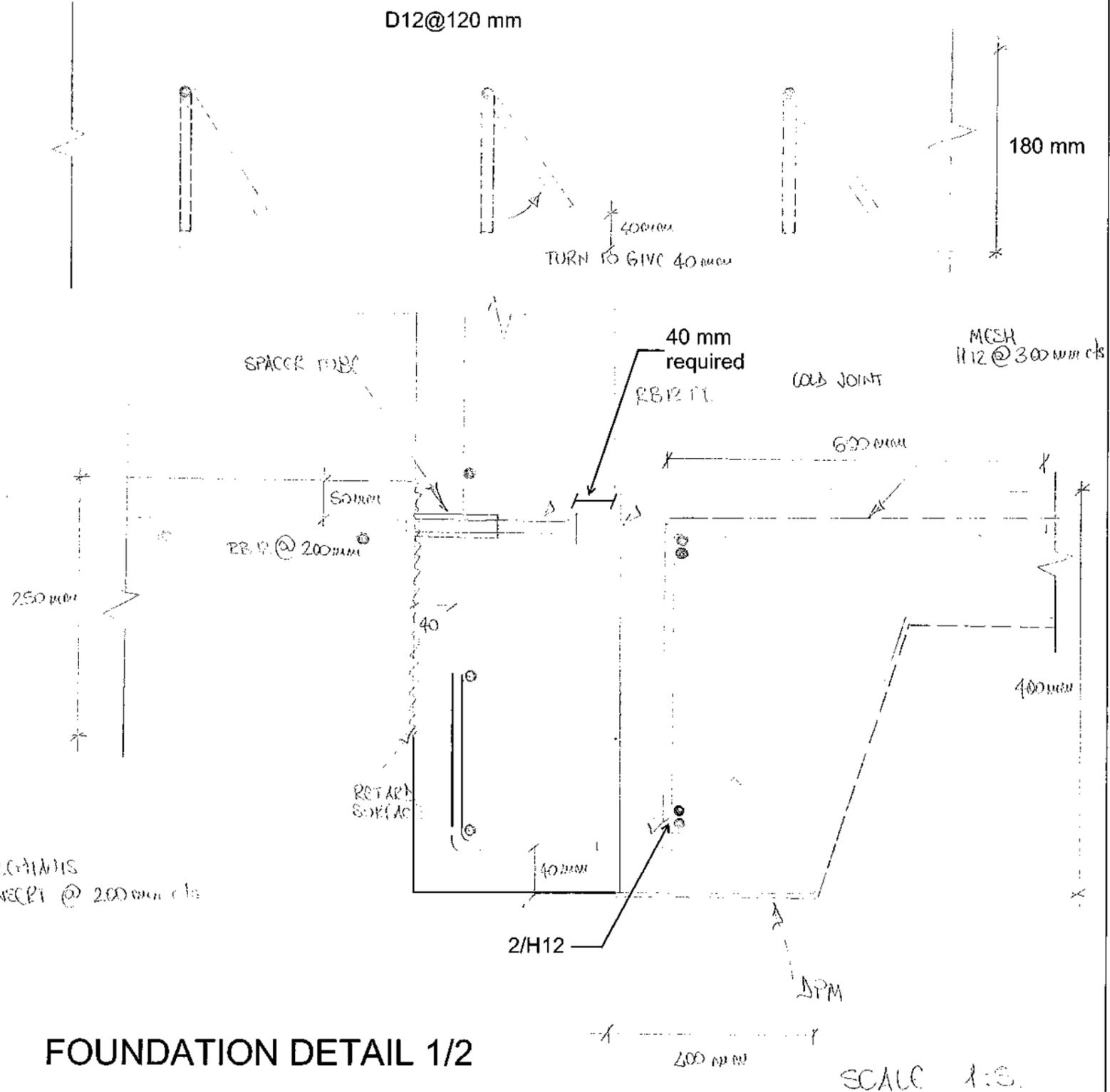
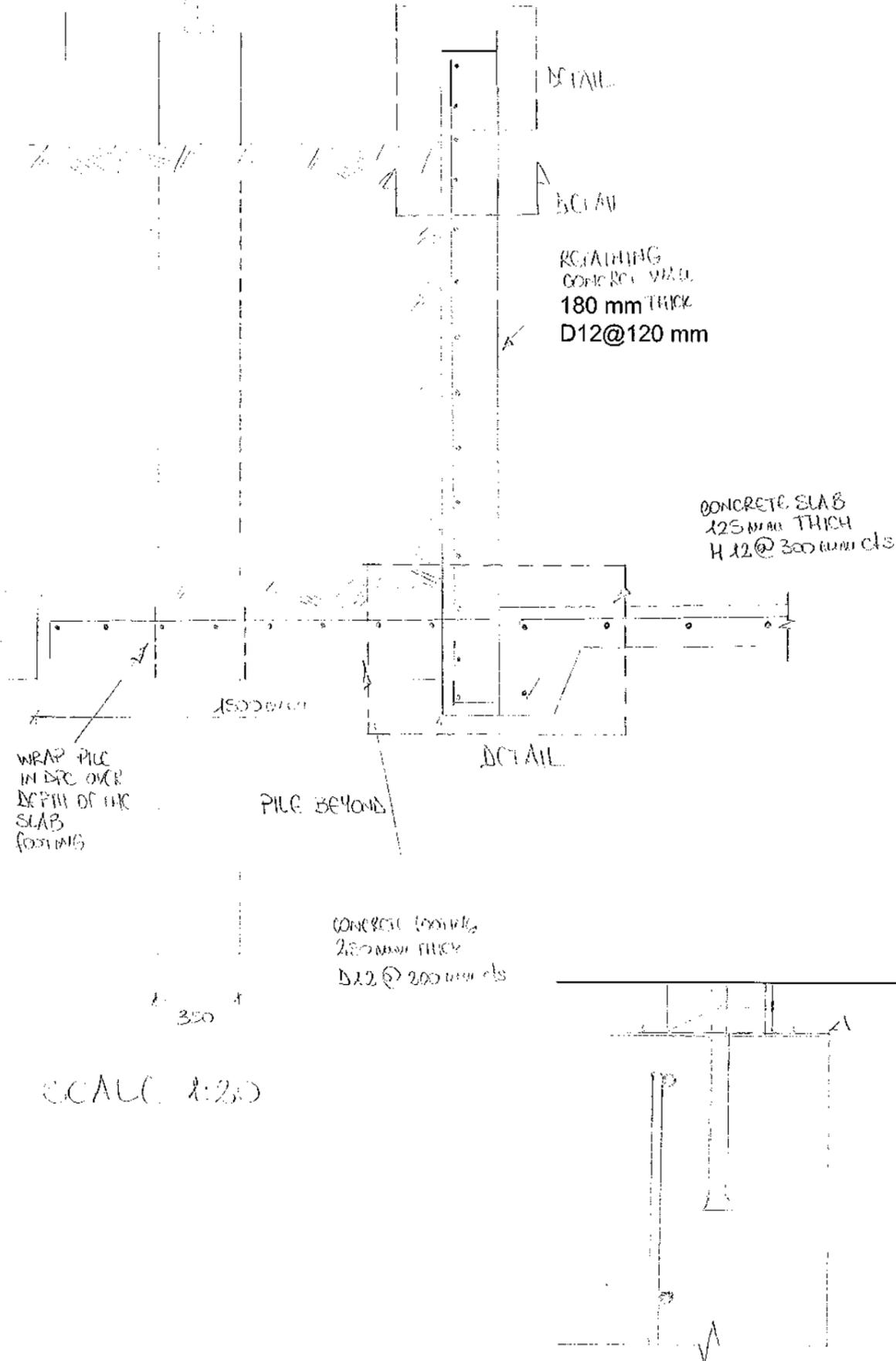


Revision : A

SKETCH

JOB NAME:	E TOILET SK		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
1310	CS	11-2013	SK - 06

WALL PLANE SECTION



FOUNDATION DETAIL 1/2



**Dunning
Thornton**
consultants

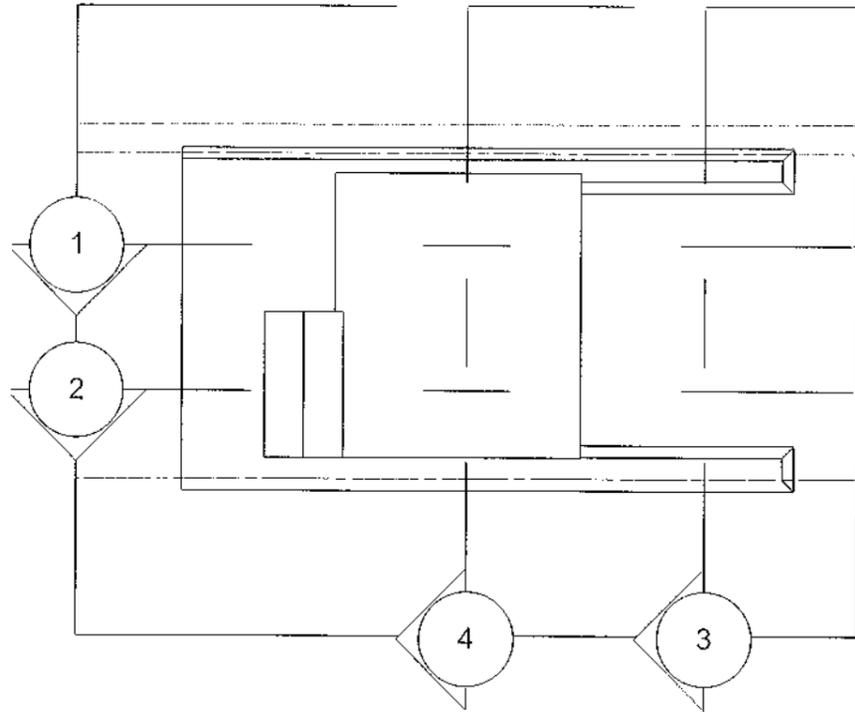
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgn@dunningthornton.co.nz



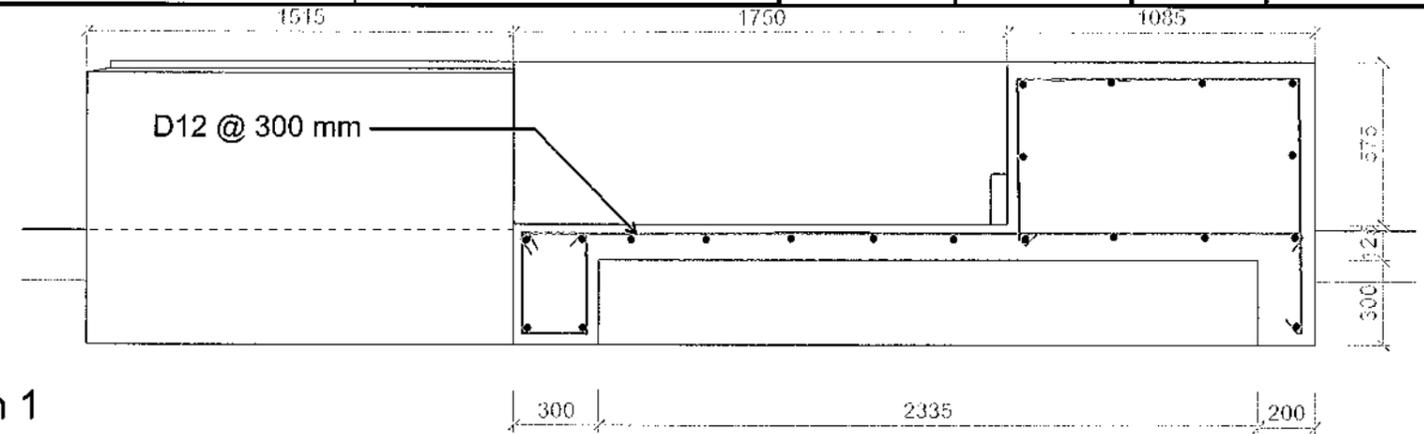
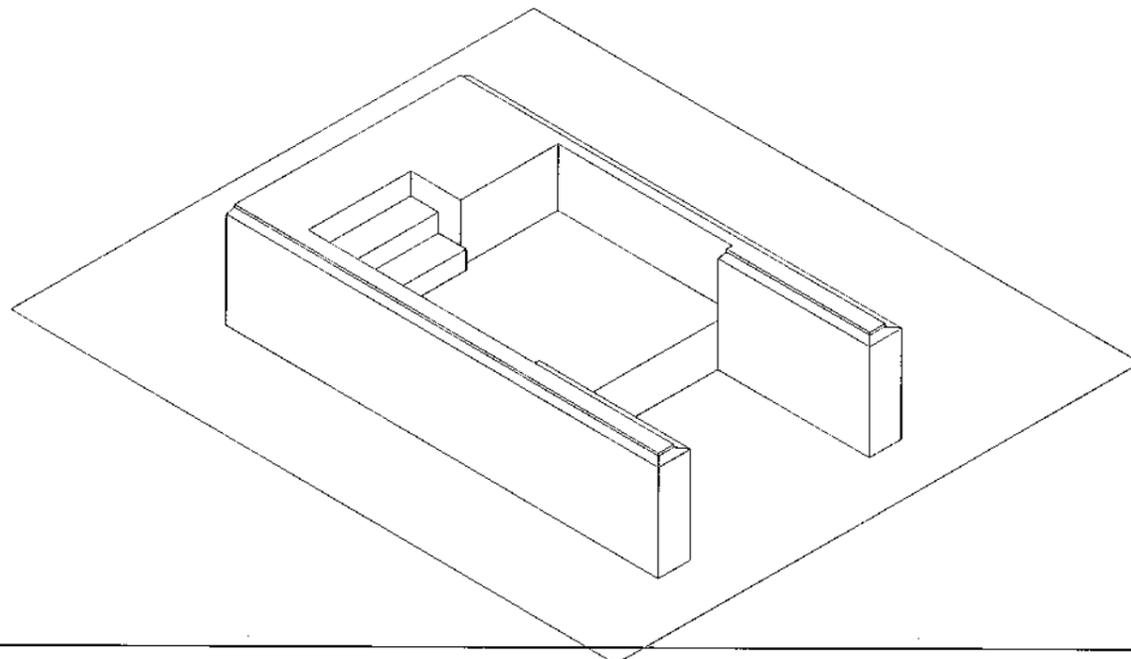
SKETCH

JOB NAME: 7 TUTERE ST.	
JOB NO: 7370	DRAWN BY: CaS
DATE: 11-2013	SKT NO: SK - 07

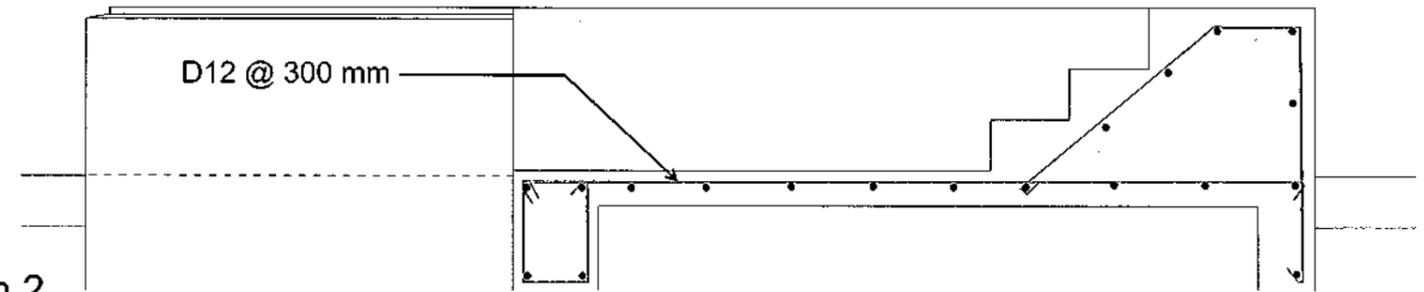
Revision : A



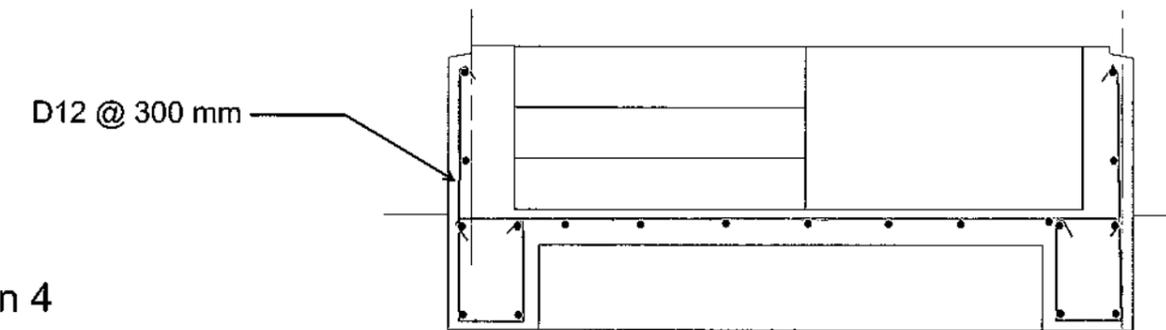
FOUNDATION DETAIL 2/2



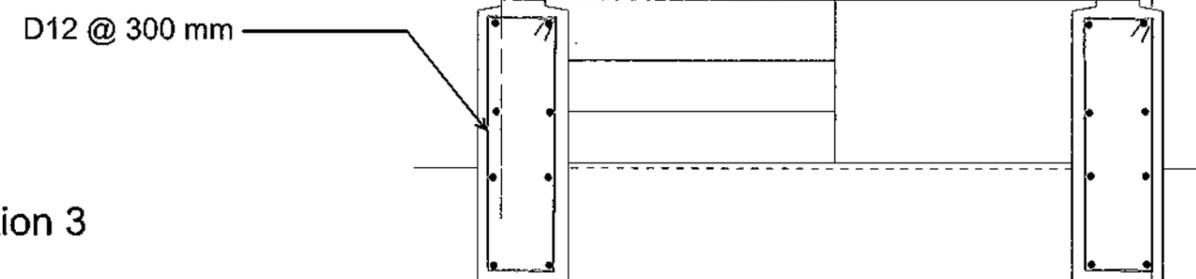
section 1



section 2



section 4



section 3



**Dunning
Thornton**
consultants

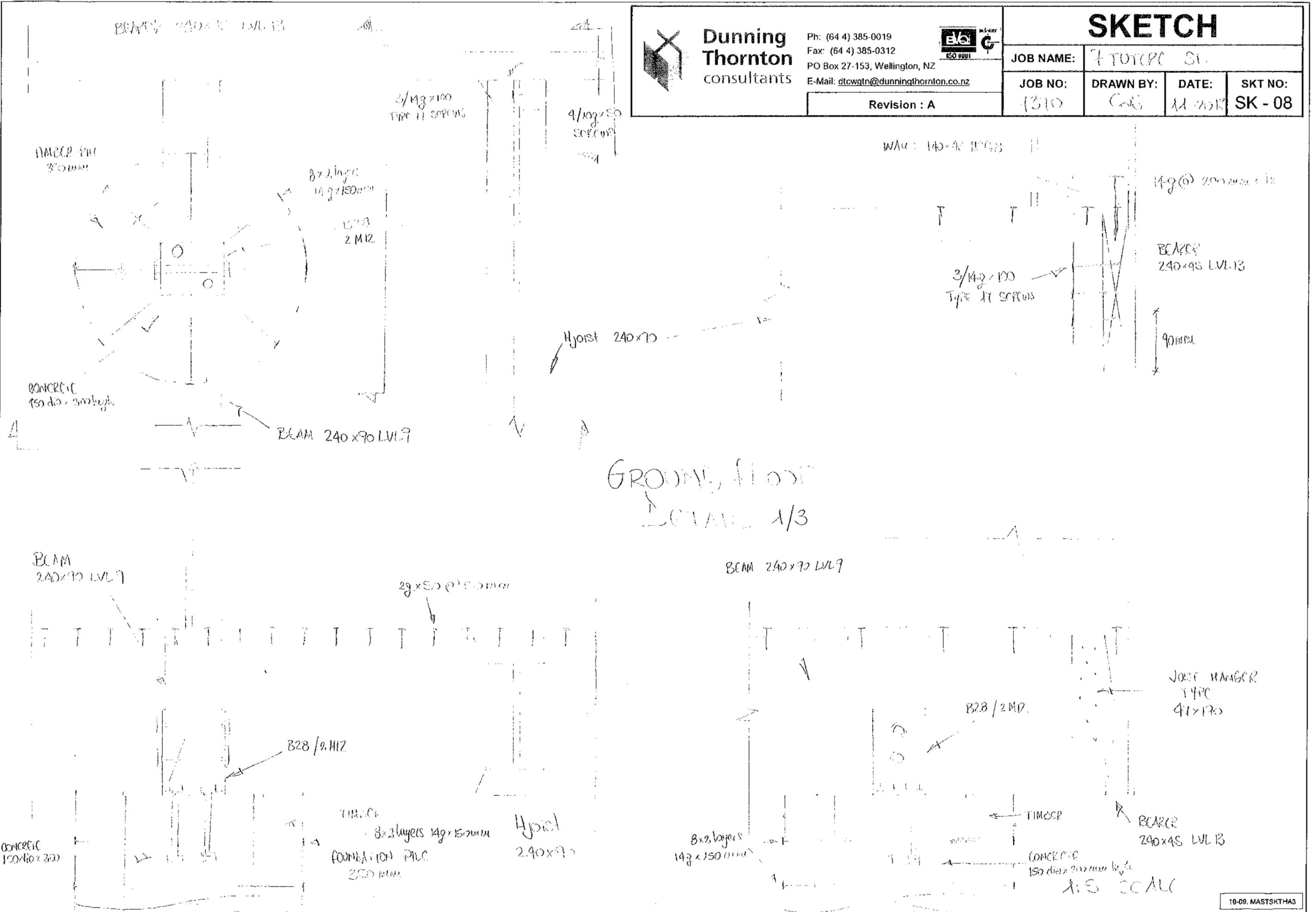
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgn@dunningthornton.co.nz



Revision : A

SKETCH

JOB NAME:	7 TUTOR ST.		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
1310	CAS	11/2012	SK - 08



GROUND FLOOR
SECTION 1/3



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgt@DunningThornton.co.nz

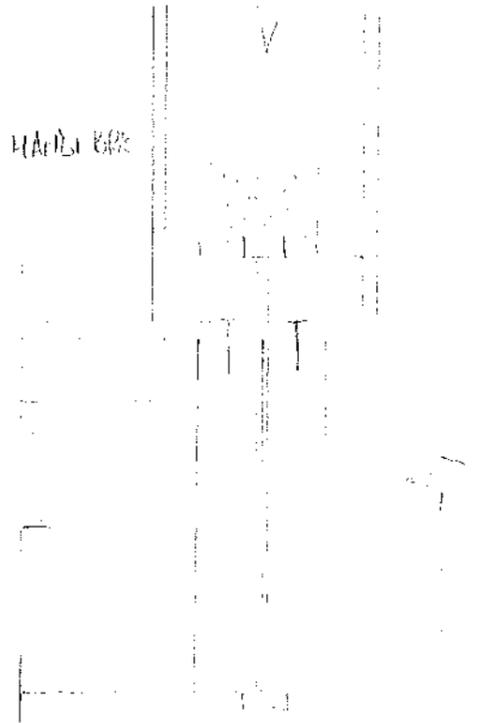


Revision : A

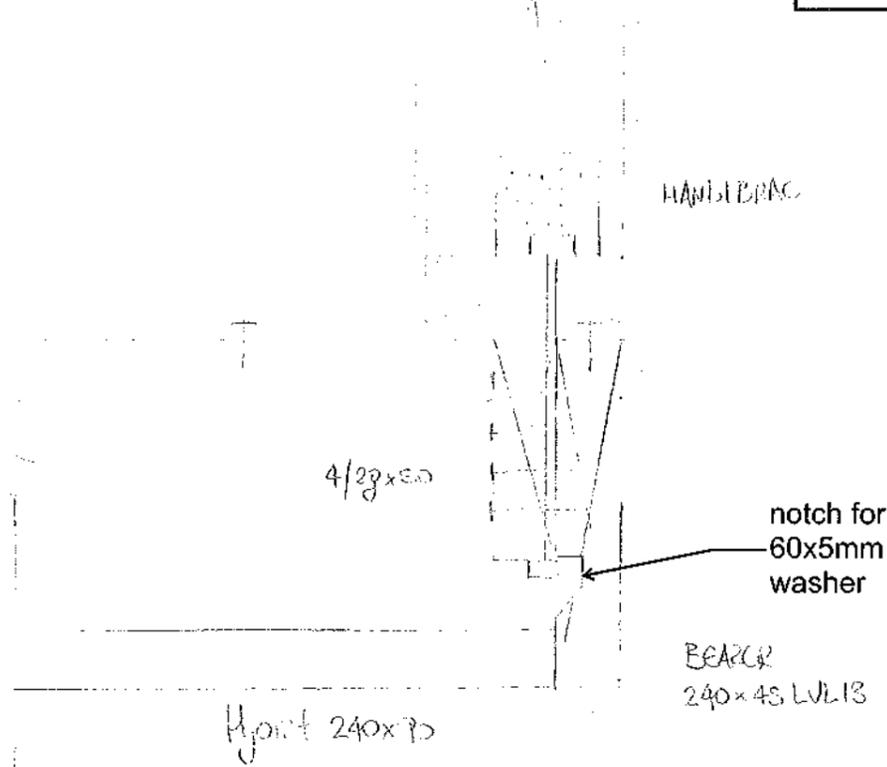
SKETCH

JOB NAME:	7 TOWER		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	Cas	11/2013	SK - 09

WALL: 140x45 MSCB

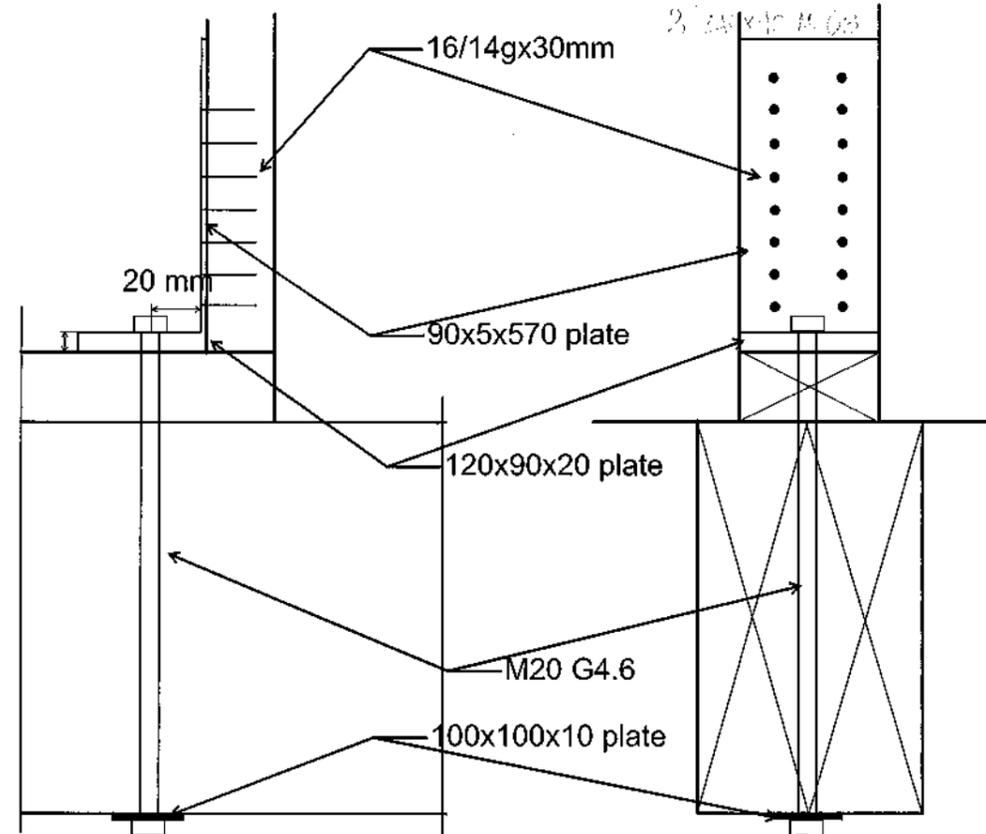


MIDDLE DETAIL

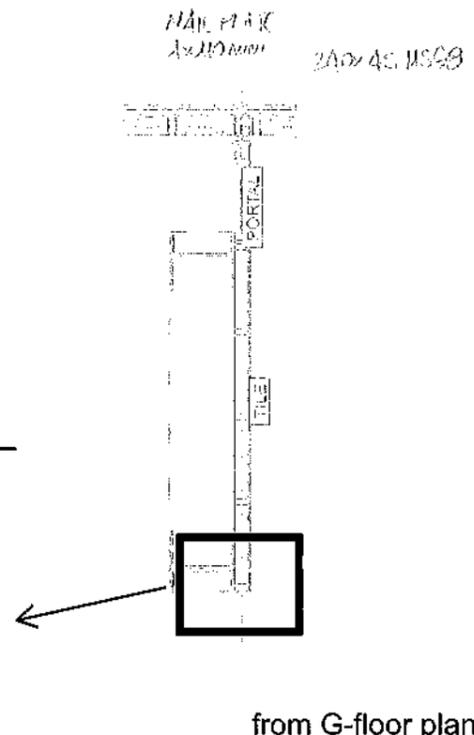
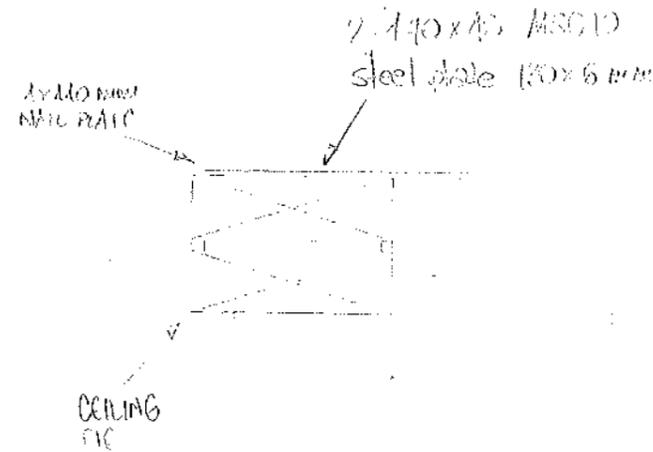


EDGE DETAIL

GROUND FLOOR DETAIL 2/3



STAIRS: TRANSOM



from G-floor plan



**Dunning
Thornton**
consultants

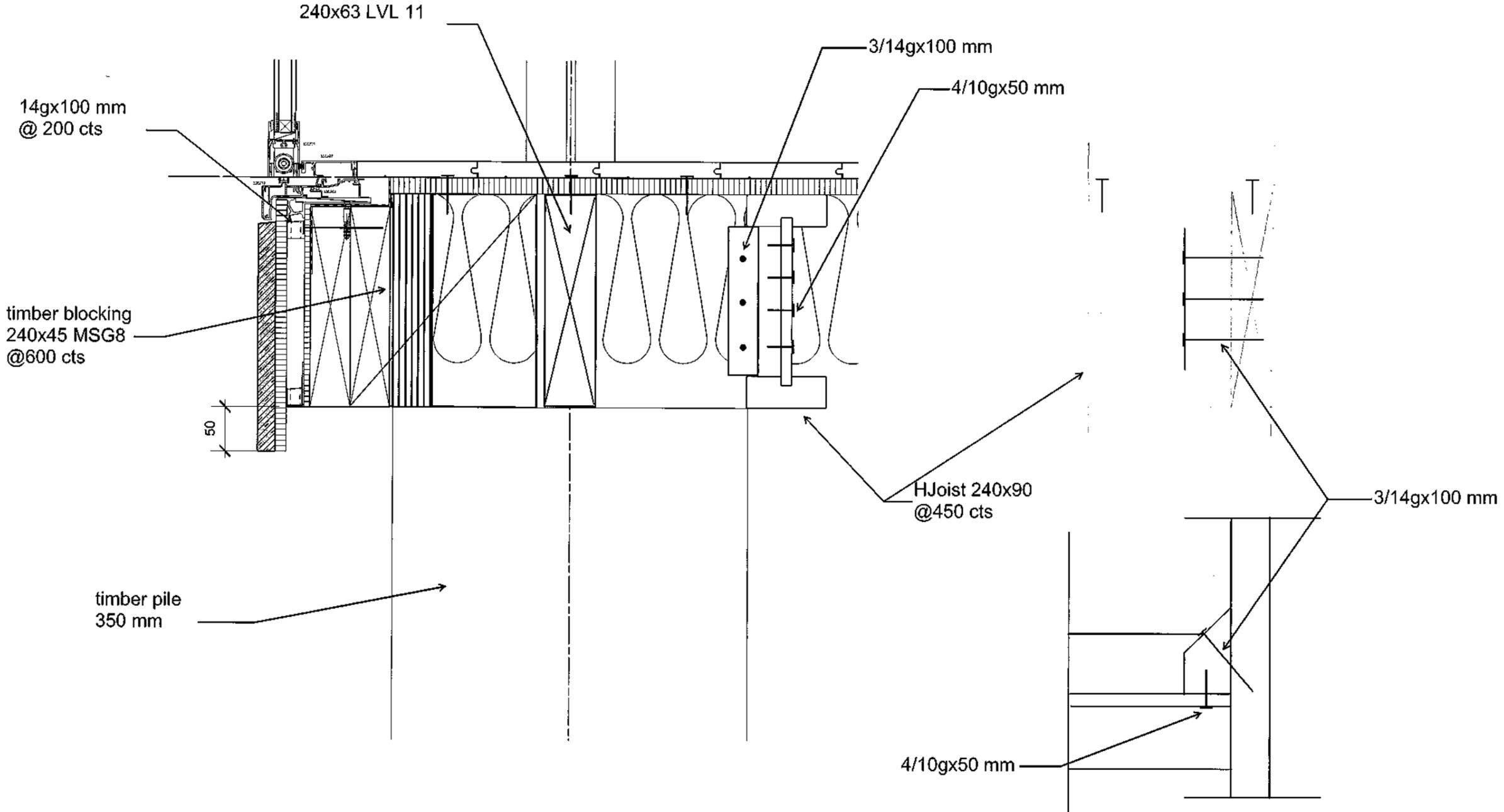
Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27-153, Wellington, NZ
 E-Mail: dtcwgn@dunningthornton.co.nz



SKETCH

JOB NAME:		7 TUTERE ST.	
JOB NO:	DRAWN BY:	DATE:	SKT NO:
7370	CaS	11-2013	SK - 10

Revision : A



GROUND FLOOR DETAIL 3/3



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgtn@dunningthornton.co.nz



Revision : A

SKETCH

JOB NAME:	7 TUTERE ST		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
1310	CaS	1/10/2005	SK - 11

2 M12 bolt @ refer to the architect's drawings for set-out

joist 240x45 @600 cts
MSG 8
with mid-span

PORTAL @ FLOOR

beams 2/240x45 MSG8
steel plate 500x12 mm

FIRST FLOOR DETAIL 1/3

2 M12 bolt @ refer to the architect's drawings for set-out

block 140x45 MSG8
@1000 cts

stud 140x45 MSG8
@600 cts

sheet brace strap
3 nails E.S. of joint

PORTAL @ WALL

column 2/190x45 MSG8
steel plate 340x12 mm

from ground floor plan

from long section 4

FIRST FLOOR DETAIL 2/3



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dtcwgn@dunningthornton.co.nz



SKETCH

JOB NAME:	7-TUTERU SE		
JOB NO:	DRAWN BY:	DATE:	SKT NO:
1370	CWB	10/1/2013	SK - 12

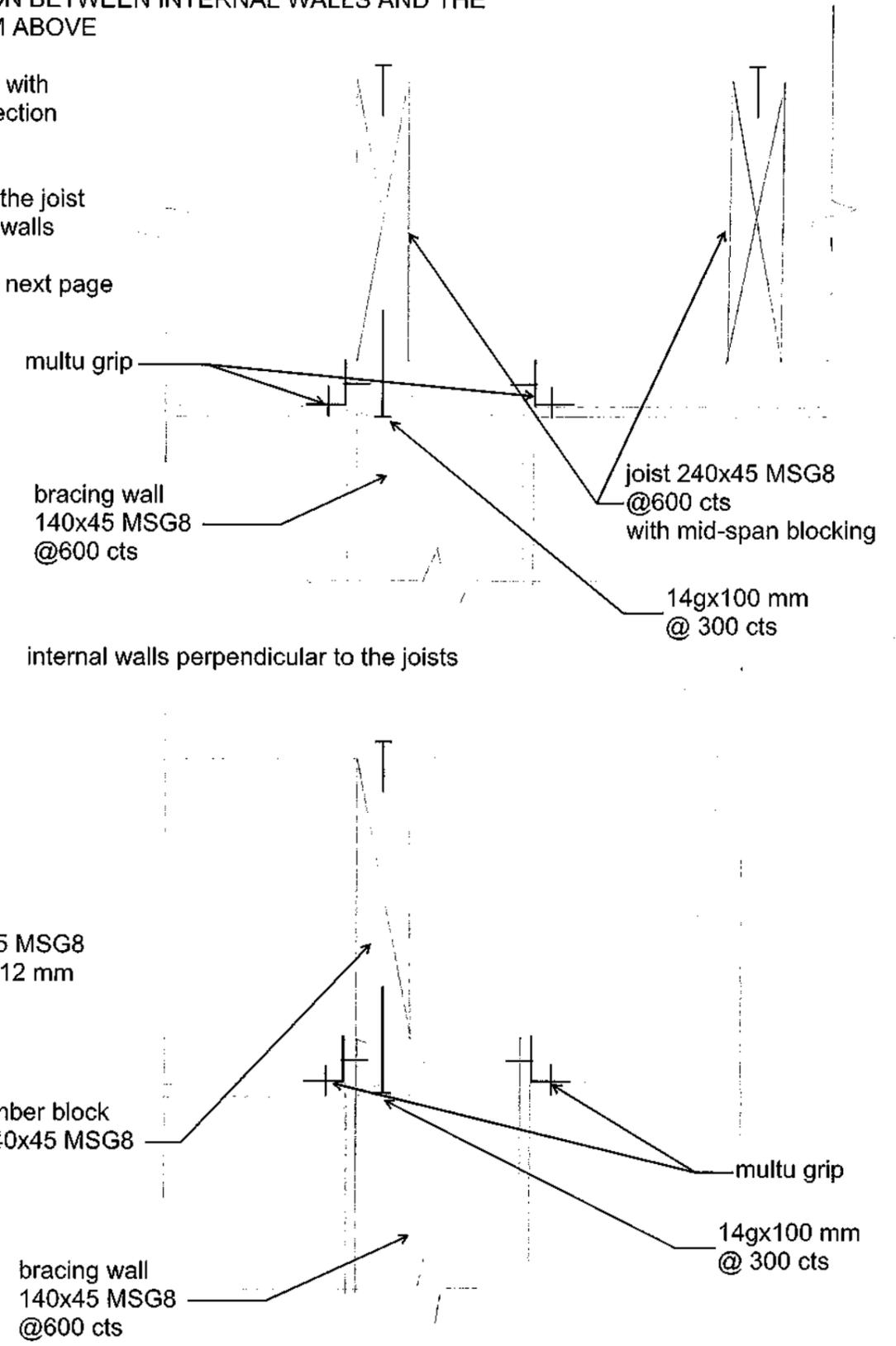
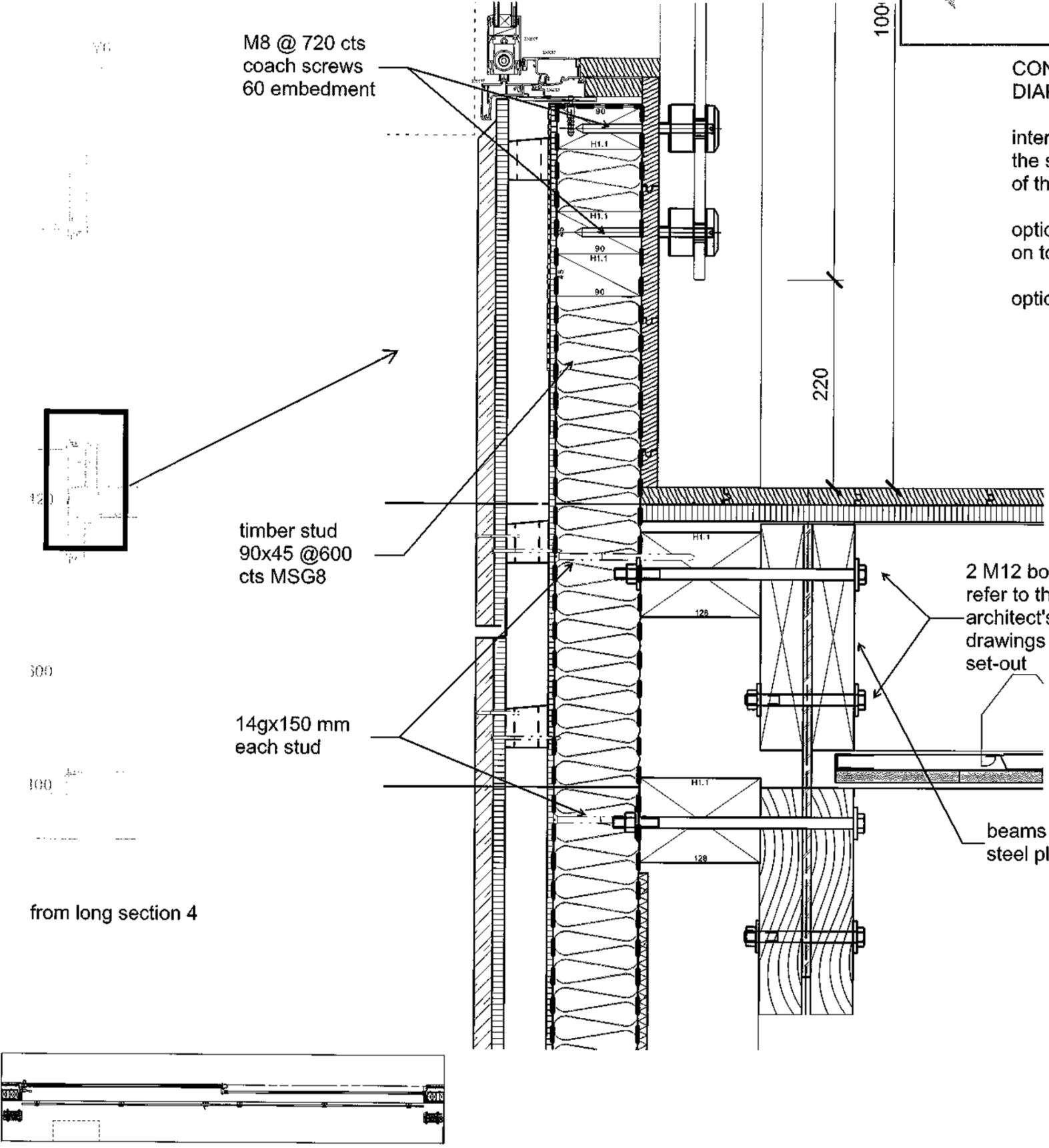
Revision : A

CONNECTION BETWEEN INTERNAL WALLS AND THE DIAPHRAGM ABOVE

internal walls with the same direction of the joists

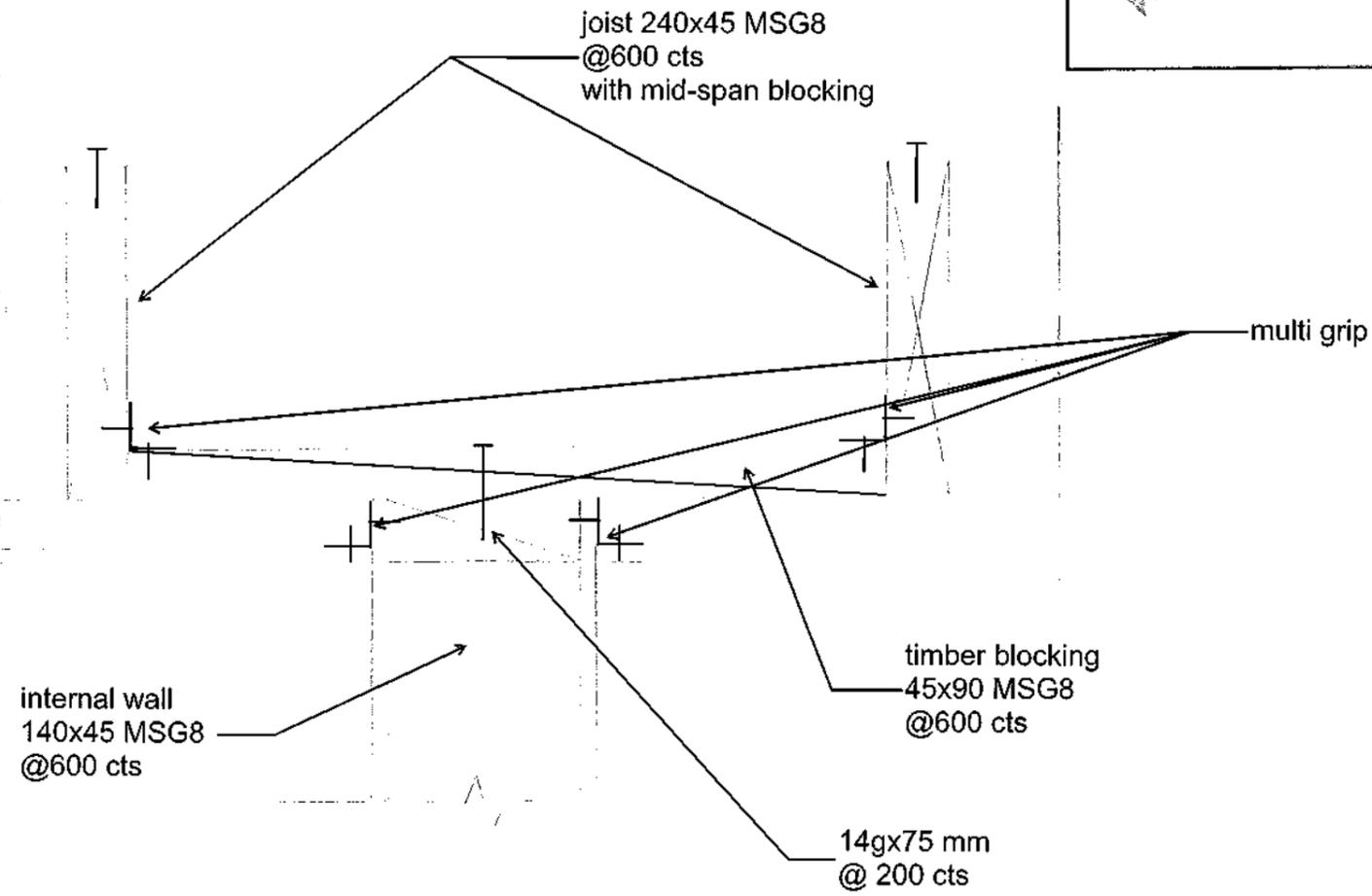
option 1) put the joist on top of the walls

option 2) see next page

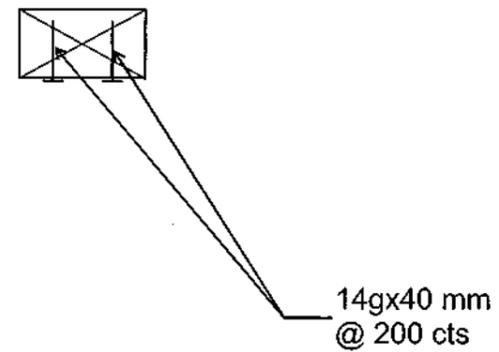


CONNECTION BETWEEN INTERNAL WALLS AND THE DIAPHRAGM ABOVE

option 2)



FIRST FLOOR DETAIL 3/3



SKETCH

 Dunning Thornton consultants	Ph: (64 4) 385-0019 Fax: (64 4) 385-0312 PO Box 27-153, Wellington, NZ E-Mail: dlcwqtn@dunningthornton.co.nz		JOB NAME: 7 TUICRE ST		
	Revision : A	JOB NO: 7370	DRAWN BY: CAS	DATE: Nov 2008	SKT NO: SK - 13



from long section 4

from long section 4



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27-153, Wellington, NZ
E-Mail: dctwgn@dunningthornton.co.nz

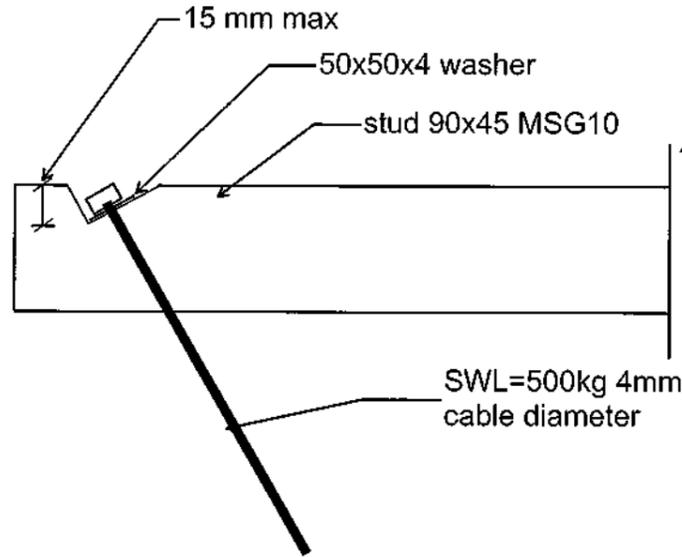


Revision : A

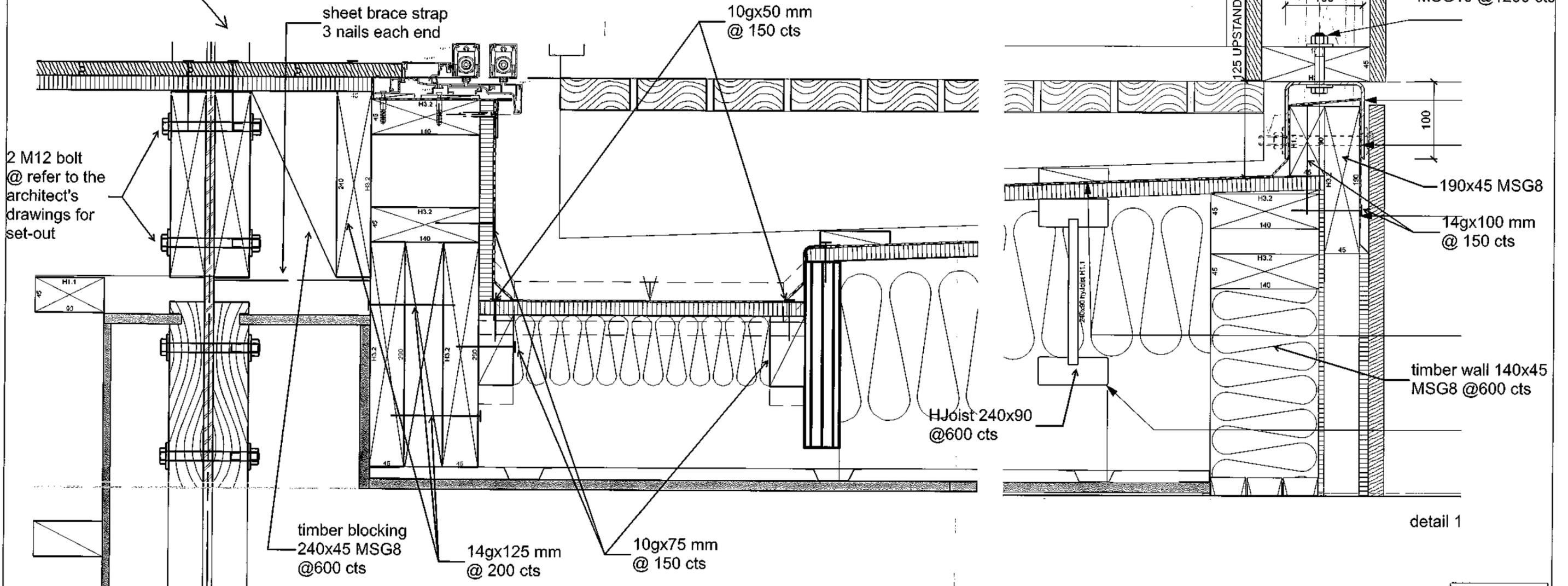
SKETCH

JOB NAME:	7 TOROKA ST		
JOB NO:	1310	DRAWN BY:	CAS
DATE:	NOV-2005	SKT NO:	SK - 14

DECK DETAIL



detail 1



RECEIVED
13 JAN 2014
BY: SH

10380077

CALCULATIONS

NEW HOUSE
AT
7 TUTERE ST, WAIKANAЕ
FOR
SHANE O'BRIEN

JOB NO: 7370

DATE: DEC 2013



**Dunning
Thornton**
consultants

Dunning Thornton Consultants Ltd
Consulting Structural Engineers
Project & Construction Consultants





Quality Plan Checklist - Calculations

Job No. 7370	PS1 to be issued? <input checked="" type="checkbox"/> Y/N	FILE COPY TO REMAIN IN COMMISSION FILE
---------------------	--	--

Building Consent Authority

DTC Contact Name

Other Engineers (Name / Initials)

KCDE	
ALISTAIR CATTANACH	
CRISTINA SOCCORSI	CaS

NZBC Verification Method B1/VM1

(Current Standards at time of Design Review unless noted otherwise)

(✓)

AS/NZS1170	Structural Design Actions	✓
Part 0	General Principles	✓
Part 1	Permanent, imposed and other actions	✓
Part 2	Wind actions	✓
Part 3	Snow and ice actions	✓
Part 5	Earthquake actions – New Zealand	✓
NZS 3101	Concrete Structures Standard	✓
NZS 3404	Steel Structures Standard	✓
NZS 3603	Timber Structures Standard	✓
NZS 4230	Design of Reinforced Concrete Masonry Structures	✓

NZBC Acceptable Solutions B1/AS1, B1/AS2

(✓)

NZS 3604	Timber Framed Buildings	✓
NZS 4229	Concrete Masonry Buildings	✓
NZBC AS2	Timber Barriers	✓
Scope of Structural Design	Part (eg. Level 1 joists, garage roof, bracing to extension only)	Full
Bracing	ELEMENT CAPACITY/LOAD BY SPECIFIC DESIGN	✓
Foundations		
Floor and Deck Framing		
Roof and Ceiling Framing		
Pillars and Posts		
Barriers/Balustrades		

Alternative Solutions to the NZBC

(✓)

NZSEE	Assessment & Improvement of the Structural Performance of Buildings in Earthquakes	Primary Structure %NBS =	Secondary Structure %NBS =

NZBC Verification Method B1/VM4

(✓)

(✓)

(✓)

Soil Parameter Source:	Assumption		Penetrometer Investigation	✓	Specialist Consultant
Site Verification by:	DTC		Contractor	✓	Specialist Consultant

Design Review	Concept	Prelim	Detailed
Date	10/12	10/12	10/12/2011
DIC / Engineer	/	/	/

Site Monitoring Levels	None	CM1	CM2	CM3	CM4	CM5
Primary Structure			✓			
Proprietary Structure	✓					



Building Code Clause(s).....B1.....

PRODUCER STATEMENT – PS1 – DESIGN

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

ISSUED BY:.....Dunning Thornton Consultants Ltd.....
(Design Firm)
TO:.....Shane O'Brien.....
(Owner/Developer)
TO BE SUPPLIED TO:.....Kapiti Coast District Council.....
(Building Consent Authority)
IN RESPECT OF:.....New House.....
(Description of Building Work)
AT:.....7 Tutere St, Waikanae.....
(Address)
LOT..... DP SO

All work carried out under jurisdiction of producer statement to meet the engineer's requirements fully. Engineer to sign off work supervision after construction

We have been engaged by the owner/developer referred to above to provide Structural Design of Specific Elements in respect of the requirements of (Extent of Engagement)

Clause(s) B1 - Structural.....of the Building Code for All [] or Part only [x] (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:

- [x] Compliance Documents issued by the Ministry of Business, Innovation & Employment... B1/VM1.....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 ... 7 Tutere St..... and numbered 7370..... 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:

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

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 () following level of construction monitoring/observation:

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

I, ... Alistair Cattanach..... am: [x] CPEng ... 168031.....# [] Reg Arch #

I am a Member of : [x] IPENZ [] NZIA and hold the following qualifications: ... BE(Hons)..... 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: [x]

SIGNED BY ... Alistair Cattanach..... ON BEHALF OF ... Dunning Thornton Consultants Ltd..... (Design Firm)

Date... 10 December 2013..... (signature)..... 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.

Memorandum from licensed building practitioner: Certificate of design work**Section 45 and Section 30C, Building Act 2004**

Please fill in the form as fully and correctly as possible.

If there is insufficient room on the form for requested details, please continue on another sheet and attach the additional sheet(s) to this form.

THE BUILDINGStreet address: **7 Tutere St**Suburb: **Waikanae Beach**Town/City **Waikanae**Postcode: **5036****THE OWNER**Name(s): **Shane O'Brien**Mailing address: **c/- Assembly Architects Ltd**Suburb: **Arrowtown**PO Box/Private Bag: **192**Town/City: **Queenstown**

Postcode:

Phone number:

Email address: **justin@assembly.co.nz****BASIS FOR PROVIDING THIS MEMORANDUM**

I am providing this memorandum in my role as the: Please tick the option that applies (✓)	
<input type="checkbox"/>	sole designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design myself – no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	lead designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and no other person will be providing any additional memoranda for the project
<input type="checkbox"/>	lead designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the other designers will provide their own memoranda relating to their specific RBW design
<input checked="" type="checkbox"/>	specialist designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)I **Allstair Cattnach** carried out / the following design work that is restricted building work**PRIMARY STRUCTURE: B1**

Design work that is restricted building work	Description	Carried out/ supervised	Reference to plans and specifications
Tick (✓) if included Cross (X) if excluded	[If appropriate, provide details of the restricted building work]	[Specify whether you carried out this design work or supervised someone else carrying out this design work]	[If appropriate, specify references]

Primary structure

All RBW Design work relating to B1	(✓)		() Carried out (✓) Supervised	Refer docs for scope
Foundations and subfloor framing	()	<i>Working loads provided for driven piles to performance spec. Retaining Wall</i>	() Carried out (✓) Supervised	Refer sketches & specification
Walls	()	<i>Wind speed & stud selection</i>	() Carried out (✓) Supervised	Architect drawings & struct sketches
Roof	(✓)	<i>Hyjoist Purlins</i>	() Carried out (✓) Supervised	Refer docs for scope
Columns and beams	(✓)	<i>Refer documentation</i>	() Carried out (✓) Supervised	Refer docs for scope
Bracing	(✓)	<i>Refer documentation (specific design)</i>	() Carried out (✓) Supervised	Refer docs for scope
Other	()		() Carried out () Supervised	

WAIVERS AND MODIFICATIONS

Waivers or modifications of the building code are required (✓) Yes () No

If Yes, provide details of the waivers or modifications below:

Clause	Waiver/modification required
<i>[List relevant clause numbers of building code]</i>	<i>[Specify nature of waiver or modification of building code]</i>
B1	<i>Driven piles to meet required loads in DTC specification. Calculated using Hiley formula.</i>

Note: continue on another page if necessary.

ISSUED BY

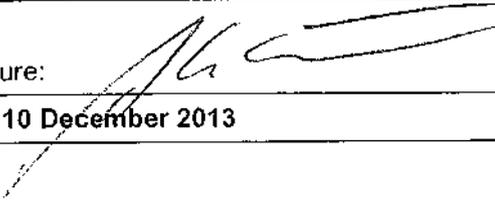
Name: Alistair Cattanach	LBP or Registration number: 168031
The practitioner is a: () Design LBP () Registered architect (✓) Chartered professional engineer	
Design Entity or Company (optional): Dunning Thornton Consultants Ltd	
Mailing address (if different from below): PO Box 27153	
Street address / Registered office: Level 9, 94 Dixon St	
Suburb: Te Aro	Town/City: Wellington
PO Box/Private Bag: 27-153	Postcode: 6141
Phone number: 04-3850019	Mobile: 021 190 1410
After Hours:	Fax: 04 3850312
Email address: alistair@dunningthornton.co.nz	Website: www.dunningthornton.co.nz

DECLARATION

I Alistair Cattanach *[name of practitioner]*, LBP,

state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:

- Complies with the building code; or
- Complies with the building code subject to any waiver or modification of the building code recorded on this form.

Signature: 

Date: **10 December 2013**



7 Tutere St, Waikanae
 Dunning Thornton Consultants Ltd
 DOCUMENT REGISTER
 Job No. 7370



Issue Date					
XX.XX.XXXX	10/12/2013				
PDB	AGC				

verified by

Sketch Number									
7370	SK01	Foundation Plan	-	0					
7370	SK02	Ground Floor Plan	-	0					
7370	SK03	First Floor Plan	-	0					
7370	SK03a	Middle Floor Plan	-	0					
7370	SK04	Roof Plan	-	0					
7370	SK05	Bracing Walls Ground Floor 1/2	-	0					
7370	SK05a	Bracing Walls Ground Floor 2/2	-	0					
7370	SK05b	Bracing Walls First Floor	-	0					
7370	SK06	Foundation detail 1/2	-	0					
7370	SK07	Foundation detail 2/2	-	0					
7370	SK08	Ground Floor Detail 1/3	-	0					
7370	SK09	Ground Floor Detail 2/3	-	0					
7370	SK10	Ground Floor Detail 3/3	-	0					
7370	SK11	First Floor Detail 1/3	-	0					
7370	SK12	First Floor Detail 2/3	-	0					
7370	SK13	First Floor Detail 3/3	-	0					
7370	SK14	Deck Detail	-	0					
7370	SK15	Roof Detail	-	0					

Specification Register									
7370	DOM	Domestic Specification		0					

Calculation Register									
7370	-	Cover, PS1, Memo LBP		0					
7370	Pgs 0-96	Calculation Pages		0					

CALCULATIONS



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



JOB NAME:	7 TUTUKEA ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Sep - 2013	

load

Roof:

$$Area = 19m \times 5m = 95m^2$$

$$G = 0.2 kPa$$

$$G = 0.2 kPa \times 95m^2 = 28.5 kN$$

$$Q = 0.25 kPa$$

$$\psi_s = 0.3 + \frac{3}{NA} = 0.61$$

$$Q = 0.61 \times 0.25 kPa \times 95m^2 = 14.3 kN$$

Floor:

$$Area = 19m \times 5m + 9.3m \times 2.4m = 117.3m^2$$

$$G = 0.4 kPa$$

$$G = 0.4 kPa \times 117.3m^2 = 47 kN$$

$$SDL = 0.25 kPa \times 117.3m^2 = 29.3 kN$$

$$Q = 1.5 kPa$$

$$\psi_s = 0.3 + \frac{3}{NA} = 0.58$$

$$Q = 0.58 \times 1.5 kPa \times 117.3m^2 = 102 kN$$

Wall:

$$Perimeter = 19m \times 2 + 5m \times 2 + 2.4m \times 2 + 9.3m = 62m$$

$$h = 3m$$

$$G = 0.2 kPa$$

$$G = 0.2 kPa \times 62m \times \frac{3}{2}m = 21.9 kN$$

	G	Q
Roof	28.5 kN + 21.9 kN = 50.4 kN	14.3 kN
1 st floor	47 kN + 29.3 kN + 2 \times 21.9 kN = 119.4 kN	102 kN
2 nd floor	47 kN + 29.3 kN + 21.9 kN = 98.2 kN	102 kN



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dctw@dnunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

EARTHQUAKE

$$C(T) = C_h(T) Z R_N(T, \Delta)$$

Soil Δ

$$T = 0.3 \text{ s} \rightarrow C_h(T) = 3$$

WAIKANAE $Z = 0.4$

$$\Delta = 15 - 20 \text{ km}$$

Importance level 2

Annual Probability of exceedance for ULS: $1/500$

SLS1: $1/25$

$$R_u = 1 \text{ (ULS)}$$

$$R_s = 0.25 \text{ (SLS)}$$

Structural ductility factor

$$\mu = 3 \rightarrow S_p = 0.7$$

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.
7370

Calc'd By
CaS

Date
2-Dec-13

Page

MASTEOK.xls

STATIC EARTHQUAKE LOADS ON MULTI-STOREY BUILDING

Type of Occupancy: Other applications

$\psi_e = 0.6$ floor
 $\psi_e = 0$ roof

FOUNDATION

T (sec) = 0.3
 $\mu = 1.25$
Soil Type Deep
 $C_h(T) = 3$
 $k_u = 1.1071$

$R_u = 1.0$
 $Z = 0.4$
 $N = 1.0$
 $S_p = 0.93$
 $C_d(T1) = 1.0026$

Seismic Weight Calculation

Static Lateral Load Distribution

Level	Live Area	ψ_a	Q_b	Q_u	G	$G+Q_u$	Height	Σ Height	H^*Wt	$\frac{H^*Wt}{\Sigma H^*Wt}$	F_x	V_x	M_x
	(m ²)		(kPa)	(kN)	(kN)	(kN)	(m)	(m)	(MNm)		(kN)	(kN)	(kNm)
TYP	117		1.5		3351		3.0						
ROOF	95	0.61	0.25	0	56.4	56	3.0	8.4	474	0.317	105	105	0
2	117	0.58	1.5	61	99	160	3.0	5.4	863	0.578	150	255	314
1	117	0.58	1.5	61	4	65	2.4	2.4	156	0.104	27	282	1079
GRD					71.5								1755
SUM									1492	1.000	282		

20 piles $\rightarrow V_x = \frac{282}{20} = 14 \text{ kN}$

Seismic Weight, W_t 280.99 kN
Base Shear 281.72 kN

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST.

Job No.
7370

Calc'd By
CaS

Date
2-Oct-13

Page

MASTEQK.xls

STATIC EARTHQUAKE LOADS ON MULTI-STOREY BUILDING

Type of Occupancy: Other applications

$\psi_e = 0.3$ floor
 $\psi_e = 0$ roof

ULS

T (sec) = 0.3
 $\mu = 3.00$

$k_u = 1.8571$

Soil Type Deep
 $C_h(T) = 3$

$R_u = 1.0$
 $Z = 0.4$
 $N = 1.0$
 $S_p = 0.70$
 $C_d(T1) = 0.4523$

Seismic Weight Calculation

Static Lateral Load Distribution

Level	Live Area	ψ_a	Q_b	Q_u	G	G+ Q_u	Height	Σ Height	Ht*Wt	$\frac{Ht*Wt}{\Sigma Ht*Wt}$	F_x	V_x	M_x
	(m ²)		(kPa)	(kN)	(kN)	(kN)	(m)	(m)	(MNm)		(kN)	(kN)	(kNm)
TYP	117		2.5		3351		3.0						
ROOF	95	0.61	0.25	0	56.4	56	3.0	8.4	474	0.334	50	50	0
2	117	0.58	1.5	30	99.4	130	3.0	5.4	701	0.494	59	110	151
1	117	0.58	1.5	30	71.5	102	2.4	2.4	245	0.172	21	130	480
GRD													793
SUM						288			1420	1.000	130		

5 steel frames $f_x = \frac{50 \text{ kN}}{5} = 10 \text{ kN}$
 $= \frac{59 \text{ kN}}{5} = 11.8 \text{ kN}$
 $= \frac{21 \text{ kN}}{5} = 4.2 \text{ kN}$

4 steel frames $f_x = \frac{50 \text{ kN}}{4} = 12.5 \text{ kN}$ $55 \times 0.33 = 18.15 \text{ kN}$
 $= \frac{59 \text{ kN}}{4} = 14.75 \text{ kN}$ $59 \times 0.49 = 28.95 \text{ kN}$
 $= \frac{21 \text{ kN}}{4} = 5.25 \text{ kN}$ $21 \times 0.17 = 3.57 \text{ kN}$

Seismic Weight, W_t 288.21 kN
Base Shear 130.36 kN

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST.

Job No.
7370

Calc'd By
CaS

Date
2-Oct-13

Page

MASTEQK.xls

STATIC EARTHQUAKE LOADS ON MULTI-STOREY BUILDING

Type of Occupancy: Other applications

$\psi_e = 0.3$ floor
 $\psi_e = 0$ roof

SLS

T (sec) = 0.3
 $\mu = 3.00$

$k_u = 1.8571$

Soil Type Deep
 $C_h(T) = 3$

$R_u = 0.3$ 0.25
 $Z = 0.4$
 $N = 1.0$
 $S_p = 0.70$
 $C_d(T) = 0.1131$

Seismic Weight Calculation

Static Lateral Load Distribution

Level	Live Area	ψ_a	Q_b	Q_u	G	G+ Q_u	Height	Σ Height	Ht*Wt	$\frac{Ht*Wt}{\Sigma Ht*Wt}$	F_x	V_x	M_x
	(m ²)		(kPa)	(kN)	(kN)	(kN)	(m)	(m)	(MNm)		(kN)	(kN)	(kNm)
TYP	117		2.5		3351		3.0						
ROOF	95	0.61	0.25	0	56.4	56	3.0	8.4	474	0.334	13	13	0
2	117	0.58	1.5	30	99.4	130	3.0	5.4	701	0.494	15	27	38
1	117	0.58	1.5	30	71.5	102	2.4	2.4	245	0.172	5	33	120
GRD													198
SUM									288	1420	1.000	33	

5 steel frames $F_x = \frac{13 \text{ kN}}{5} = 2.6 \text{ kN}$
 $= \frac{15 \text{ kN}}{5} = 3 \text{ kN}$
 $= \frac{5 \text{ kN}}{5} = 1 \text{ kN}$

4 steel frames $F_x = \frac{13 \text{ kN}}{4} = 3.2 \text{ kN}$ $13 \times 0.33 = 4.3 \text{ kN}$
 $= \frac{15 \text{ kN}}{4} = 3.7 \text{ kN}$ $15 \times 0.33 = 4.95 \text{ kN}$
 $= \frac{5 \text{ kN}}{4} = 1.2 \text{ kN}$ $5 \times 0.33 = 1.65 \text{ kN}$

Seismic Weight, W_t 288.21 kN
Base Shear 32.59 kN



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgln@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Sep - 2013	

WIND

WAIKARUA

WIND REGION W, Importance level 2, Terrain category 1

$$V_{site} = V_R M_d (M_{z,ref} M_s M_t)$$

Average probability of exceedance for ULS $\frac{1}{300}$

SLS $\frac{1}{25}$

$$V_R = 51 \text{ m/s ULS}$$

$$= 43 \text{ m/s SLS}$$

$$M_d = 1 \quad (\text{N, S, SW})$$

$$0.7 \quad (\text{NE, NW})$$

$$0.8 \quad (\text{E})$$

$$0.9 \quad (\text{SE, W})$$

$$M_{z,ref} = 1.02 \quad (\text{Terrain Category 1}) \rightarrow \text{category 2 for ULS}$$

$$M_s = 1$$

$$M_t = 1$$

$$V_{site} = 51 \text{ m/s} \times 1 (1.02 \times 1 \times 1) = 52 \text{ m/s (N, S, SW) ULS}$$

$$43 \text{ m/s} \times 1 (1.02 \times 1 \times 1) = 43.9 \text{ m/s SLS}$$

$$51 \text{ m/s} \times 0.9 (1.02 \times 1 \times 1) = 46.8 \text{ m/s (SE, W) ULS}$$

$$43 \text{ m/s} \times 0.9 (1.02 \times 1 \times 1) = 39.5 \text{ m/s SLS}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dlcwotn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Sep - 2013	

$$P = (0.5 \rho_a v) [V_{site}]^3 C_{pi} C_{pe}$$

INTERNAL PRESSURE

$$C_{pi} \cdot C_{pe} \cdot k_c$$

$$C_{pi} = 0.3, 0.0$$

$$k_c = 1$$

EXTERNAL PRESSURE

$$C_{pe} \cdot C_{pi} \cdot k_a \cdot k_c \cdot k_e \cdot k_p$$

WALLS

$$C_{pe} = 0.7 \text{ (windward wall)}$$

$$= -0.25 \text{ (leeward wall)}$$

$$= -0.65 \text{ (0 to 1h) (side wall)}$$

$$= -0.5 \text{ (1h to 2h)}$$

9.5

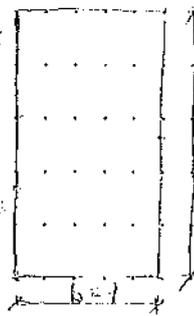
w

7

-0.65

-0.5

0.65



$$h = 7, \alpha < 10^\circ$$

$$\frac{d}{b} = 2.7$$

$$d = 19 \text{ m}$$

$$h = 9.5$$

$$C_{pe} = -0.9, 0.4$$

$$-0.5, 0.0$$

Roof
0 to h = 9.5m

9.5 to 2h = 18.9m

$$\frac{h}{d} = \frac{9.5}{19} = 0.5$$

$$k_p = 1.5 \quad a = 1.4 \text{ m} \quad \text{SA1, RA1} \quad (0.2b)$$

$$2 \quad a = 0.7 \text{ m} \quad \text{SA2, RA2} \quad (0.2b)$$

$$k_a = 0.8 \quad A = 7 \times 19 = 133 \text{ m}^2$$

$$k_c = k_e = 1$$

Vsite	ULS	SLS	
N	52.0	43.9	m/s
W	46.8	39.5	m/s

NORTH	Cpe	ka	kc	kl	kp	Cpi		Cfig	p (kPa)	
									ULS	SLS
windward	0.70	0.80	1.0	1.0	1.25	-0.3	$z=h \leq 25m$	1.00	1.62	1.16
Leeward	-0.25	0.80	1.0	1.0	1.0	0.0	$d/b=2.7$	-0.20	-0.32	-0.23
side walls	-0.65	0.80	1.0	1.0	1.0	0.0	(L) 0m-9.5m	-0.52	-0.84	-0.60
	-0.50	0.80	1.0	1.0	1.0	0.0	(L) 9.5m-12m	-0.40	-0.65	-0.46
SA1	-0.65	0.85	1.0	1.5	1.0	0.0	$a=1.4m$	-0.83	-1.34	-0.96
SA2	-0.65	0.85	1.0	2.0	1.0	0.0	$a=0.7m$	-1.11	-1.79	-1.28
roof	-0.90	0.80	1.0	1.0	1.0	0.0		-0.72	-1.17	-0.83
	-0.40	0.80	1.0	1.0	1.0	-0.3		-0.02	-0.03	-0.02
RA1	-0.90	0.85	1.0	1.5	1.0	0.0	$a=1.4m$	-1.15	-1.86	-1.33
RA2	-0.90	0.85	1.00	2.00	1.00	0.0	$a=0.7m$	-1.53	-2.48	-1.77

up
down

West	Cpe	ka	kc	kl	kp	Cpi		Cfig	p (kPa)	
									ULS	SLS
windward	0.70	0.80	1.0	1.0	1.25	-0.3	$z=h \leq 25m$	1.00	1.31	0.94
Leeward	-0.50	0.80	1.0	1.0	1.0	0.0	$d/b=0.4$	-0.40	-0.53	-0.37
side walls	-0.65	0.80	1.0	1.0	1.0	0.0	(L) 0m-7m	-0.52	-0.68	-0.49
	-0.65	0.85	1.0	1.5	1.0	0.0	$a=1.4m$	-0.83	-1.09	-0.78
SA2	-0.65	0.85	1.0	2.0	1.0	0.0	$a=0.7m$	-1.11	-1.45	-1.03
roof	-0.90	0.80	1.0	1.0	1.0	0.0		-0.72	-0.95	-0.67
	-0.40	0.80	1.0	1.0	1.0	-0.3		-0.02	-0.03	-0.02
RA1	-0.90	0.85	1.0	1.5	1.0	0.0	$a=1.4m$	-1.15	-1.51	-1.07
RA2	-0.90	0.85	1.00	2.00	1.00	0.0	$a=0.7m$	-1.53	-2.01	-1.43



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27 153, Wellington
 E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

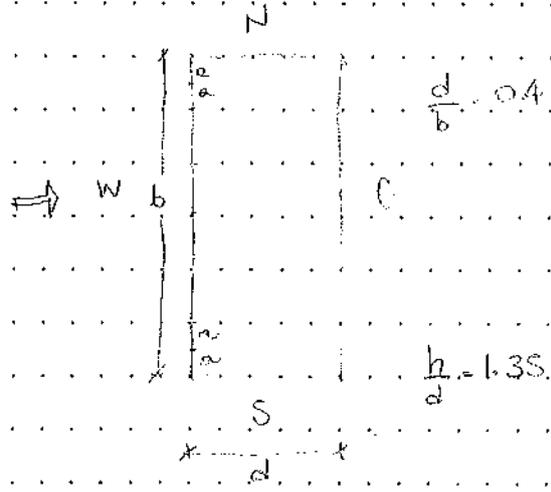
JOB NAME:	7 TUTORI ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7310	CaS	Sep - 2013	

WALLS

$$C_{pe} = 0.7 \text{ (w)}$$

$$= -0.5 \text{ (L)}$$

$$= -0.65 \text{ (S) (o to h)}$$

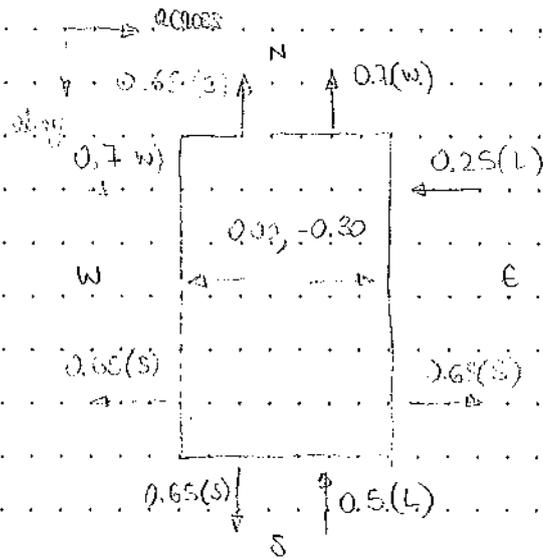


Roof

$$C_{pe} = -1.3, -0.6 \text{ (o to h)}$$

Roof

$$C_{pe} = -0.9, -0.4 \text{ o to h} = 7.5m$$



for bearing: $C_{pe} = 1.2$

$$0.6 V_{dir}^2 = 1.62 \text{ kPa ULS}$$

$$= 1.16 \text{ kPa SLS}$$

$$0.6 V_{ile}^2 = 1.31 \text{ kPa ULS}$$

$$= 0.94 \text{ kPa SLS}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

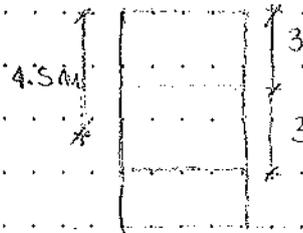
JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

WALLS BRACING DEMANDS (C.D.)

ULS	Roof	$50 \text{ kN} \times 20 = 1000 \text{ Bu's}$	$50 + 59 = 110 \text{ kN} = 2200 \text{ Bu's}$
	1 st floor	$59 \text{ kN} \times 20 = 1180 \text{ Bu's}$	
	G. floor	$21 \text{ kN} \times 20 = 420 \text{ Bu's}$	

SLS	Roof	$13 \text{ kN} \times 20 = 260 \text{ Bu's}$	$13 + 15 = 28 \text{ kN} = 560 \text{ Bu's}$
	1 st floor	$15 \text{ kN} \times 20 = 300 \text{ Bu's}$	
	G. floor	$5 \text{ kN} \times 20 = 100 \text{ Bu's}$	

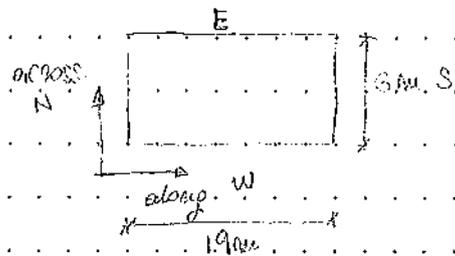
(WNB)



Along (N) $0.6 \text{ m} \times 0.6 \text{ m} = 0.36 \text{ m}^2$

ULS $p = 1.2 \times 1.62 \text{ kPa} = 1.94 \text{ kPa}$

SLS $= 1.2 \times 1.16 \text{ kPa} = 1.39 \text{ kPa}$



Across (W)

ULS $p = 1.2 \times 1.31 \text{ kPa} = 1.57 \text{ kPa}$

SLS $= 1.2 \times 0.94 \text{ kPa} = 1.13 \text{ kPa}$

Along

ULS $= 1.94 \text{ kPa} \times (4.5 \times 2) \text{ m} = 17.55 \text{ kN} \times 20 = 351 \text{ Bu's}$

SLS $= 1.39 \text{ kPa} \times 4.5 \text{ m} \times 2 = 12.51 \text{ kN} \times 20 = 250 \text{ Bu's}$

Across

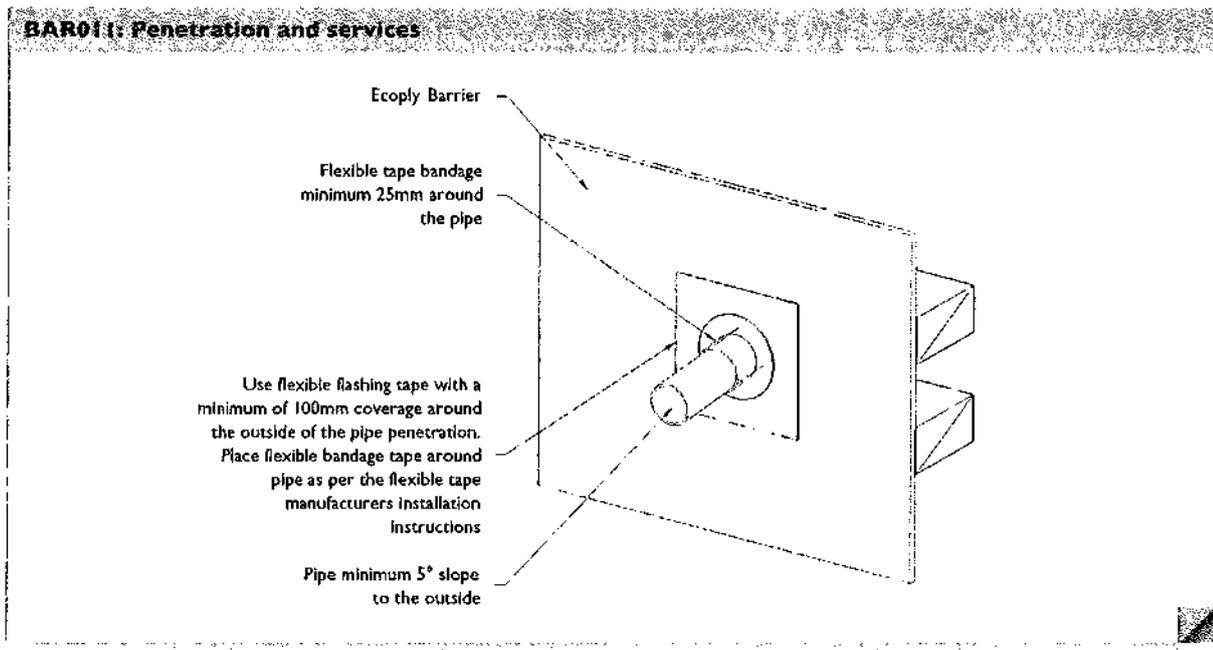
ULS $= 1.57 \text{ kPa} \times 4.5 \text{ m} \times 1.9 \text{ m} = 13.4 \text{ kN} \times 20 = 2680 \text{ Bu's}$

SLS $= 1.13 \text{ kPa} \times 4.5 \text{ m} \times 1.9 \text{ m} = 9.7 \text{ kN} \times 20 = 1940 \text{ Bu's}$

Bracing Demands governs for house walls

	Across	Along	C.D.
ULS	134 kN = 2680 Bu's	52 kN = 1048 Bu's	110 kN = 2200 Bu's
SLS	97 kN = 1940 Bu's	37 kN = 740 Bu's	28 kN = 560 Bu's

✓



Note: Refer to Figure 60 E2/AS1 for further information.

6.12. STRUCTURAL BRACING

Where Ecoply® Barrier is used as structural bracing refer to the specifications detailed in Section 3.0: Structural Bracing in the Ecoply Specification and Installation Guide.

Detailing of flexible flashing tapes for Ecoply Barrier used as structural bracing are as per the specifications outlined in this guide.

TABLE 3: SUMMARY P2I RATINGS FOR 2.4 M HIGH ECOPLY® BARRIER WALL ELEMENT

Specification No.	Minimum Wall Length	Lining Requirements	BU's/m Wind	BU's/m Earthquake
EPI	0.6 m	7 mm Ecoply®/Ecoply® Barrier one side	125	130
EP2	0.6 m	7 mm Ecoply®/Ecoply® Barrier each side	140	150
EPG	0.4 m	7 mm Ecoply®/Ecoply® Barrier one side and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	150
EPGs	0.4 m	7 mm Ecoply®/Ecoply® Barrier one side* and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	120

* Plywood side of element can be a maximum of 300 mm below top plate

Note: Bracing technical information has been specifically tested using Ecoply branded structural plywood. This information cannot be used with any other plywood brands no matter how similar they may appear

6.13. CLADDING SYSTEM INSTALLATION

- Cladding should be installed within 6 months of Ecoply Barrier installation
- Claddings must comply and be installed in line with NZ Building Code and cladding supplier specifications
- Cladding maintenance advice should be sought from the cladding manufacturer
- Cladding fastener lengths must be increased by a minimum of 7 mm to ensure the required fastener pull out loadings are achieved



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcw@dn.dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$h = 3 \text{ m}$ need to multiply $\frac{2.4}{5} = 0.8$

Along = $22.6 \text{ m} \times 0.8 \times 125 \frac{\text{Bo's}}{\text{m}} = 2260 \text{ Bo's} > 2120 \text{ Bo's ok}$

EPA = 125 Bo's/m
130 Bo's/m

BL1-11 = 120 Bo's/m (min d)
105 Bo's/m (concrete)

Across = $3.6 \text{ m} \times 2.8 \times 125 \frac{\text{Bo's}}{\text{m}} = 860 \text{ Bo's}$

$14.1 \text{ m} \times 0.8 \times 120 \frac{\text{Bo's}}{\text{m}} = 1353.6 \text{ Bo's}$

2213.6 Bo's < 2530 Bo's

$2530 \text{ Bo's} - 2213.6 \text{ Bo's} = 445 \text{ Bo's}$

$445 \text{ Bo's} = 23.5 \text{ kN}$
20



**Dunning
Thornton**
consultants

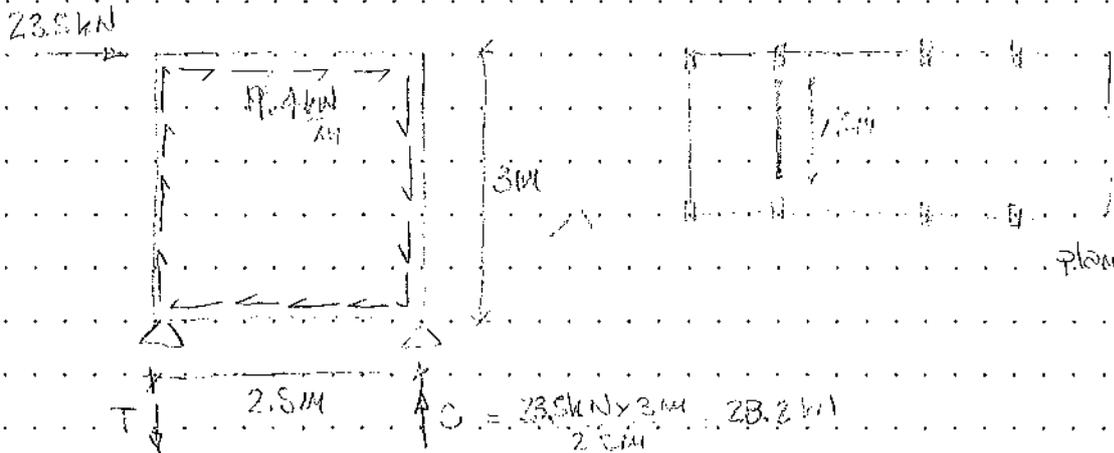
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgt@DunningThornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTORE SL		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	11 - 2013	

W_u - wind load: 23.5 kN



$$V^* \leq \phi R_n \text{ k } R_{u1}$$

$$V^* = \frac{23.5 \text{ kN}}{2.5 \text{ m}} = 9.4 \frac{\text{kN}}{\text{m}}$$

$$\phi = 0.8$$

k = 1 corrugated

k = 1.4 plywood

k = 1.3 (≥ 50 nails)

JS ϕ 2.50 - R_v 407 N

ϕ 2.50 (≥ 100 mm) 4 ply

$$\phi R_n = 0.8 \times 1.32 \times 407 \text{ kN} = 0.59 \text{ kN}$$

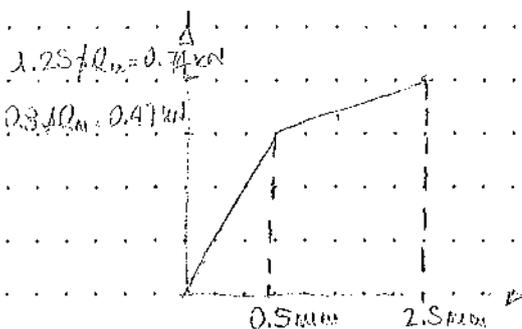
$$0.59 \text{ kN} \times 2 \text{ sides} \times \frac{1000 \text{ mm}}{100 \text{ mm c/s}} = 11.8 \frac{\text{kN}}{\text{m}} \geq 9.4 \frac{\text{kN}}{\text{m}} \text{ ok}$$

$$R^* P = \frac{9.4 \frac{\text{kN}}{\text{m}}}{11.8 \frac{\text{kN}}{\text{m}}} \times 0.59 \text{ kN} = 0.47 \text{ kN/m}$$

W_u CAPACITY

$$11.8 \frac{\text{kN}}{\text{m}} \times 2.5 \text{ m} = 29.5 \text{ kN}$$

DEFORMATIONS





**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqln@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOWER ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Nov - 2013	

$$\delta = \frac{k_{37} (0.8) P^2}{Q_M^2}$$

$$k_{37} = 1.0$$

$$\delta = \frac{1 \times (0.8) \times 2.47 \text{ kN}^2}{0.59^2} = 0.5 \text{ mm}$$

$$\Delta_W = \Delta_4 + \Delta_5 + \Delta_6 + \Delta_7$$

$$\Delta_4 = 0$$

$$\Delta_5 = \frac{PH}{GBL} = \frac{37000 \text{ N} \times 3000 \text{ mm}}{828 \text{ mm} \times 2500 \text{ mm} \times 140 \text{ mm}} = 0.6 \text{ mm}$$

$$\Delta_6 = 2(1+\nu) \mu e_M$$

$$= 2 \times (1+2) \times 2 \times 0.5 \text{ mm}$$

$$= 6 \text{ mm}$$

$$e_M = 0.5 \text{ mm}$$

$$\nu = 2$$

$$\mu = 2$$

$$\Delta_7 = \frac{2VH^3}{3EAB^3} + H\phi$$

$$\frac{2 \times 23500 \text{ N} \times 3000^3 \text{ mm}^3}{3 \times 8000 \text{ mm} \times 6300 \text{ mm}^2 \times 2500^3 \text{ mm}^3} + 3000 \text{ mm} \times 0.0027 =$$

$$= 15 \text{ mm}$$

$$V = 23500 \text{ N}$$

$$H = 3000 \text{ mm}$$

$$A = (140 \times 48) \text{ mm}^2 = 6300 \text{ mm}^2$$

$$B = 2500 \text{ mm}$$

$$\phi = \frac{8 \text{ mm}}{3000 \text{ mm}} = 0.0027 \text{ rad}$$

$$\Delta_W = (0.6 + 6 + 15) \text{ mm} = 15.6 \text{ mm}$$



**Dunning
Thornton**
consultants

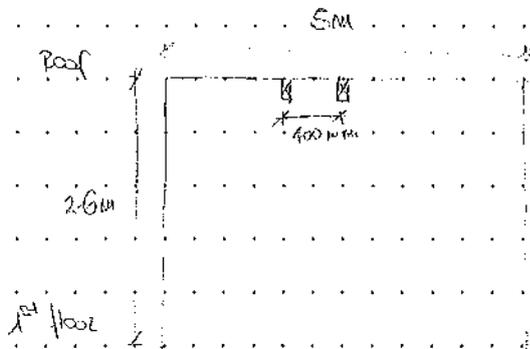
Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27 153, Wellington
 E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOWER ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Sep - 2013	

ROOF



$$G = 0.3 \text{ kPa}$$

$$Q = 0.25 \text{ kPa}$$

b, a, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z

ULS $1.2G + 1.5Q$
 $1.2G + W_{u,down}$
 $0.9G + W_{u,up}$

SLS $W_{s,up}$
 $G + W_{s,down}$
 $G + \psi Q$

$$G = 0.3 \text{ kPa} \times 3.8 \text{ m} = 1.14 \text{ kN/m}$$

$$Q = 0.25 \text{ kPa} \times 3.8 \text{ m} = 0.95 \text{ kN/m}$$

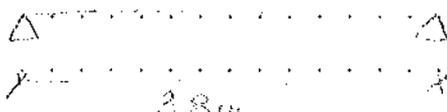
$$W_{u,down} = 1.02 \text{ kPa} \times 3.8 \text{ m} = 3.88 \text{ kN/m} \downarrow \oplus$$

$$W_{u,up} = -1.17 \text{ kPa} \times 3.8 \text{ m} = -4.45 \text{ kN/m} \uparrow \ominus$$

$$W_{s,down} = -0.02 \text{ kPa} \times 3.8 \text{ m} = -0.08 \text{ kN/m} \downarrow \oplus$$

$$W_{s,up} = 0.83 \text{ kPa} \times 3.8 \text{ m} = 3.15 \text{ kN/m} \uparrow \ominus$$

RASTER: @ 400 cts



$$G = 0.3 \text{ kPa} \times 0.4 \text{ m} = 0.12 \text{ kN/m}$$

$$Q = 0.25 \text{ kPa} \times 0.4 \text{ m} = 0.1 \text{ kN/m}$$

$$W_{u,down} = -0.03 \text{ kPa} \times 0.4 \text{ m} = -0.012 \text{ kN/m}$$

$$W_{u,up} = 1.17 \text{ kPa} \times 0.4 \text{ m} = 0.47 \text{ kN/m}$$

$$W_{s,down} = -0.02 \text{ kPa} \times 0.4 \text{ m} = -0.008 \text{ kN/m}$$

$$W_{s,up} = 0.83 \text{ kPa} \times 0.4 \text{ m} = 0.33 \text{ kN/m}$$

ULS $1.2G + 1.5Q = 0.29 \text{ kN/m} \downarrow$
 $1.2G + W_{u,down} = 0.16 \text{ kN/m} \downarrow$
 $0.9G + W_{u,up} = 2.35 \text{ kN/m} \uparrow \checkmark$

SLS $W_{s,up} = 0.33 \text{ kN/m} \uparrow \checkmark$
 $G + W_{s,down} = 0.13 \text{ kN/m} \downarrow$
 $G + \psi Q = 0.16 \text{ kN/m} \downarrow$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOTERO ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Sep - 2013	

$$M^* = \frac{0.36 \text{ kN/m} \times 3.8^2 \text{ m}^2}{8} = 0.55 \text{ kNm}$$

$$S_{max} = \frac{5}{384} \frac{WL^4}{EI}$$

140 x 45 MSG 8 V with mid span.

$$I = \frac{bh^3}{12} = \frac{45 \times 140^3}{12} = 102,900,000 \text{ mm}^4$$

$$E = 8000 \text{ MPa}$$

$$W = 0.32 \text{ kN/m}$$

$$S_{max} = \frac{5 \times 0.32 \text{ N/mm} \times 3800^4 \text{ mm}^4}{384 \times 8000 \text{ MPa} \times 102,900,000 \text{ mm}^4} = 10.9 \text{ mm}$$

$$\Delta = \frac{3800}{300} = 12.6 \text{ mm} > 10.9 \text{ mm} \text{ ok}$$

$$\phi M_u = \phi k_1 k_2 k_3 k_8 f_t \frac{Z}{\gamma}$$

$$f_t = 14 \text{ MPa}$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind}$$

$$k_2 = 1 \text{ 1 element}$$

$$k_3 = 1$$

$$k_8 = 0.68 \leq 0.75 \text{ NO. with mid span } k_8 = 0.9 \text{ (S1=15) ok}$$

$$S_1 = 1.32 \left[\frac{L_e}{b} \sqrt{\frac{d^2}{b}} - 1 \right] \leq 1.32 \left[\frac{3800}{45} \sqrt{\frac{140^2}{45}} - 1 \right] = 21.3 \leq 0.7$$

$$Z = \frac{bd^2}{6} = \frac{45 \times 140^2}{6} = 147,000 \text{ mm}^3$$

$$\phi M_u = 0.8 \times 1 \times 1 \times 1 \times 0.9 \times 14 \text{ MPa} \times 147,000 \text{ mm}^3 = 1.32 \text{ kNm} \geq M^* \text{ ok}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwatn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

try 240×45 MSG8 @ 400 c/s with 2 mid-span blocking.

$$I = \frac{bh^3}{12} = \frac{45 \times 240^3}{12} = 51840000 \text{ mm}^4$$

$$\sigma_{max} = \frac{5 \times 0.33 \text{ N/mm} \times 3800^4 \text{ mm}^4}{34 \times 8000 \text{ MPa} \times 51840000 \text{ mm}^4} = 2.2 \text{ N/mm} \leq 11 \text{ N/mm} \quad \text{ok}$$

$$S_1 = 1.35 \left[\frac{3800/3}{45} \left[\left(\frac{240}{45} \right)^2 - 1 \right]^{0.5} \right]^{0.5} = 16 \rightarrow k_B = 0.89 \geq 0.73 \quad \text{ok}$$

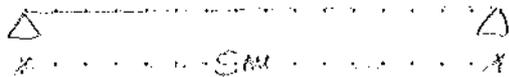
2 mid-span

$$I = \frac{bd^2}{6} = \frac{45 \times 240^2}{6} = 432000 \text{ mm}^3$$

$$\phi M_u = \phi k_1 k_4 k_s k_B \phi b f$$

$$\phi M_u = 0.8 \times 0.89 \times 14 \text{ MPa} \times 432000 \text{ mm}^3 = 4.3 \text{ kNm} \geq 0.65 \text{ kNm} \geq M^* \quad \text{ok}$$

RAM



$$\begin{cases} 1.2G + 1.5Q = 1.2 \times 1.14 \text{ kN/m} + 1.5 \times 0.95 \text{ kN/m} = 2.8 \text{ kN/m} \\ 1.2G + W_{s,down} = 1.2 \times 1.14 \text{ kN/m} + 0.11 \text{ kN/m} = 1.5 \text{ kN/m} \\ 0.9G + W_{s,up} = 0.9 \times 1.14 \text{ kN/m} - 4.45 \text{ kN/m} = -3.4 \text{ kN/m} \quad \checkmark \end{cases}$$

$$\begin{cases} W_{s,up} = -3.15 \text{ kN/m} \quad \checkmark \\ G + W_{s,down} = 1.14 \text{ kN/m} + 0.08 \text{ kN/m} = 1.2 \text{ kN/m} \\ G + \psi Q = 1.14 \text{ kN/m} + 0.4 \times 0.95 \text{ kN/m} = 1.5 \text{ kN/m} \end{cases}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$M^* \leq \phi M_m$$

$$M^* = \frac{3.4 \text{ kN/m} \times 5^2 \text{ m}^2}{8} = 10.6 \text{ kNm}$$

$$\phi M_m = \phi \cdot k_1 \cdot k_4 \cdot k_s \cdot k_g \cdot f_b \cdot Z$$

2/45 x 240 MSG BV

$$I = \frac{90 \times 240^3}{12} = 103680000 \text{ mm}^4$$

$$f_b = 14 \text{ MPa}$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind}$$

$$k_4 = 1.14 \text{ 2 element}$$

$$k_s = 1 + (k_4 - 1) \left(1 - \frac{2s}{L_B}\right) = 0.92 \leq 1 \quad s = 3.3 \text{ m} \quad L_B = 5 \text{ m}$$

$$k_g = 1$$

$$S_1 = 1.35 \left[\frac{L_{ay}}{b} \left[\left(\frac{d}{b} \right)^2 - 1 \right]^{0.5} \right]^{0.5}$$

$$= 1.35 \left[\frac{400}{90} \left[\left(\frac{240}{90} \right)^2 - 1 \right]^{0.5} \right]^{0.5}$$

$$= 4.5 \quad k_B = 1 \geq 0.73 \text{ ok}$$



$$Z = \frac{2 \times 45 \times 240^2}{6} = 864000 \text{ mm}^3$$

$$\phi M_m = 0.8 \times 1 \times 1.14 \times 1 \times 1 \times 14 \text{ MPa} \times 864000 \text{ mm}^3 = 11 \text{ kNm} \geq M^* \text{ ok}$$

$$\Delta = \frac{5000}{300} = 16.7 \text{ mm}$$

$$\Delta_{max} = \frac{S \times 3.15 \text{ N/mm} \times 5000^4 \text{ mm}^4}{384 \times 8000 \text{ MPa} \times 103680000 \text{ mm}^4} = 30.9 \text{ mm} \text{ NO}$$

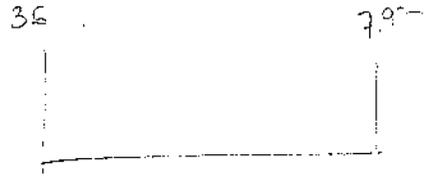
→ HY 300 x 40

$\Delta_{max} = 16.3 \text{ mm} < 16.7 \text{ mm}$
E = 9.56 Pa

Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131001 steel frame
 7370 131001 steel frame

$$\beta_{m1} = \frac{3.6}{7.93} = 0.45$$



$$\alpha_{m1} = 1.13 + 0.12\beta_{m1} = 1.18$$

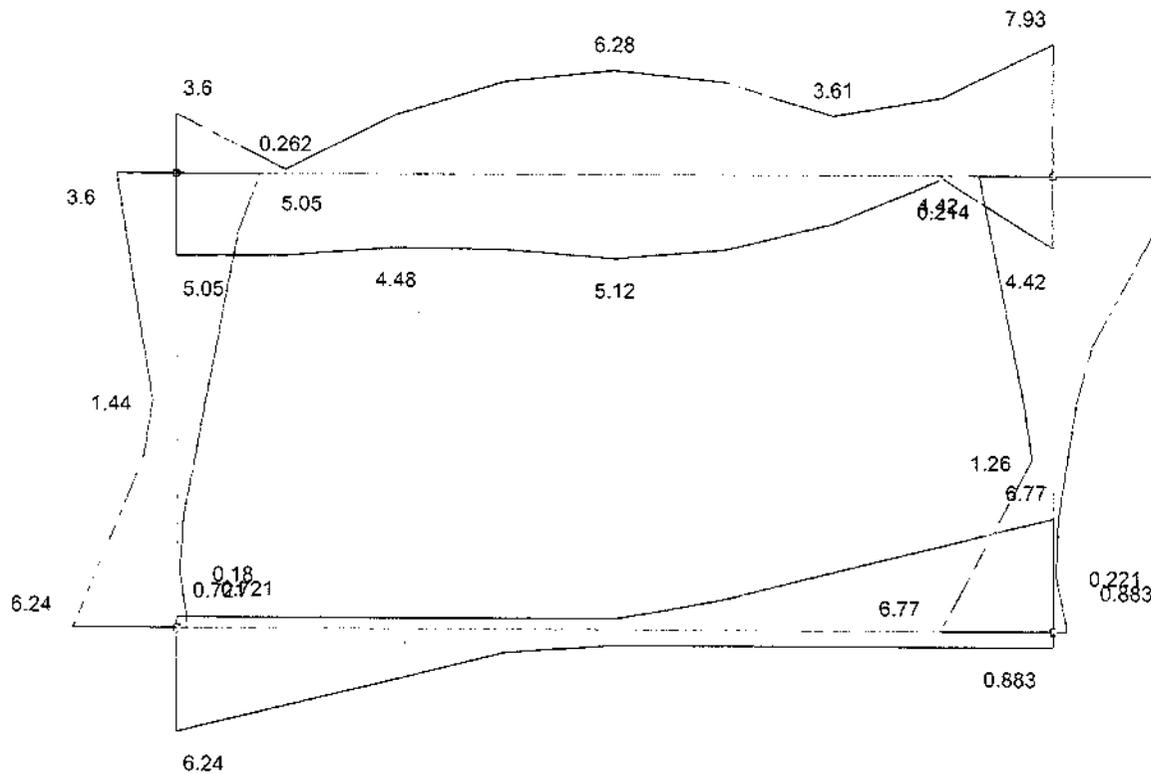
03/10/2013
 11:24:18 a.m.

Envelope for Moment Mz

- Maximum
- Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



$$M_0 = \sqrt{\frac{2EI_y}{L_e^2} \left(G + \frac{E^2 C_{2W}}{C_e^2} \right)}$$

$$L_e = 5m$$

$$E = 200000 \text{ MPa}$$

$$I_y = 0.02 \times 10^8 \text{ mm}^4$$

$$G = 80000 \text{ MPa}$$

$$J = 85 \times 10^3 \text{ mm}^4$$

$I_w = 0$ narrow rectangular section

$$M_0 = \sqrt{\frac{2 \times 200000 \text{ MPa} \times 0.02 \times 10^8 \text{ mm}^4}{5000^2 \text{ mm}^2} \left(80000 \text{ MPa} + \frac{85 \times 10^3 \text{ mm}^4}{5000^2 \text{ mm}^2} \right)}$$

$$= 3.3 \text{ kNm}$$

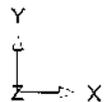
$$\alpha_s = 0.6 \left\{ \sqrt{\frac{M_{0y}^2}{M_{0z}^2} + 3} - \frac{M_{0x}}{M_{0z}} \right\}$$

$$= 0.6 \left\{ \sqrt{\frac{(7.5 \text{ kNm})^2}{(3.3 \text{ kNm})^2} + 3} - \frac{7.5 \text{ kNm}}{3.3 \text{ kNm}} \right\}$$

$$= 0.04$$

5 frames

Bending Moment, Mz



theta: 270 phi: 0

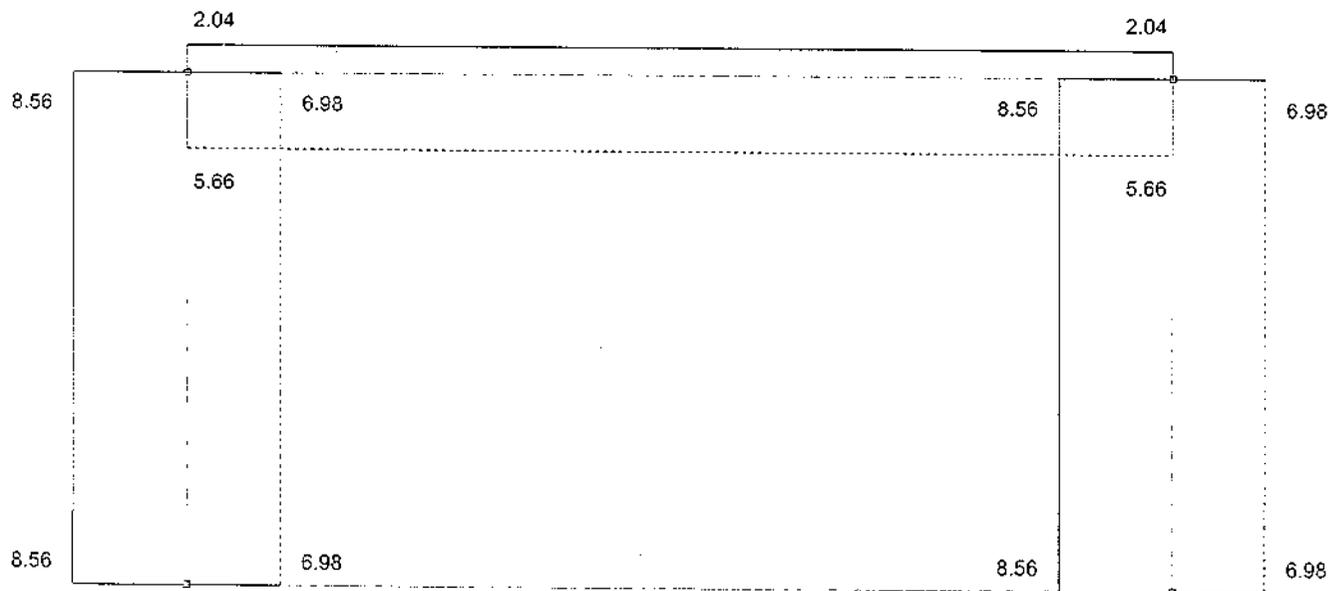
Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131001 steel frame
7370 131001 steel frame

03/10/2013
12:45:33 p.m.

Envelope for Axial Force
— Maximum
— Minimum

Enveloped Cases:
7 C 1.2G+1.5Q
8 C 1.2G+Wu,down
9 C 0.9G+Wu,up
15 C G+Eu



Y
↑
Z → X
theta: 270 phi: 0

5 frames

Axial Force, Fx



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwotn@dunningthornton.co.nz

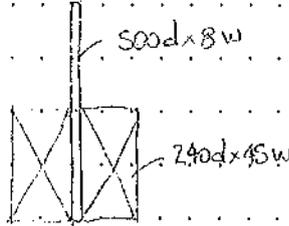


CALCULATIONS

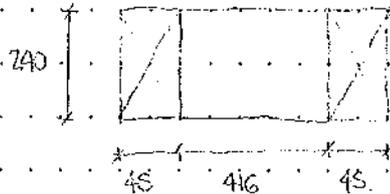
JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

BEAM

$$\frac{f_s}{C_1} = \frac{200000 \text{ MPa}}{8000 \text{ MPa}} = 25$$



$$A_{tot} = (240 \times 45) \text{ mm}^2 \times 2 + 25 \times (500 \times 8) \text{ mm}^2 = 121600 \text{ mm}^2$$



$$Z = \frac{bd^2}{6} = \frac{506 \times 240^2}{6} = 4857600 \text{ mm}^3$$

$$\phi M_{ult} = \phi k_1 k_4 k_s k_b f_b Z$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind}$$

$$k_4 = 1.2 \text{ 3 elements}$$

$$k_s = 1$$

$$k_b = 1 \quad l_{ay} = 400 \text{ mm}$$

$$f_b = 14 \text{ MPa}$$

$$\phi M_{ult} = 0.8 \times 1 \times 1.2 \times 1 \times 1 \times 1 \times 14 \text{ MPa} \times 4857600 \text{ mm}^3 = 65 \text{ kNm} \geq 38 \text{ kNm}$$

steel plate

$$\phi M_{s,r} = \phi f_y Z_e$$

$$\phi = 0.9$$

$$f_y = 250 \text{ MPa}$$

$$Z_e = \frac{bd^2}{6} = \frac{8 \times 500^2}{6} = 333333 \text{ mm}^3$$

$$\phi M_{s,r} = 0.9 \times 250 \text{ MPa} \times 333333 \text{ mm}^3 = 75 \text{ kNm}$$

$$M_{max} = 1.18 \times 0.04 \times 75 \text{ kNm} = 3.5 \text{ kNm} < 8 \text{ kNm}$$

Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131003 steel frame
 7370 131001 steel frame

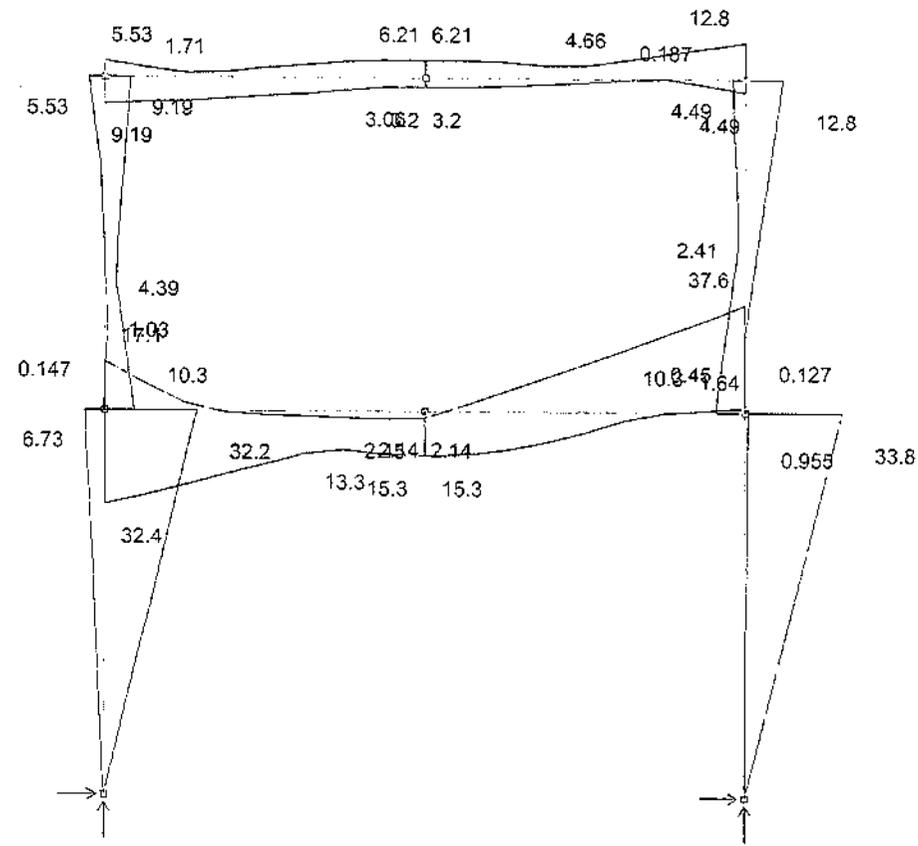
03/10/2013
 05:24:21 p.m.

Envelope for Moment Mz

— Maximum
 — Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



Y
 ↑
 Z → X
 theta: 270 phi: 0

S frames

Bending Moment, Mz

Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131003 steel frame
 7370 131001 steel frame

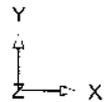
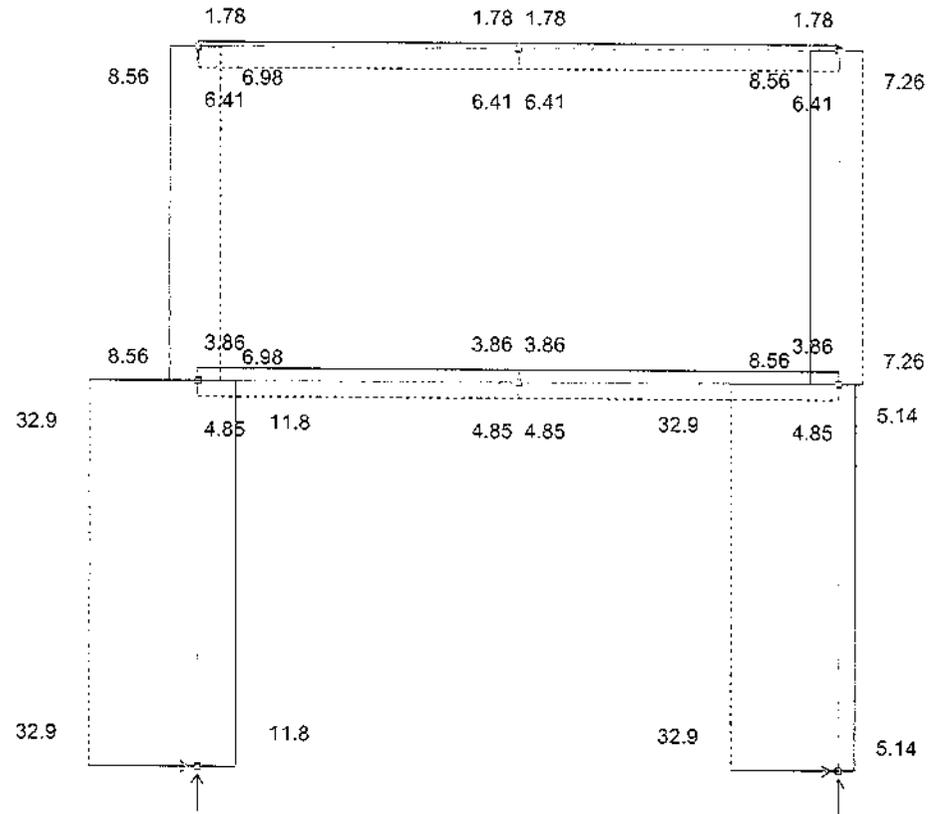
03/10/2013
 05:24:46 p.m.

Envelope for Axial Force

- Maximum
- Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



theta: 270 phi: 0

S frames

Axial Force, Fx

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131003 steel frame
7370 131001 steel frame

03/10/2013
05:23:56 p.m.

Load Cases:
10 C Ws,up

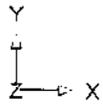
0.018 0.000 0.018 0.001 0.018 -0.000

0.015 0.000 0.015 -0.000 0.015 -0.000

0.000 0.000

0.000 0.000

5 frames



theta: 270 phi: 0

Displaced Shape



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

COLUMN

$$f_s = 200000 \text{ MPa} \quad 25$$

$$f_c = 8000 \text{ MPa}$$



140x45
MSG 8V

340x15w

$$A_{tot} = (140 \times 45) \text{ mm}^2 \times 2 + 25 \times (340 \times 15) \text{ mm}^2 = 140100 \text{ mm}^2$$

$$Z = \frac{bd^2}{6} = \frac{100 \times 140^3}{6} = 3266666 \text{ mm}^3$$

$$\phi M_u = \frac{0.8 \times 1.2 \times 14 \text{ MPa} \times 3266666 \text{ mm}^3}{1000000} = 44 \text{ kNm} > 21 \text{ kNm}$$

Ok

BUCKLING

$$\phi N_x = k_1 k_2 f_c A$$

$$k_1 = 0.8 \text{ Medium load}$$

$$k_2 = 0.9$$

$$f_c = 18 \text{ MPa}$$

$$A = 140100 \text{ mm}^2$$

$$S_2 = \frac{3000}{140} = 21$$

$$\phi N_x = \frac{0.8 \times 0.9 \times 18 \text{ MPa} \times 140100 \text{ mm}^2}{1000} = 1315 \text{ kN}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwtgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

WALLS:

Design studs for external walls.

windward walls / NORTH side

$$p = 1.62 \text{ kPa ULS}$$

$$1.16 \text{ kPa SLS}$$

$$h \text{ stud.} = 3 \text{ m} \quad \text{try stud. @ 600 cts.}$$

$$1.62 \text{ kPa} \times 0.6 \text{ m} = 0.97 \text{ kN/m ULS}$$

$$1.16 \text{ kPa} \times 0.6 \text{ m} = 0.7 \text{ kN/m SLS}$$

$$M^* = \frac{0.97 \text{ kN/m} \times 3^2 \text{ m}^2}{8} = 1.09 \text{ kNm}$$

$$\boxed{140 \times 95 \text{ MSG 8}} \quad I = \frac{95 \times 140^3}{12} = 10290000 \text{ mm}^4$$

$$\phi M_m = \phi k_1 k_4 k_5 k_8 f_b \frac{I}{L}$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind}$$

$$k_4 = 1 \text{ element}$$

$$k_5 = 1$$

$$k_8 = 1 \quad S_{11} = \frac{3d}{L} = 9.3 < 10$$

$$f_b = 14 \text{ MPa}$$

$$\frac{I}{L} = \frac{bd^2}{6} = \frac{95 \times 140^2}{6} = 137200 \text{ mm}^3$$

$$\phi M_m = 0.8 \times 1 \times 1 \times 1 \times 1 \times 14 \text{ MPa} \times 137200 \text{ mm}^3 = 1.5 \text{ kNm} \geq M^* \text{ ok}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwatn@dunningthornton.co.nz



CALCULATIONS

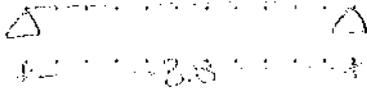
JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$\Delta = \frac{3000}{200} = 15 \text{ mm}$$

$$S_{max} = \frac{S}{384} \times \frac{0.7 \text{ kN/m} \times 3000^3 \text{ mm}^4}{8000 \text{ MPa} \times 10290000 \text{ mm}^4} = 9 \text{ mm} \leq \Delta \text{ ok}$$

FLOOR

JOIST @ 600 mm cts



ULS: $1.2G + 1.5Q$

SLS: $G + 0.4Q$

$G = 0.4 \text{ kPa}$

$Q = 1.5 \text{ kPa}$

$W_u = 1.2 \times 0.4 \text{ kPa} \times 0.6 \text{ m} + 1.5 \times 1.5 \text{ kPa} \times 0.6 \text{ m} = 1.6 \text{ kN/m}$

$W_s = 0.4 \text{ kPa} \times 0.6 \text{ m} + 0.4 \times 1.5 \text{ kPa} \times 0.6 \text{ m} = 0.6 \text{ kN/m}$

POINT LOAD = 1 kN

$M^* = \frac{1.6 \text{ kN/m} \times 3.8^2 \text{ m}^2}{8} = 2.9 \text{ kNm}$

240 x 45 MSG 8V with mid-span @ 600 cts

$I = \frac{bb^3}{12} = \frac{45 \times 240^3}{12} = 51840000 \text{ mm}^4$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$\phi = 0.8$$

$$k_1 = 0.8 \text{ Medium live load}$$

$$k_2 = 1$$

$$k_3 = 1$$

$$k_4 = 0.8$$

$$f_b = 14 \text{ MPa}$$

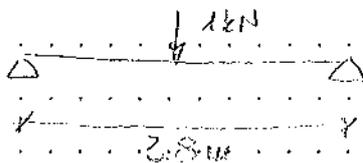
$$Z = \frac{bd^2}{6} = \frac{45 \times 240^2}{6} = 432000 \text{ mm}^3$$

$$\phi M_{res} = \frac{0.8 \times 0.8 \times 1 \times 1 \times 0.8 \times 14 \text{ MPa} \times 432000 \text{ mm}^3}{1000000} = 3.1 \text{ kNm} \geq 2.9 \text{ kNm}$$

$$\Delta = \frac{3800 \text{ mm}}{300} = 12.7 \text{ mm}$$

$$s_{max} = \frac{2 \times 5}{384} \times \frac{0.6 \text{ N/mm}^2 \times 3800^4 \text{ mm}^4}{8000 \text{ MPa} \times 51840000 \text{ mm}^4} = 7.8 \text{ mm} \leq \Delta \text{ ok}$$

POINT-LOAD



$$1 \leq \Delta \leq 2 \text{ mm}$$

$$s_{max} = \frac{WL^3}{48EI} = \frac{1000 \text{ N} \times 3800^3 \text{ mm}^3}{48 \times 8000 \text{ MPa} \times 51840000 \text{ mm}^4} = \frac{2.8}{2} = 1.4 \text{ mm} \text{ ok}$$

d	13	mm
A_n	133	mm ²
f_y	250	MPa
k_f	1	
ϕ	0.9	
N_s	33	kN
ϕN_s	30	kN
I	1402	1.4E+15
L_e	2400	mm
r	3	
λ_n	738	
α_a	3	
α_b	1.000	
λ	741	
η	2.37	OK
ξ	0.52	
α_c	0.01	
N_c	0.5	kN
ϕN_c	0.4	kN



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

GROUND FLOOR

$$G = 0.4 \text{ kPa}$$

$$Q = 1.5 \text{ kPa}$$

$$\text{ULS: } 1.2G + 1.5Q$$

$$1.2 = 0.4 \text{ kPa} \times 0.6 \text{ m} \times 1.5 + 1.5 \text{ kPa} \times 0.6 \text{ m}$$

$$1.6 \text{ kN/m}$$

$$\text{SLS: } G + 0.4Q$$

$$0.4 \text{ kPa} \times 0.6 \text{ m} + 0.4 \times 1.5 \text{ kPa} \times 0.6 \text{ m} =$$

$$0.6 \text{ kN/m}$$



600 mm

Rj. 240x70 @ 600ds

$$M^* = \frac{1.6 \text{ kN/m} \times 5^2 \text{ m}^2}{8} = 5 \text{ kNm}$$

$$\phi M_{br} = 18.5 \text{ kNm} \gg M^* \text{ ok}$$

$$\Delta = \frac{5000}{300} = 16.7 \text{ mm}$$

$$\Delta_{max} = \frac{2 \times 5}{384} \times \frac{0.6 \text{ N/mm} \times 5000^4 \text{ mm}^4}{905 \times 10^9 \text{ Nmm}^2} = 10.7 \text{ mm} \leq \Delta \text{ ok}$$

$$S_1 = 1.35 \times \left[\frac{2500}{90} \left[\left(\frac{240}{90} \right)^2 - 1 \right] \right]^{0.8} = 11.2 \quad k_B = 0.98 \geq 0.73 \text{ ok}$$

with mid-span blocking.



Dunning
Thornton
consultants

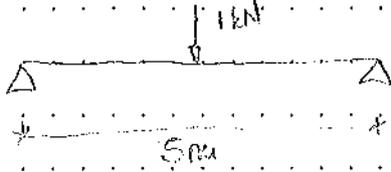
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

POINT LOAD



maximum $\Delta = 1 - 2 \text{ mm}$

$$\delta_{\text{max}} = \frac{1000 \text{ N} \times 5000^3 \text{ mm}^3}{48 \times 906 \times 10^9 \text{ N/mm}^2} = \frac{2.8 \text{ mm}}{2} = 1.4 \text{ mm} \leq \Delta \text{ ok}$$

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.
7370

Calc'd By
CaS

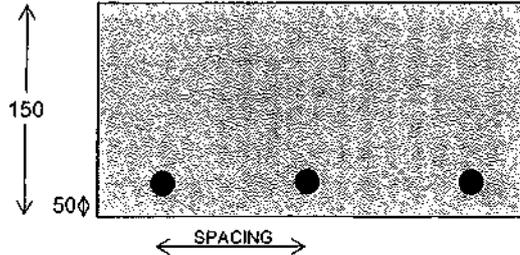
Date
4-Oct-13

Page

LASTSLB2-16

SIZE AND SPACING OF STEEL FOR SINGLY-REINFORCED CONCRETE SLAB

D =	150 mm
Cover =	50 mm
f_y =	500 MPa
f_c =	30 MPa
ϕ =	0.85



α_1 = 0.85
 β_1 = 0.85

ρ_b = 0.0236

ρ_{min} = $\min(0.7/f_y, 0.0014)$ = 0.0014 (Based on gross section area ---> Full depth, D)

ρ_{max} = $0.75\rho_b$ = 0.0177 (Based on effective section area ---> Effective depth, d)

Moment Capacity (ϕM_n) in kNm per metre width of slab

SPACING (mm)	BAR DIAMETER (mm)							
	10	12	16	20	24	25	28	32
$\phi M_n(\rho_{min})$ =	8.3	8.2	8.0	7.8	7.7	7.6	7.5	7.3
$\phi M_n(\rho_{max})$ =	56.2	55.0	52.7	50.4	48.2	47.7	46.1	43.9
25	85.7	95.5	45.0	177.3	687.6	876.2	1627.4	3163.6
50	53.1	69.0	89.9	75.8	2.7	36.6	181.8	503.8
75	37.7	50.8	74.9	87.1	74.0	64.9	19.2	96.3
100	29.1	39.9	61.8	79.0	83.9	82.1	67.1	17.6
125	23.7	32.7	52.1	69.8	80.8	81.8	78.9	57.2
150	20.0	27.8	44.9	61.8	74.9	77.1	79.8	71.8
175	17.3	24.1	39.4	55.2	68.8	71.5	77.0	76.4
200	15.2	21.3	35.1	49.8	63.3	66.2	73.0	76.2
225	13.6	19.0	31.6	45.3	58.4	61.3	68.8	74.4
250	12.3	17.2	28.8	41.5	54.0	57.0	64.7	71.7
275	11.2	15.7	26.4	38.3	50.2	53.1	60.9	68.8
300	10.3	14.5	24.3	35.5	46.9	49.7	57.5	65.8
325	9.5	13.4	22.6	33.1	44.0	46.7	54.3	62.8
350	8.9	12.5	21.1	31.0	41.4	44.0	51.4	60.0
375	8.3	11.7	19.8	29.1	39.1	41.5	48.8	57.4
400	7.8	11.0	18.6	27.5	37.0	39.4	46.4	54.9
425	7.3	10.3	17.6	26.0	35.1	37.4	44.2	52.6
450	6.9	9.8	16.6	24.7	33.4	35.6	42.2	50.5
475	6.6	9.3	15.8	23.5	31.8	34.0	40.4	48.5
500	6.2	8.8	15.0	22.4	30.4	32.5	38.7	46.6

SHADED COMBINATIONS OF SPACING AND BAR SIZE MAY NOT BE USED DUE TO ONE OR MORE OF THE FOLLOWING REASONS (NZS3101:1995):

- * Steel ratio is greater than ρ_{max} for that bar diameter --> Must use different bar, or doubly reinforced section
- * Steel ratio is lower than ρ_{min} for that bar diameter --> Must design for $\phi M_{n,min}$
- * Spacing between bars is less than 25mm or 1 bar diameter
- * Spacing between centres is greater than 450mm, or 3 * slab depth



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

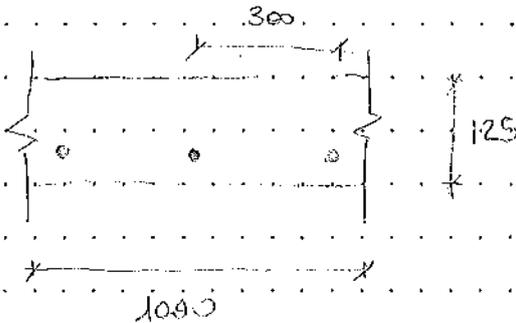
JOB NAME:	7 TUTERE St		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

SLAB

Ground floor:

$$p_{min} = \min \begin{cases} 0.7/f_y = 0.7/500 = 0.0014 \\ 0.0014 \end{cases}$$

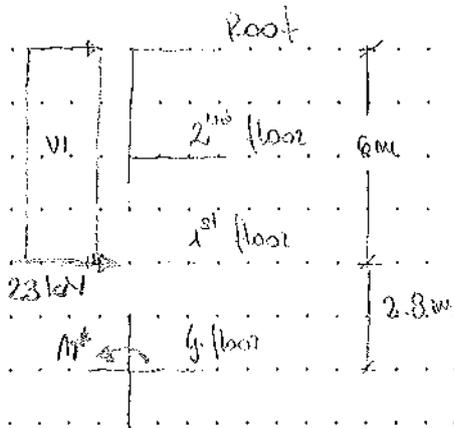
$$f_y = 500 \text{ MPa}$$



125 concrete slab
#12 @ 300 c/s

$$\frac{A_s}{A_c} = \frac{\pi \cdot 12^2 / 4 \times 3 \text{ bars}}{125 \times 1000} = 0.0027 \geq 0.0014 \text{ ok}$$

PILE



WIND

$$W = 1.94 \text{ kPa} \times 2 \text{ m} \times 6 \text{ m} = 23 \text{ kN}$$

$$M^* = 23 \text{ kN} \times 2.8 \text{ m} = 64 \text{ kNm}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dlcwqln@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

CANTILEVER PILE $\phi 350 \text{ mm}$

$$\phi M_u = \phi k_1 k_4 k_5 k_8 k_{20} k_{21} k_{22} f_b Z$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind, earthquake}$$

$$k_4 = 1 \text{ 1 element}$$

$$k_5 = 1$$

$$k_8 = 1$$

$$S = \frac{L}{d_f} = \frac{2800}{350} = 8$$

$$k_{20} = 0.9 \text{ Machine peeling applied to fb}$$

$$k_{21} = 0.85 \text{ applied to fb}$$

$$k_{22} = 1$$

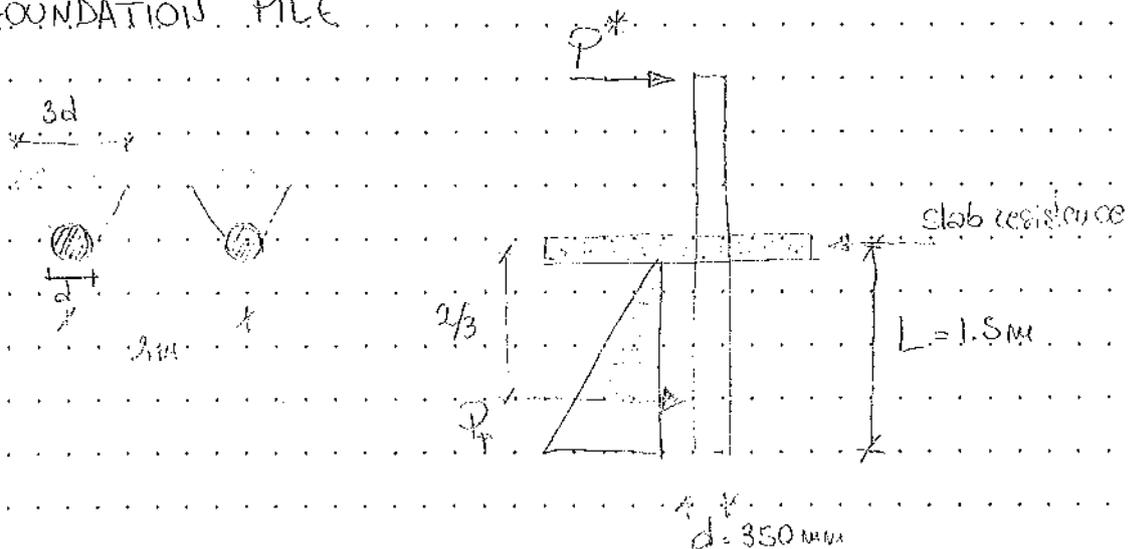
$$f_b = 38 \text{ MPa}$$

$$Z = \frac{\pi d^3}{32} = \frac{\pi \times 350^3}{32} = 4209243 \text{ mm}^3$$

$$\phi M_u = \frac{0.8 \times 0.9 \times 0.85 \times 38 \text{ MPa} \times 4209243 \text{ mm}^3}{1000000}$$

$$= 97 \text{ kNm} \geq 64 \text{ kNm} \quad \text{ok}$$

FOUNDATION PILE





Dunning
Thornton
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dwcgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$\phi' = 30^\circ$$

$$\gamma = 18 \frac{\text{kN}}{\text{m}^3} \quad \text{Assume sand}$$

$$k_p = 3$$

$$d = 350 \text{ mm}$$

$$L = 1.5 \text{ m}$$

$$\sigma_H = k_p \gamma x h$$

$$P_p = k_p \gamma (3A) \times \frac{L^2}{2}$$

$$= 3 \times 18 \frac{\text{kN}}{\text{m}^3} \times (3 \times 0.35 \text{ m}) \times \frac{1.5^2 \text{ m}^2}{2} = 64 \text{ kN}$$

$$\phi_{bc} = 0.5$$

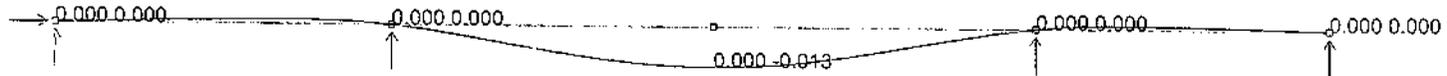
$$\phi_{bc} P_p = 0.5 \times 64 \text{ kN} = 32 \text{ kN} \geq 23 \text{ kN} \quad \underline{\text{ok}}$$

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 stairs lintel
7370 131025 stairs lintel

25/10/2013
10:56:10 a.m.

Load Cases:
— 4 P Ws



Y
Z → X

theta: 270 phi: 0

Displaced Shape



**Dunning
Thornton**
consultants

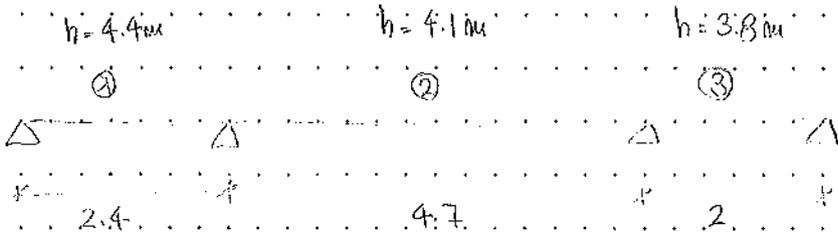
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dctw@dn.dunningthornton.co.nz



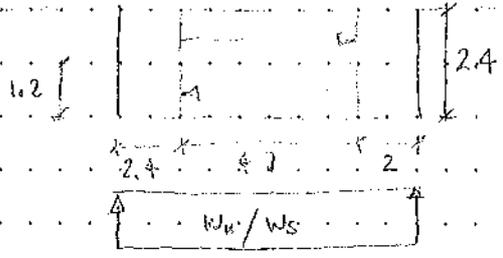
CALCULATIONS

JOB NAME:	7 TUTUPE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

STAIRS TRANSOM



G = 0.4 kPa floor
0.3 kPa wall
Q = 1.5 kPa floor



$$1.26 \times 1.5 = 0$$

$$1.7 \times 0$$

①

$$G = 0.4 \text{ kPa} \times 1.2 \text{ m} + 0.3 \text{ kPa} \times 4.4 \text{ m} = 1.8 \text{ kN/m}$$

$$Q = 1.5 \text{ kPa} \times 1.2 \text{ m} = 1.8 \text{ kN/m}$$

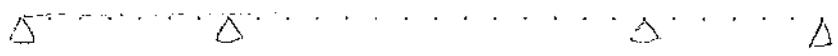
②

$$G = 0.3 \text{ kPa} \times \frac{(4.1 + 2.4) \text{ m}}{2} = 0.98 \text{ kN/m}$$

③

$$G = 0.4 \text{ kPa} \times 1.2 \text{ m} + 0.3 \text{ kPa} \times \frac{(3.8 + 2.4) \text{ m}}{2} = 1.4 \text{ kN/m}$$

$$Q = 1.8 \text{ kN/m}$$



① $W_u = 1.62 \text{ kPa} \times 4.4 \text{ m} = 3.6 \text{ kN/m}$ $W_s = 1.16 \text{ kPa} \times \frac{4.4 \text{ m}}{2} = 2.6 \text{ kN/m}$

② $W_u = 1.62 \text{ kPa} \times \frac{(4.1 + 2.4) \text{ m}}{2} = 5.3 \text{ kN/m}$ $W_s = 1.16 \text{ kPa} \times \frac{(4.1 + 2.4) \text{ m}}{2} = 3.8 \text{ kN/m}$

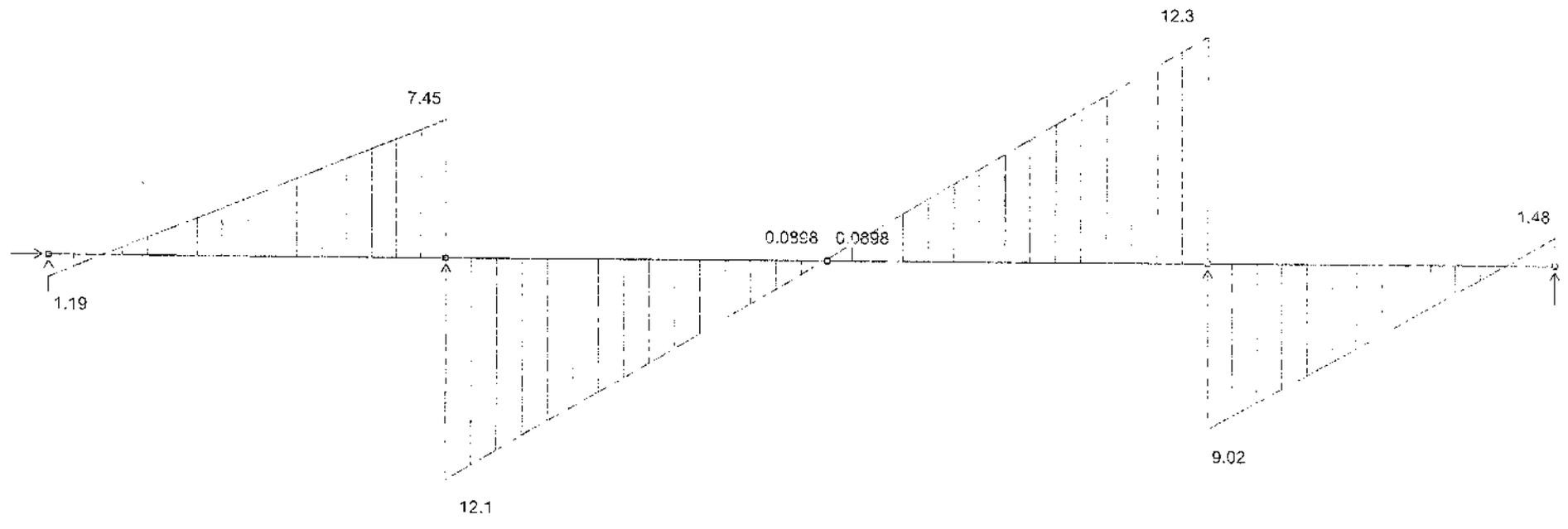
③ $W_u = 1.62 \text{ kPa} \times \frac{(3.8 + 2.4) \text{ m}}{2} = 5.1 \text{ kN/m}$ $W_s = 1.16 \text{ kPa} \times \frac{(3.8 + 2.4) \text{ m}}{2} = 3.6 \text{ kN/m}$

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 stairs lintel
7370 131025 stairs lintel

31/10/2013
01:49:21 p.m.

Load Cases:
3 P Wu



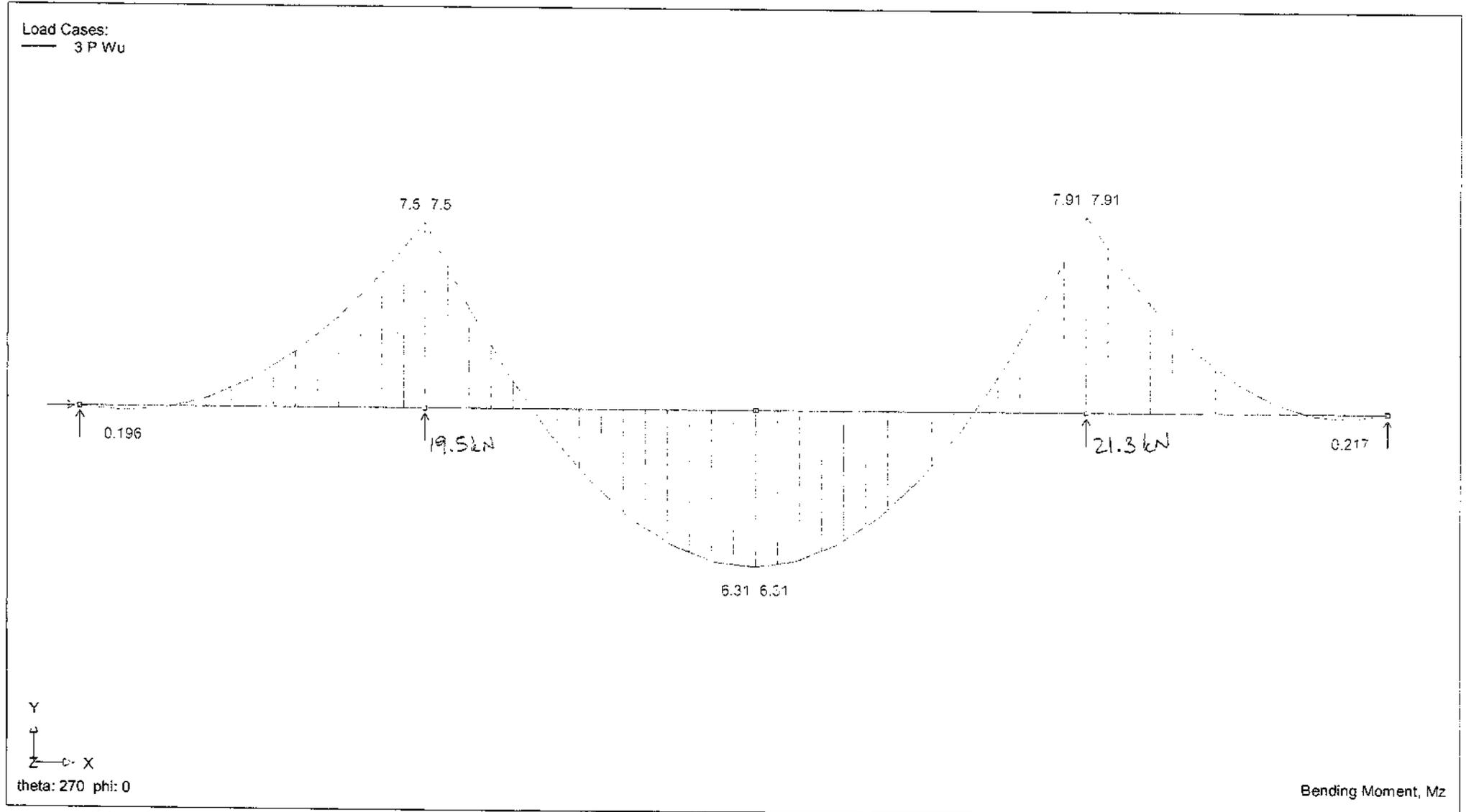
Y
Z → X
theta: 270 phi: 0

Shear Force, Fy

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 stairs lintel
7370 131025 stairs lintel

31/10/2013
01:49:32 p.m.



Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 stairs lintel
7370 131025 stairs lintel

31/10/2013
01:49:43 p.m.

Load Cases:
— 4 P Ws



Y
↑
Z → X
theta: 270 phi: 0

Displaced Shape



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

W_u

3/140x45 MSG10

$$\phi M_{Mn} = \phi k_1 k_2 k_3 k_4 f_b Z$$

$$\phi = 0.8$$

$$k_1 = 1 \text{ Wind}$$

$$k_4 = 1.2 \text{ 3 element}$$

$$k_3 = 1$$

$$S_1 = 1.35 \left[\frac{4700}{135} \left[\left(\frac{140}{135} \right)^2 - 1 \right] \right]^{0.5 \cdot 0.5} = 1 \rightarrow k_2 = 1$$

$$I_b = 20113$$

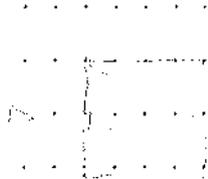
$$Z = \frac{140 \times 135^2}{6} = 425250 \text{ mm}^3$$

$$\phi M_{Mn} = 0.8 \times 1.2 \times 1 \times 1 \times 20113 = 42425 \text{ mm}^3 = 8.2 \text{ kNm} \geq 7.9 \text{ kNm}$$

OK

$$\Delta_{max} = \frac{4700}{300} = 15.7 \text{ mm} \leq 23 \text{ mm} \quad \text{NO}$$

✓ try 2/140x45 MSG10 + 130x6 steel plate $I_y = 250 \text{ M}^2$



$$\begin{matrix} 140 & 20 \\ 130 & 6 \end{matrix}$$

$$I_y = 2 \times (140 \times 45^3) + 20 \times (130 \times 6^3) = 28200 \text{ mm}^4$$

$$Z = \frac{140 \times 201^2}{6} = 942690 \text{ mm}^3$$

$$S_1 = 1.35 \left[\frac{4700}{140} \left[\left(\frac{201}{140} \right)^2 - 1 \right] \right]^{0.5 \cdot 0.5} = 7.9 \rightarrow k_2 = 1$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 THICK ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$\phi M_{ux} = 0.8 \times 1.2 \times 1 \times 1 \times 20 \text{ MPa} = 942690 \frac{\text{mm}^3}{1000} = 18 \text{ kNm} \geq 7.9 \text{ kNm} \quad \text{ok}$$

$$\Delta_{max} = 15.7 \text{ mm} \geq 14 \text{ mm} \quad \text{ok}$$



MUTIGRIP:

$$\phi 13.24 \text{ kN} = 0.8 \times 13.24 \text{ kN} = 10.6 \text{ kN} \times 2 \text{ Mutigrrips} = 21 \text{ kN} > 12 \text{ kN}$$

240x45 MSFB $\phi N_{ucy} = k_1 k_2 f_c A$

$$k_1 = 0.8 \text{ live load}$$

$$S_{18} = \frac{l_{ay}}{b} = \frac{2000}{45} = 44 \rightarrow k_2 = 0.15$$

$$f_c = 18 \text{ MPa}$$

$$A = 240 \times 45 = 10800 \text{ mm}^2$$

$$\phi N_{ucy} = 0.8 \times 0.8 \times 0.15 \times 18 \text{ MPa} \times 10800 \text{ mm}^2 = 18.6 \text{ kN} < 21 \text{ kN} \quad \text{NO}$$

with mid-span $S_{18} = \frac{l_{ay}}{b} = \frac{2000/2}{45} = 22 \rightarrow k_2 = 0.56$

$$\phi N_{ucy} = 0.8 \times 0.8 \times 0.56 \times 18 \text{ MPa} \times 10800 \text{ mm}^2 = 40 \text{ kN} \geq 21 \text{ kN} \quad \text{ok}$$

2/140x45 $S_{18} = \frac{2000}{45 \times 2} = 22 \rightarrow k_2 = 0.56$

$$A = 140 \times 90 = 12600 \text{ mm}^2$$

$$\phi N_{ucy} = 0.8 \times 0.8 \times 0.56 \times 18 \text{ MPa} \times 12600 \text{ mm}^2 = 81 \text{ kN} \geq 21 \text{ kN} \quad \text{ok}$$



**Dunning
Thornton**
consultants

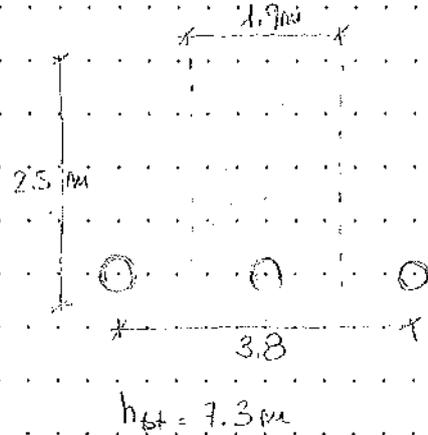
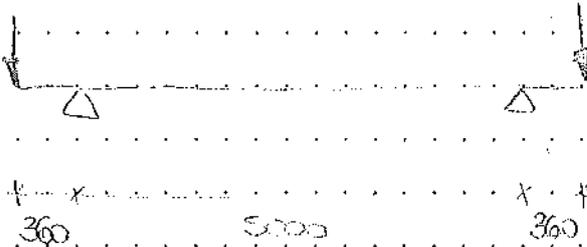
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwt@dnunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7870	CaS	Oct - 2013	

GROUND FLOOR



$$1.2G + 1.5Q \quad \text{ULS}$$

$$G + \psi_s Q \quad \text{SLS}$$

Roof $G = 0.3 \times (1.3 \times 2.5) \text{ m}^2 = 0.98 \text{ kN}$

2 floors $G = 2.4 \times (1.3 \times 2.5) \text{ m}^2 = 1.3 \text{ kN}$

Wall $G = 0.3 \text{ kPa} \times (1.9 \times 1.3) \text{ m}^2 = 4.2 \text{ kN}$

$$G_{\text{tot}} = 0.98 + 2 \times 1.3 + 4.2 \text{ kN} = 7.8 \text{ kN}$$

Roof $Q = 0.25 \text{ kPa} \times (1.3 \times 2.5) \text{ m}^2 = 0.81 \text{ kN}$

Floors $Q = 1.5 \text{ kPa} \times (1.3 \times 2.5) \text{ m}^2 = 4.9 \text{ kN}$

$$Q_{\text{tot}} = 0.81 + 2 \times 4.9 = 10.6 \text{ kN}$$

$$M^* = 9.1 \text{ kNm}$$

$$V^* = 25.3 \text{ kN}$$

$$A = \frac{360 \times 2}{300} = 2.4 \text{ mm}^2$$

$$S = \frac{P_e^3}{300} = \frac{16000 \text{ N} \cdot 360^3 \text{ mm}^3}{3 \times 300} = 1.6 \times 10^8$$

$$40 \times 40^3 = 51340000$$

$$240 \times 45 \text{ MCG 8}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dltw@dnunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE SC		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$\phi V_u = \phi k_1 k_2 k_3 f_s A_s \quad 2/240 \times 45 \text{ MSG8}$$

$$f_s = 3.0 \text{ MPa}$$

$$A_s = \frac{2db}{3} = \frac{2 \times 240 \times 90}{3} = 14400 \text{ mm}^2$$

$$k_1 = 0.8 \text{ medium load}$$

$$k_2 = 1.14 \text{ 2 elements}$$

$$\phi V_u = 0.8 \times 0.8 \times 1.14 \times 3 \text{ MPa} \times 14400 \text{ mm}^2 = 31.5 \text{ kN} \geq 25 \text{ kN} \text{ ok}$$

$$\phi M_u = \phi k_1 k_2 k_3 k_8 I_e$$

$$C_1 = 1.35 \times \left[\frac{5000}{90} \left[\left(\frac{240}{90} \right)^2 - 1 \right] \right]^{0.5} = 15.8 \rightarrow k_8 = 0.87$$

$$I_e = \frac{bd^3}{6} = \frac{90 \times 240^3}{6} = 864000 \text{ mm}^3$$

$$\phi M_u = 0.8 \times 0.8 \times 1.14 \times 0.87 \times 14 \text{ MPa} \times 864000 \text{ mm}^3 = 7.7 \text{ kNm} \leq 9.1 \text{ kNm} \text{ NO}$$

✓ | 3y. Hy 240x90. E = 9.5 GPa. | LVL. $\delta_{max} = 14 \text{ mm} \leq \frac{5000}{300} = 16.7 \text{ mm} \text{ ok}$

$$\phi M_u = 0.8 \times 0.8 \times 2.31 \times 35 \text{ MPa} \times 864000 \text{ mm}^3 = 16.8 \text{ kNm} \geq 9.1 \text{ kNm} \text{ ok}$$

$$\text{Hy. } 3/240 \times 45 \text{ MSG8}$$

$$\delta_{max} = 11 \text{ mm} \leq 16.7 \text{ mm} \text{ ok}$$

$$C_1 = 1.35 \times \left[\frac{5000}{135} \left[\left(\frac{240}{135} \right)^2 - 1 \right] \right]^{0.5} = 11 \rightarrow k_8 = 1$$

$$I_e = \frac{135 \times 240^3}{6} = 1296000 \text{ mm}^3$$

$$\phi M_u = 0.8 \times 0.8 \times 2.2 \times 14 \text{ MPa} \times 1296000 \text{ mm}^3 = 13.9 \text{ kNm} \geq 9.1 \text{ kNm} \text{ ok}$$



Dunning
Thornton
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dclwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUREKI ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Dec - 2013	

Try 240x63 LVL 13

$$\phi M_m = 0.8 \times 2.8 \times 0.7 \times 48 \text{ MPa} \times \frac{63 \times 240^2}{5} \text{ mm}^3$$

$$= 16.7 \text{ kNm} \geq 9.1 \text{ kNm} \quad \text{OK}$$

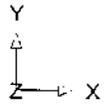
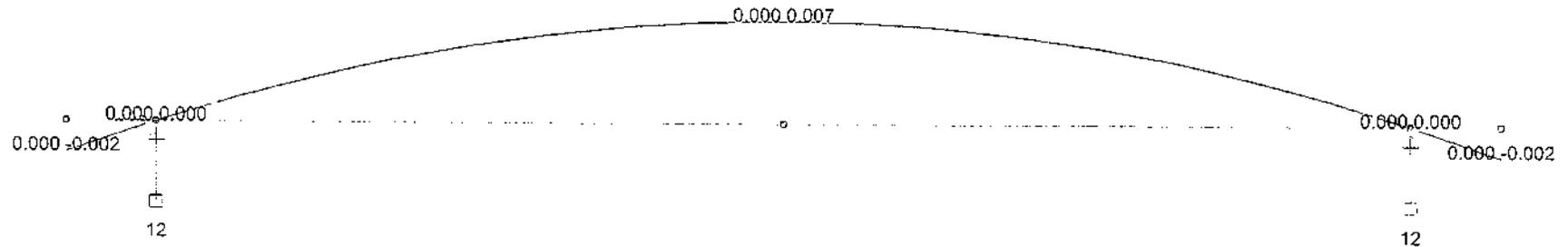
Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 joist gfloor
7370 131025 joist gfloor

10/12/2013
01:40:44 p.m.

Load Cases:
— 4 C G+0.4Q

2/240x63 LVL 13



theta: 270 phi: 0

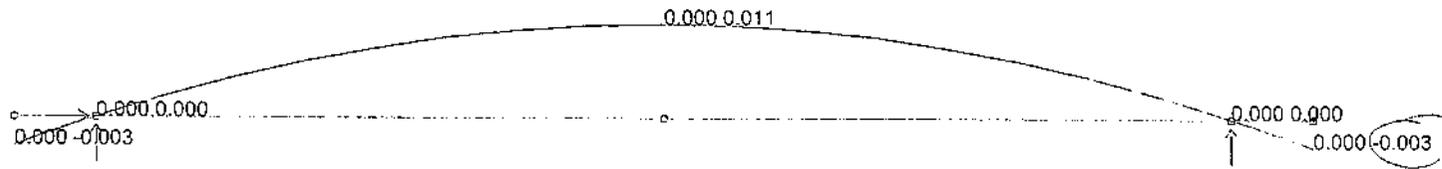
Displaced Shape
Support Reactions

Microstran V9

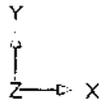
Dunning Thornton Consultants Ltd
Job: 7370 131025 joist gfloor
7370 131025 joist gfloor

25/10/2013
04:29:38 p.m.

Load Cases:
— 4 C G+0.4Q



$$\frac{350 \times 2}{300} = 2.4 \text{ mm}$$



theta: 270 phi: 0

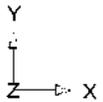
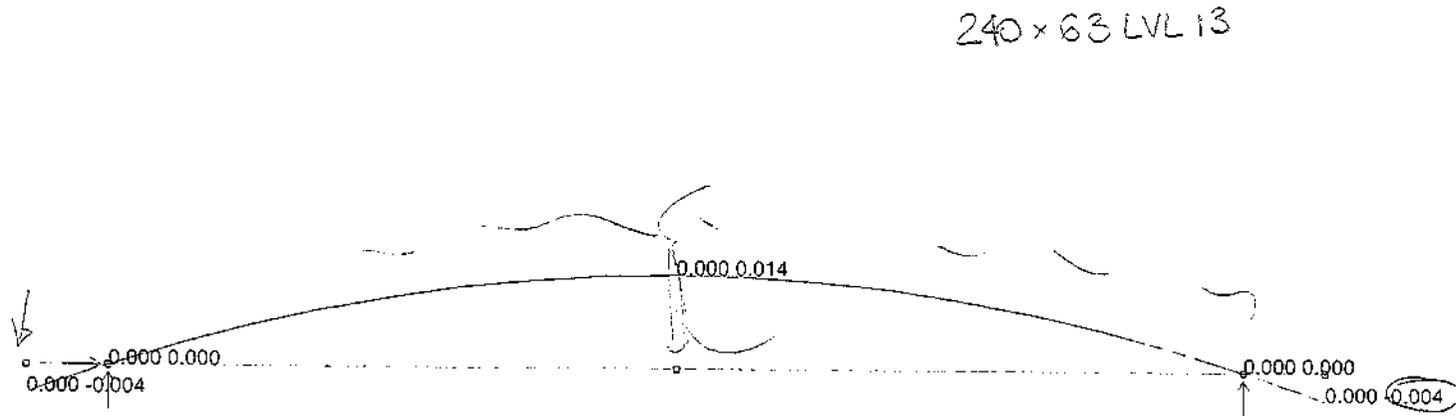
Displaced Shape

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 joist gfloor
7370 131025 joist gfloor

10/12/2013
01:33:39 p.m.

Load Cases:
— 4 C G+0.4Q



theta: 270 phi: 0

Displaced Shape

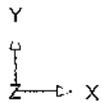
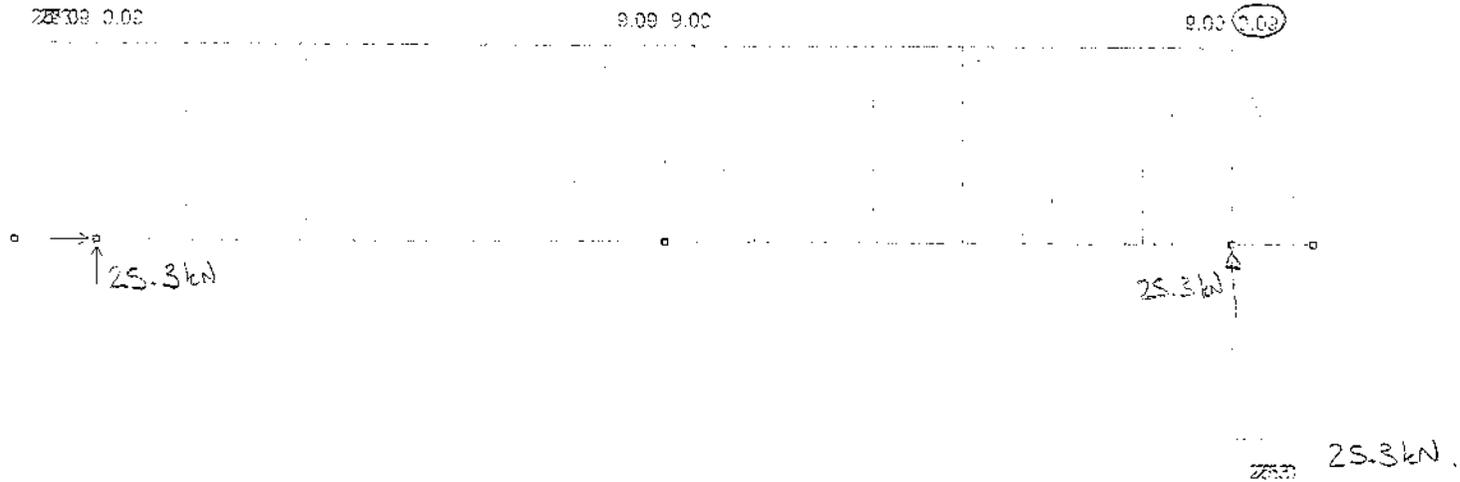
Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 joist gfloor
7370 131025 joist gfloor

25/10/2013
04:29:54 p.m.

Load Cases:

3 C 1.2G+1.5Q



theta: 270 phi: 0

Shear Force, Fy
Bending Moment, Mz



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019

Fax: (64 4) 385-0312

PO Box 27 153, Wellington

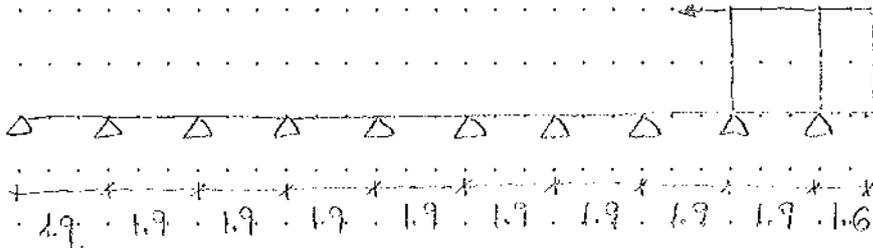
E-Mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERU ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

BEARER



LVL 13.2 HS 300 x 63

ULS	SLS (short term)	St.S. (long term)
1.2G + 1.5Q	G + 0.7Q	G + 0.4Q
G = 0.4 kPa floor	(k ₂ = 1)	(k ₂ = 2)
G = 0.3 kPa walls		
Q = 1.5 kPa		

Tributary width = 5m

$$G_{\text{walls}} = 0.3 \text{ kPa} \times \frac{3 \text{ m}}{2} = 0.45 \frac{\text{kN}}{\text{m}}$$

$$G_{\text{floor}} = 0.4 \text{ kPa} \times 5 \text{ m} = 2 \frac{\text{kN}}{\text{m}}$$

$$G_{\text{TOT}} = 2.45 \text{ kN/m}$$

$$Q = 1.5 \text{ kPa} \times 5 \text{ m} = 7.5 \text{ kN/m}$$

$$\phi M_u = \phi k_1 k_2 k_3 k_4 k_5 k_6 Z$$

$$\phi = 0.8$$

$$k_1 = 0.8$$

$$S_1 = 1.35 \times \left[\frac{1900}{63} \times \left(\left(\frac{300}{63} \right)^2 - 1 \right)^{0.5} \right]^{0.8} = 16 \rightarrow k_3 = 0.9$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERU SI		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

$$f_b = 48 \text{ MPa}$$

$$I = \frac{bd^2}{6} = \frac{63 \times 300^2}{6} = 945000 \text{ mm}^3$$

$$\phi M_{u1} = \frac{0.8 \times 0.8 \times 0.7 \times 48 \text{ MPa} \times 945000 \text{ mm}^3}{1000000} = 26.1 \text{ kNm} \geq 18.2 \text{ kNm} \quad \text{ok}$$

$$\delta = \left\{ \begin{array}{l} \text{7 mm} \leq \frac{1600 \times 2}{300} = 10.7 \text{ mm} \quad \text{ok} \\ \text{1 mm} \leq \frac{1900}{300} = 6.3 \text{ mm} \quad \text{ok} \end{array} \right\} \text{SHORT TERM}$$

$$\delta = \left\{ \begin{array}{l} 4.9 \text{ mm} \times 2 = 9.8 \text{ mm} \leq 10.7 \text{ mm} \quad \text{ok} \\ 1 \text{ mm} \times 2 = 2 \text{ mm} \leq 6.3 \text{ mm} \quad \text{ok} \end{array} \right\} \text{LONG TERM}$$

LVL 13 HS 240x45

$$S_1 = 1.33 \times \left[\frac{1900}{48} \times \left(\frac{240^2}{25} + 1 \right) \right]^{0.25} \times 20 = 0.61$$

$$I = \frac{bd^2}{6} = \frac{45 \times 240^2}{6} = 432000 \text{ mm}^3$$

$$\phi M_u = \frac{0.3 \times 0.3 \times 0.57 \times 48 \text{ MPa} \times 432000 \text{ mm}^3}{1000000} = 8.7 \text{ kNm} \geq 5.41 \text{ kNm} \quad \text{ok}$$

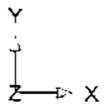
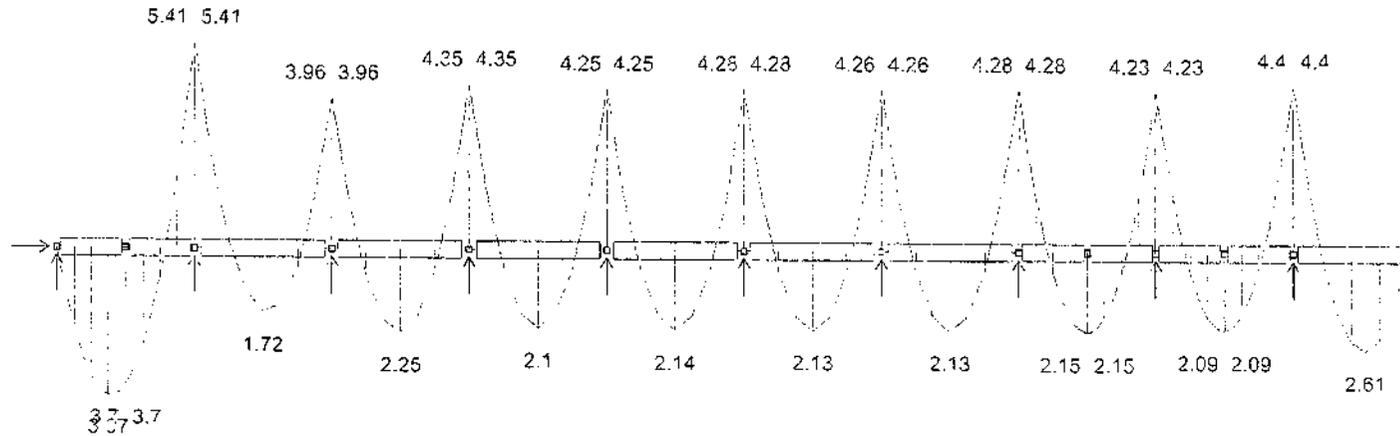
$$\delta = 1 \text{ mm} \times 2 = 2 \text{ mm} \leq 6.3 \text{ mm} \quad \text{LONG TERM} \quad \text{ok}$$

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131029 bearer
7370 131029 bearer

31/10/2013
12:54:23 p.m.

Load Cases:
— 3 C 1.2G+1.5Q



theta: 270 phi: 0

Bending Moment, Mz

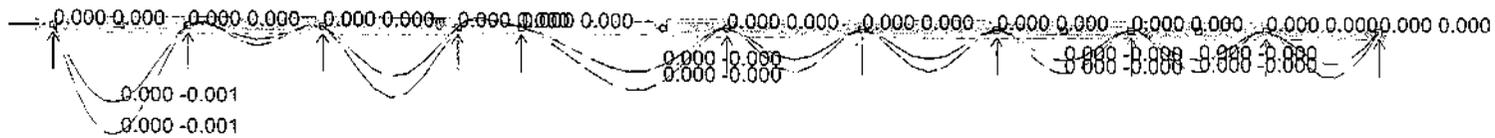
Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131029 bearer
7370 131029 bearer

09/12/2013
04:14:54 p.m.

Load Cases:
—— 4 C G+0.7Q
—— 5 C G+0.4Q

190 x 45 LVL 13
240 x 45 LVL 13



Y
Z X

theta: 270 phi: 0

Displaced Shape



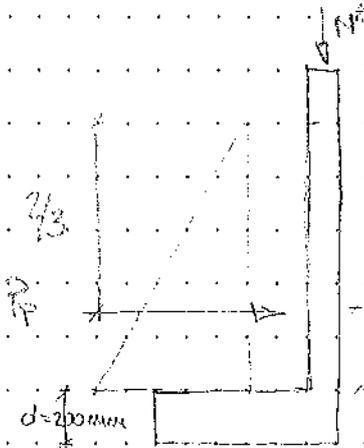
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dctwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TOTERE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	



$H = 1.7 \text{ m}$

$$\phi' = 30^\circ$$

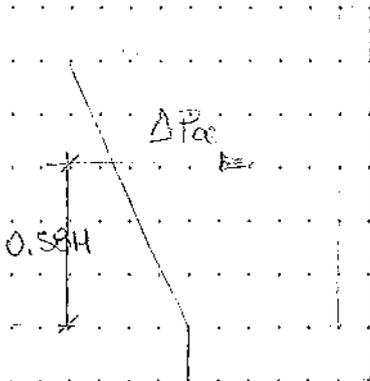
$$\gamma = 18 \frac{\text{kN}}{\text{m}^3} \text{ sand}$$

$$k_p = 3$$

$$P_p = k_p \gamma \frac{H^2}{2}$$

$$= 3 \times 18 \frac{\text{kN}}{\text{m}^3} \times \frac{1.7^2}{2} \text{ m}^2 = 78 \frac{\text{kN}}{\text{m}}$$

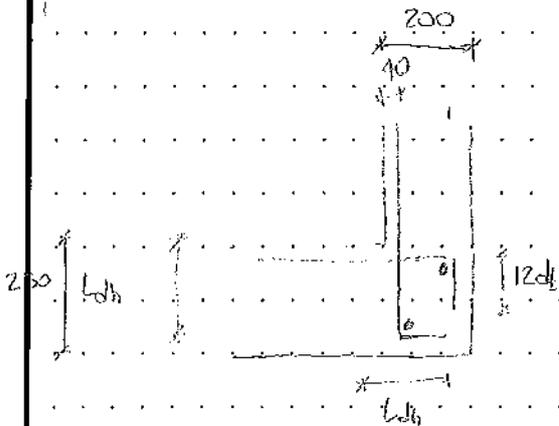
$$N^* = 0$$



$$\Delta P_{poc} = C(\phi) \gamma H^2 \text{ (fixed)}$$

$$C(\phi) = C_n(\phi) E R_n(T, D)$$

$$= 1.12 \times 0.4 \times 1 \times 1 = 0.45$$



$\Delta 12 @ 200 \text{ c/c}$

$$l_{dh} = 0.24 \alpha_b \alpha_s \alpha_2 \frac{f_y d_b}{\sqrt{f_c}} \geq 8 d_b$$

$$\alpha_b = \frac{A_{se}}{A_{sp}} = 1; \alpha_s = 1; \alpha_2 = 1$$

$$f_y = 300 \text{ MPa}$$

$$f_c = 30 \text{ MPa}$$

$$d_b = 12 \text{ mm}$$

$$l_{dh} = 0.24 \times \frac{300 \text{ MPa} \times 12 \text{ mm}}{\sqrt{30 \text{ MPa}}} = 160 \text{ mm} \geq 8 \times 12 \text{ mm} = 96 \text{ mm} \text{ ok}$$

$$12 d_b = 12 \times 12 \text{ mm} = 144 \text{ mm}$$

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgn@dunningthornton.co.nz



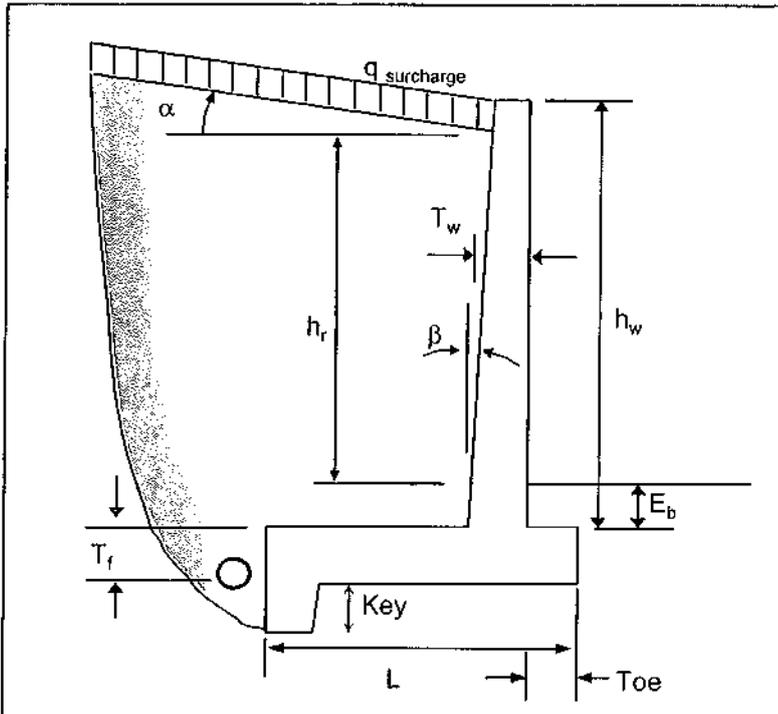
CALCULATIONS

Job Name: 7 TUTERE ST

Job No.	Calc'd By	Date	Page
7370	CaS	31-Oct-13	
MASTRETW.xls			

WALL DIMENSIONS AND SOIL PROPERTIES

Design of retaining wall using Rankine's method of analysis

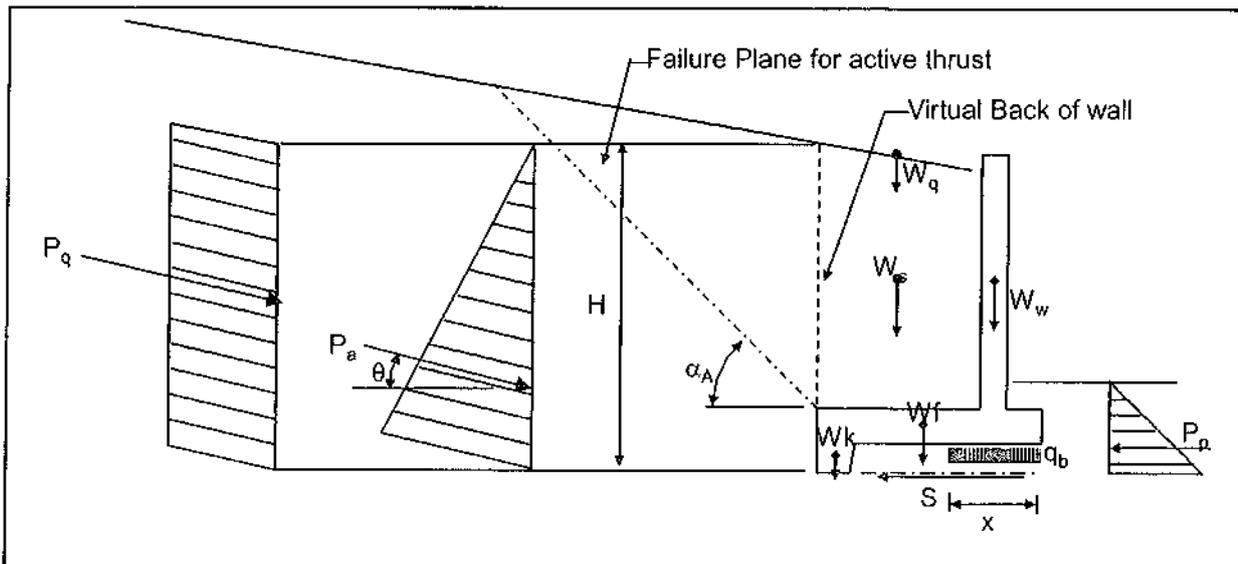


SOIL PARAMETERS :

ϕ =	30 °
γ =	18 kN/m ³
$\phi_{bc}\sigma_v$ =	150 kPa
h_r =	1.7 m
E_b =	0 m
α =	0 °
Surchge. =	2.5 kPa

WALL PARAMETERS :

h_w =	1.9 m
L =	1.5 m
TOE =	0 m
T_f =	0.25 m
KEY =	0.2 m
T_w =	0.2 m
β =	0 °
Foot. wt. =	24 kN/m ³
Wall wt. =	24 kN/m ³



Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgt@Dunningthornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.	Calc'd By	Date	Page
7370	CaS	31-Oct-13	

MASTRETW.XIS

MONONOBE-OKABE ANALYSIS OF WALL STABILITY

Height of soil above base of key, H	=	2.15 m	
Design seismic coefficient, C(0)	=	0.45	
Angle of wall friction, $\delta = 2/3\phi$	=	20.0 °	
Angle of base friction, δ_b	=	20 °	
Total weight of footing, W_f	=	9.00 kN/m run of wall	Distance from Toe 0.75 m
Total weight of wall stem, W_w	=	7.98 kN/m run	0.0875 m
Total weight of key, W_k	=	0.84 kN/m run	1.4125 m
Weight of soil above heel, W_s	=	40.55 kN/m run	0.8375 m
Net surcharge, W_q	=	3.31 kN/m run	0.8375 m
Weight of soil above toe, W_{st}	=	0.00 kN/m run	0 m

$$K_a = \frac{\cos^2(\phi - \beta)}{\cos^2 \beta \cos(\delta + \beta) \left(1 + \frac{\sin(\phi + \delta) \sin(\phi - \alpha)}{\cos(\delta + \beta) \cos(\alpha - \beta)} \right)^2} = 0.30$$

$$K_p = \frac{\cos^2(\phi + \beta)}{\cos^2 \beta \cos(\delta + \beta) \left(1 - \frac{\sin(\phi - \delta) \sin(\phi + \alpha)}{\cos(\delta + \beta) \cos(\alpha - \beta)} \right)^2} = 1.65$$

$$K_{AE} = \frac{\cos^2(\phi - \beta - \theta)}{\cos \delta \cos^2 \beta \cos(\delta + \beta + \theta) \left(1 + \frac{\sin(\phi + \delta) \sin(\phi - \alpha - \theta)}{\cos(\delta + \beta + \theta) \cos(\alpha - \beta)} \right)^2} = 0.86$$

$$\alpha_{AE} = \alpha + \cot \alpha \left(-\tan(\phi + \delta + \beta - \alpha) + \sec(\phi + \delta + \beta - \alpha) \sqrt{\frac{\cos(\beta + \delta) \sin(\phi + \delta)}{\cos(\beta - \alpha) \sin(\phi - \alpha)}} \right) = 22.3^\circ$$

Active thrust, $P_a = \frac{1}{2} K_a \gamma h^2 = 12.37 \text{ kN/m run}$

Seismic thrust, $\Delta P_{AE} = \Delta K_{ae} \gamma^* h^2 = 23.37 \text{ kN/m run}$

$\Rightarrow P_{net} = 35.74 \text{ kN/m run}$

Angle of thrust, $\theta = \beta + \delta = 20^\circ$

Height of action (moments about base) = 0.99 m above base of footing

$\Rightarrow P_{hor} = 33.58 \text{ kN/m run}$

$P_{vert} = 12.22 \text{ kN/m run}$

Passive thrust, $P_p = \frac{1}{2} K_p \gamma h_p^2 = 3.00 \text{ kN/m run}$

Net Downwards Force = $W_f + W_w + W_k + W_s + W_q + W_{st} + P_{vert} = 73.90 \text{ kN/m run}$

Ultimate Bearing Block Length, $x = \Sigma P_{down} / \sigma = 0.49 \text{ m}$

OVERTURNING STABILITY: Moments about centre of bearing block

Overturning Moment, $M_{O+G+Qu+E} = 34.52 \text{ kNm/m run}$

Resisting Moment, $\phi M_r = 40.33 \text{ kNm/m run}$

U.L.S. RATIO AGAINST OVERTURNING = $\phi M_r / M_o = 1.17 \text{ OK}$

SLIDING STABILITY

Short term undrained shear strength $s_u = 25 \text{ kPa}$

Effective bearing width $B' = 0.790 \text{ m}$

Passive resist $\phi_{pp}(2S_u H_{frcnt} + 0.5\gamma(H_{frcnt})^2) = 12.16 \text{ kN/m run}$

Base resist = $\phi_{SL} \cdot s_u \cdot B' = 15.80 \text{ kN/m run}$

NET RESISTANCE = 27.96 kN/m run

U.L.Ss RATIO AGAINST SLIDING = 0.83 Factor of safety must be > 1.0

Dunning Thornton Consultants Ltd

Consulting Engineers

Box 27153

WELLINGTON

Phone (644) 385-0019

Fax (644) 385-0312



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.
7370

Calc'd By
CaS

Date
31-Oct-13

Page

MASTRETW.xls

REINFORCING DESIGN FOR WALL

WALL PARAMETERS:

$f_c / f_m =$	30	MPa
$f_y =$	300	MPa
$\phi =$	0.85	
Min Cover =	40	mm
$\alpha_1 =$	0.85	

ULTIMATE LOAD COMBINATIONS:

G+Qu+E \Rightarrow $M^* =$ 21.56 kNm/m run

1.5G+1.5Q \Rightarrow $M^* =$ 9.18 kNm/m run

$\therefore M^*_{max} =$ 21.56 kNm/m run

BARS	SPACING	POSN.	d (mm)	ϕM_n (kNm/m)	
12	400	Central	100	7.09	FAILS
12	300	Central	100	9.40	FAILS
12	200	Central	100	13.94	FAILS
12	400	Back Face	154	10.98	FAILS
12	300	Back Face	154	14.59	FAILS
12	200	Back Face	154	21.73	OK
16	400	Central	100	12.44	FAILS
16	300	Central	100	16.42	FAILS
16	200	Central	100	24.12	OK
16	400	Back Face	152	19.10	FAILS
16	300	Back Face	152	25.30	OK
16	200	Back Face	152	37.45	OK
20	400	Central	100	19.10	FAILS
20	300	Central	100	25.06	OK
20	200	Central	100	36.35	OK
20	400	Back Face	150	29.12	OK
20	300	Back Face	150	38.41	OK
20	200	Back Face	150	56.38	OK
25	400	Back Face	147.5	43.90	OK
25	300	Back Face	147.5	57.53	OK
25	200	Back Face	147.5	83.28	OK



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
 Fax: (64 4) 385-0312
 PO Box 27 153, Wellington
 E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Dec - 2013	

$$\phi M_m = \phi \left(f_y \frac{A_s}{s} \times 1000 \times \left(d - \left(\frac{1}{2} \times \frac{A_s}{f_c \times s} \right) \right) \right)$$

$$\phi = 0.85$$

$$l_y = 3010 \text{ mm}$$

$$d = 175 \text{ mm}$$

$$A_s = 113 \text{ mm}^2$$

$$\alpha = 0.85$$

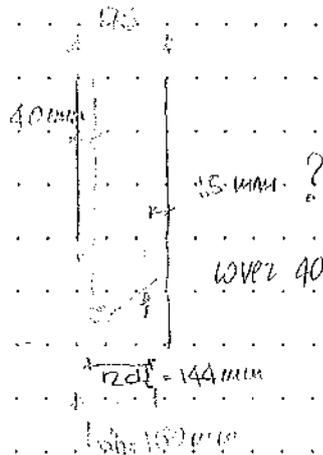
$$l_y = 3010 \text{ mm}$$

$$s = 120 \text{ mm}$$

$$M^* = 21.56 \text{ kNm} \leq \phi M_m = 22.13 \text{ kNm}$$

D12 @ 120 c/s

$$l_{ch} = 0.24 \times \frac{300 \text{ MPa} \times 12 \text{ mm}}{\sqrt{30 \text{ MPa}}} = 160 \text{ mm}$$



Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtewgtn@dunningthornton.co.nz



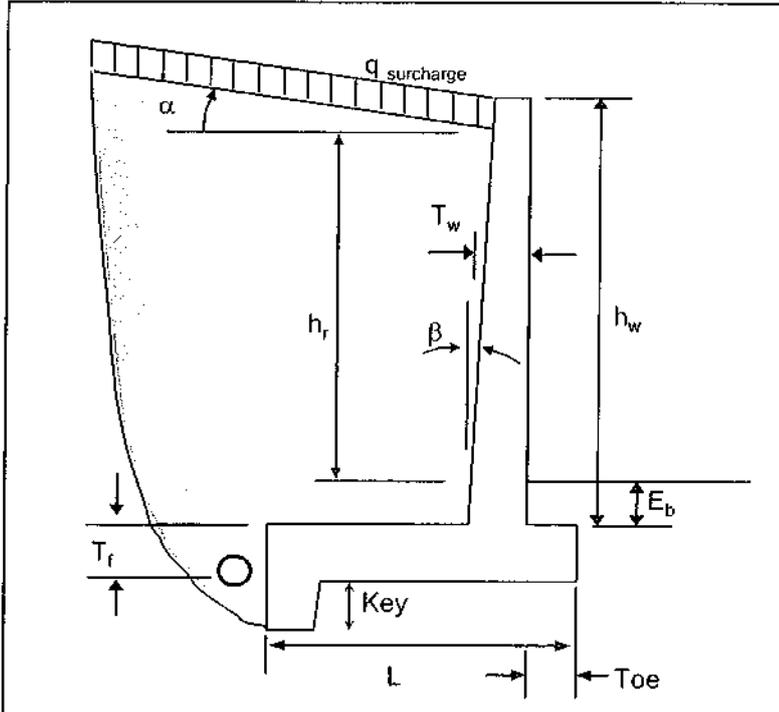
CALCULATIONS

Job Name: 7 TUTERE ST

Job No.	Calc'd By	Date	Page
7370	CaS	7-Dec-13	
MASTRETW.xls			

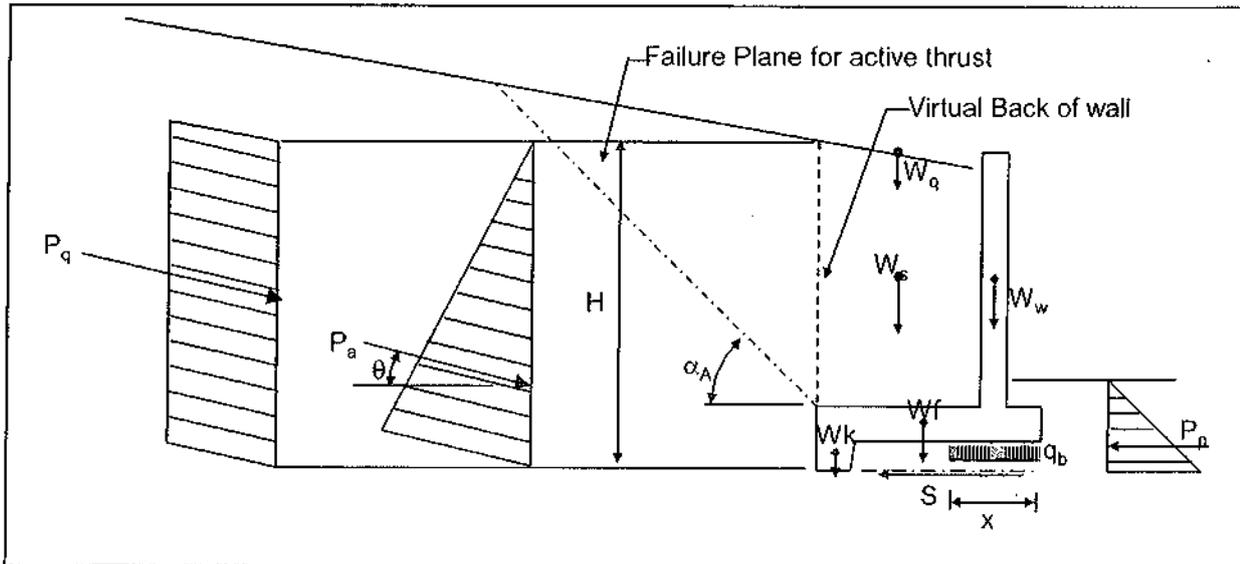
WALL DIMENSIONS AND SOIL PROPERTIES

Design of retaining wall using Rankine's method of analysis



SOIL PARAMETERS :	
$\phi =$	30 °
$\gamma =$	18 kN/m ³
$\phi_{bc}\sigma_u =$	150 kPa
$h_r =$	1.7 m
$E_b =$	0 m
$\alpha =$	0 °
Surchge. =	2.5 kPa

WALL PARAMETERS :	
$h_w =$	1.9 m
$L =$	1.5 m
TOE =	0 m
$T_r =$	0.25 m
KEY =	0.2 m
$T_w =$	0.175 m
$\beta =$	0 °
Foot. wt. =	24 kN/m ³
Wall wt. =	24 kN/m ³



Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgt@DunningThornton.co.nz



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.	Calc'd By	Date	Page
7370	CaS	7-Dec-13	

MASTRETW.xls

RANKINE ANALYSIS OF WALL STABILITY

Height of soil above base of key, H	=	2.15 m	
			Distance from Toe
Total weight of footing, W_f	=	9.00 kN/m run of wall	0.75 m
Total weight of wall stem, W_w	=	7.98 kN/m run	0.0875 m
Total weight of key, W_k	=	0.84 kN/m run	1.4125 m
Weight of soil above heel, W_s	=	40.55 kN/m run	0.8375 m
Net surcharge, W_q	=	3.31 kN/m run	0.8375 m
Weight of soil above toe, W_{st}	=	0.00 kN/m run	0 m

$$K_a = \cos \alpha \left(\frac{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha + \sqrt{\cos^2 \alpha - \cos^2 \phi}} \right) = 0.33$$

$$K_p = \cos \alpha \left(\frac{\cos \alpha + \sqrt{\cos^2 \alpha - \cos^2 \phi}}{\cos \alpha - \sqrt{\cos^2 \alpha - \cos^2 \phi}} \right) = 3.00$$

$$\alpha_A = 45^\circ + \frac{\phi}{2} + \frac{1}{2} \left(\sin^{-1} \left(\frac{\sin \alpha}{\sin \phi} \right) - \alpha \right) = 60.0^\circ$$

$$\text{Active thrust, } P_a = \frac{1}{2} K_a \gamma h^2 = 13.87 \text{ kN/m run}$$

$$\text{Surcharge thrust, } P_q = K_a \cdot q_s \cdot h = 1.79 \text{ kN/m run}$$

$$\Rightarrow P_{net} = 15.66 \text{ kN/m run}$$

$$\text{Angle of thrust, } \theta = \alpha = 0^\circ$$

$$\text{Height of action (moments about base)} = 0.56 \text{ m above base of footing}$$

$$\Rightarrow P_{hor} = 15.66 \text{ kN/m run}$$

$$P_{vert} = 0.00 \text{ kN/m run}$$

$$\text{Passive thrust, } P_p = \frac{1}{2} K_p \gamma h_p^2 = 5.47 \text{ kN/m run}$$

$$\text{Net Downwards Force} = W_f + W_w + W_k + W_s + W_q + W_{st} + P_{vert} = 61.68 \text{ kN/m run}$$

$$\text{Ultimate Bearing Block Length, } x = \Sigma P_{down} / \sigma = 0.41 \text{ m}$$

OVERTURNING STABILITY: Moments about centre of bearing block

$$\text{Overturning Moment, } M_{o,1.5G+1.5Q} = 14.51 \text{ kNm/m run}$$

$$\text{Resisting Moment, } \phi M_r = 28.38 \text{ kNm/m run}$$

$$\text{U.L.S. RATIO AGAINST OVERTURNING} = \phi M_r / M_o = 1.96 \quad \text{OK}$$

SLIDING STABILITY

$$\text{Short term undrained shear strength } s_u = 0 \text{ kPa}$$

$$\text{Effective bearing width } B' = 1.000 \text{ m}$$

$$\text{Passive resistance } \phi_{PP}(P_p) = 2.73 \text{ kN/m run}$$

$$\text{Base resist} = \phi_{SL}(s_u B' + \sigma'_n \tan \phi B') = 17.96 \text{ kN/m run}$$

$$\text{NET RESISTANCE} = 20.69 \text{ kN/m run}$$

$$\text{U.L.S. RATIO AGAINST SLIDING} = 0.88 \quad \text{ULS ratio must be } > 1.0$$

Dunning Thornton Consultants Ltd

Consulting Engineers

Box 27153

WELLINGTON

Phone (644) 385-0019

Fax (644) 385-0312



CALCULATIONS

Job Name: 7 TUTERE ST

Job No.	Calc'd By	Date	Page
7370	CaS	7-Dec-13	

MASTRETW.xls

REINFORCING DESIGN FOR WALL

WALL PARAMETERS:

$f_c / f_m =$	30	MPa
$f_y =$	300	MPa
$\phi =$	0.85	
Min Cover=	40	mm
$\alpha_1 =$	0.85	

ULTIMATE LOAD COMBINATIONS:

G+Qu+E \Rightarrow $M^* = 21.56$ kNm/m run

1.5G+1.5Q \Rightarrow $M^* = 9.18$ kNm/m run

$\therefore M^*_{max} = 21.56$ kNm/m run

BARS	SPACING	POSN.	d (mm)	ϕM_n (kNm/m)	
12	400	Central	87.5	6.19	FAILS
12	300	Central	87.5	8.20	FAILS
12	200	Central	87.5	12.14	FAILS
12	400	Back Face	129	9.18	FAILS
12	300	Back Face	129	12.19	FAILS
12	200	Back Face	129	18.12	FAILS
16	400	Central	87.5	10.84	FAILS
16	300	Central	87.5	14.28	FAILS
16	200	Central	87.5	20.92	FAILS
16	400	Back Face	127	15.90	FAILS
16	300	Back Face	127	21.03	FAILS
16	200	Back Face	127	31.04	OK
20	400	Central	87.5	16.60	FAILS
20	300	Central	87.5	21.72	OK
20	200	Central	87.5	31.35	OK
20	400	Back Face	125	24.11	OK
20	300	Back Face	125	31.73	OK
20	200	Back Face	125	46.37	OK
25	400	Back Face	122.5	36.08	OK
25	300	Back Face	122.5	47.10	OK
25	200	Back Face	122.5	67.63	OK

Dunning Thornton Consultants Ltd

Consulting Engineers

Ph: (644) 385-0019

Fax: (644) 385-0312

PO Box 27-153, Wellington, NZ

E-mail: dtcwgt@DunningThornton.co.nz



CALCULATIONS

Job Name: 7 Tutere St.

Job No.
7370

Calc'd By
CaS

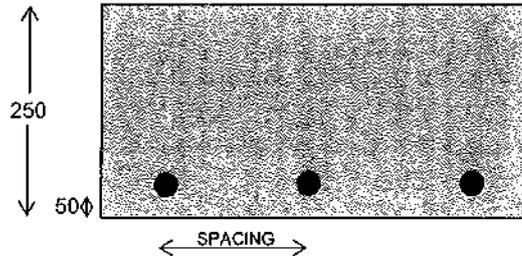
Date
31-Oct-13

Page

I:\ASTSLAB.xls

SIZE AND SPACING OF STEEL FOR SINGLY-REINFORCED CONCRETE SLAB

D =	250 mm
Cover =	50 mm
f_y =	300 MPa
f_c =	30 MPa
ϕ =	0.85



$$\alpha_1 = 0.85$$

$$\beta_1 = 0.85$$

$$p_b = 0.0482$$

$$p_{min} = \min(0.7/f_y, 0.0014) = 0.0014 \text{ (Based on gross section area ---> Full depth, D)}$$

$$p_{max} = 0.75p_b = 0.0361 \text{ (Based on effective section area ---> Effective depth, d)}$$

Moment Capacity (ϕM_n) in kNm per metre width of slab

SPACING (mm)	BAR DIAMETER (mm)						
	10	12	16	20	24	28	32
$\phi M_n(p_{min}) =$	17.2	17.1	17.0	16.8	16.6	16.4	16.2
$\phi M_n(p_{max}) =$	275.8	273.0	267.4	261.9	256.4	251.0	245.6
25	141.4	193.1	296.7	372.0	376.3	258.2	42.9
50	74.4	104.2	172.6	245.2	311.0	356.6	366.6
75	50.4	71.2	120.5	176.6	234.6	288.3	330.7
100	38.1	54.0	92.4	137.4	186.2	235.2	280.3
125	30.7	43.5	74.9	112.3	153.9	197.2	239.8
150	25.6	36.4	62.9	94.9	130.9	169.4	208.4
175	22.0	31.3	54.3	82.1	113.9	148.3	183.9
200	19.3	27.5	47.7	72.4	100.8	131.8	164.4
225	17.2	24.5	42.6	64.7	90.3	118.6	148.5
250	15.5	22.1	38.4	58.5	81.8	107.7	135.4
275	14.1	20.1	35.0	53.4	74.8	98.7	124.4
300	12.9	18.4	32.1	49.1	68.9	91.0	115.0
325	11.9	17.0	29.7	45.4	63.8	84.5	106.9
350	11.1	15.8	27.6	42.3	59.5	78.8	99.9
375	10.3	14.8	25.8	39.5	55.7	73.8	93.7
400	9.7	13.9	24.2	37.1	52.3	69.5	88.3
425	9.1	13.1	22.8	35.0	49.3	65.6	83.4
450	8.6	12.3	21.6	33.1	46.7	62.1	79.1
475	8.2	11.7	20.5	31.4	44.3	59.0	75.1
500	7.8	11.1	19.4	29.8	42.1	56.1	71.6

SHADED COMBINATIONS OF SPACING AND BAR SIZE MAY NOT BE USED DUE TO ONE OR MORE OF THE FOLLOWING REASONS (NZS3101:1995):

- * Steel ratio is greater than p_{max} for that bar diameter --> Must use different bar, or doubly reinforced section
- * Steel ratio is lower than p_{min} for that bar diameter --> Must design for $\phi M_{n,min}$
- * Spacing between bars is less than 25mm or 1 bar diameter
- * Spacing between centres is greater than 450mm, or 3 * slab depth



**Dunning
Thornton**
consultants

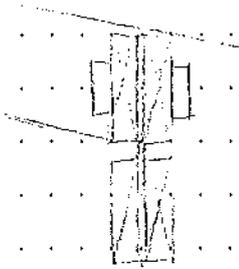
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dlcw@dn.dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST.		
JOB NO:	CaS	DATE:	PAGE NO.
7370		Oct - 2013	

roof



$$W_{up} = 1.17 \text{ kPa} \times 0.4 \text{ m} \times 3.8/2 \text{ m} = -0.9 \text{ kN}$$

$$G = 0.3 \text{ kPa} \times 0.4 \text{ m} \times 3.8/2 \text{ m} = 0.23 \text{ kN}$$

$$0.96 + W_{up} =$$

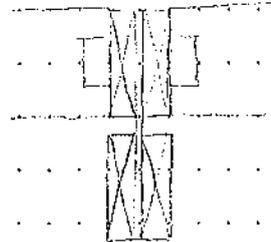
$$0.9 + 0.23 \text{ kN} - 0.9 \text{ kN} = 0.7 \text{ kN}$$

$$1.2G + 1.5Q$$

$$1.2 \times 0.23 \text{ kN} + 1.5 \times 0.23 \text{ kPa} \times 0.4 \text{ m} \times 3.8/2 \text{ m} = 0.6 \text{ kN}$$

$$\text{MULTIGRIP} : \phi \times 13.24 = 0.3 \times 13.2 \text{ kN} = 11 \text{ kN} \geq 0.7 \text{ kN}$$

1st floor



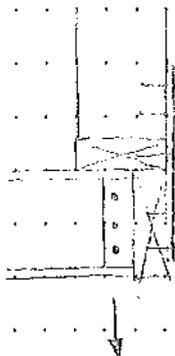
$$G = 0.1 \text{ kPa} \times 0.6 \text{ m} \times 3.8 \text{ m} / 2 = 0.5 \text{ kN}$$

$$Q = 1.5 \text{ kPa} \times 0.6 \text{ m} \times 3.8 \text{ m} / 2 = 1.7 \text{ kN}$$

$$1.2G + 1.5Q$$

$$1.2 \times 0.5 \text{ kN} + 1.5 \times 1.7 \text{ kN} = 3.15 \text{ kN}$$

$$\text{MULTIGRIP} : \phi \times 13.2 = 11 \text{ kN} \geq 3.15 \text{ kN} \text{ ok}$$



2nd floor

$$\phi V_M = \phi \mu k R_k$$

$$\phi V_M = 0.3 \times 0.5 \times 0.3 \times 265 \text{ N} = 5.1 \text{ kN} \geq 3 \text{ kN} \text{ ok}$$

3/10: SCREWS



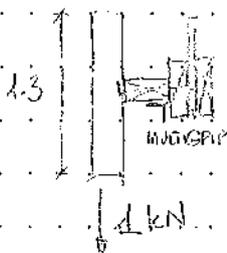
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtowgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUERO ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	



TUBEK (WINDOW)

$$G = 0.3 \text{ kPa} \times 1.3 \text{ m} \times 2 \text{ m long} \times 2 \times 0.15 \text{ kPa} \times 2.3 \text{ m} \times 1 \text{ m} = 1.26 \text{ kN}$$

$$Q = 1.5 \text{ kN}$$

$$1.26 + 1.5 Q = 1.2 \times 1.08 \text{ kN} + 1.5 \times 1 \text{ kN} = 2.8 \text{ kN}$$

$$\phi = 0.8 \text{ SCREW}$$

$$Q_u = n k_p Q_k$$

$$k_1 = 0.8 \text{ medium load}$$

$$Q_k = 1614 \text{ N}$$

8φ SCREW

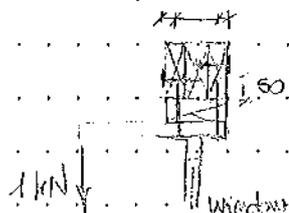
$$p Q_u = 0.8 \times 0.8 \times 1614 \text{ N} = 1033 \text{ N}$$

$$n = \frac{2800}{1033} \approx 3$$

8φ (3) 300 N/mm

$$\text{MULTIGRIP} = 13.24 \text{ kN/pair}$$

$$1300 \times 1300 = 13 \times 13 \times 17 = 31.7 \text{ mm}$$



$$N^* = 2 \times 0.15 \text{ kPa} \times 2.3 \text{ m} \times 1 \text{ m} = 0.7 \text{ kN} + 1 \text{ kN} = 1.7 \text{ kN}$$

$$N^* \leq \phi Q_u$$

$$Q_u = n k_p Q_k$$

$$2 / 8\phi \times 75 \text{ N/mm}$$

$$\phi = 0.8$$

$$Q_k = 52.6 \text{ N/mm}$$

$$p = 50 \text{ N/mm}$$

$$\phi Q_u = 0.8 \times 2 \text{ screws} \times 0.8 \times 50 \text{ mm} = 52.6 \text{ N/mm} = 3.4 \text{ kN} \geq 1.7 \text{ kN} \text{ ok}$$



Dunning
Thornton
consultants

Ph: (64 4) 385-0019

Fax: (64 4) 385-0312

PO Box 27 153, Wellington

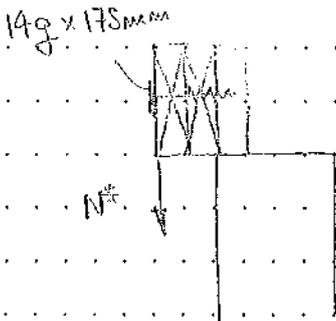
E-Mail: dtcw@dn.dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
1370	CaS	Oct - 2013	

DOOR SILL / BOTTOM OF CLADDING



$$N^* = 1.08 \text{ kN}$$

$$V^* = 1 \text{ kN} + 1.08 \cdot 2.08 \text{ kN}$$

$$\text{JS } Q_k = 3303 \text{ N}$$

$$\phi V_u = 0.8 \times 0.8 \times 3303 \text{ N} = 2.11 \text{ kN} \text{ ok}$$



**Dunning
Thornton**
consultants

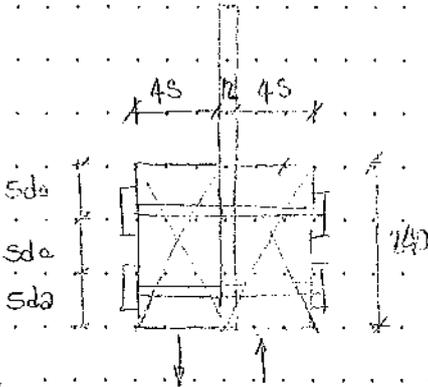
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwotn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

BEAM



2/240x4S
300x12w steel plate $f_y = 250 \text{ MPa}$

$$R_{kt} = \min \left\{ \begin{array}{l} k_{tt} f_y d_o^2 \\ 0.5 b_e f_y d_o \end{array} \right.$$

$$d_o = 12 \text{ mm}$$

$$b_e = 45 \text{ mm}$$

$$J.S. - \triangleright \left\{ \begin{array}{l} k_{tt} = 2 \\ f_y = 36.1 \text{ MPa} \end{array} \right.$$

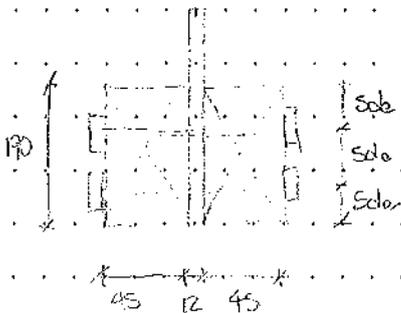
$$R_{kt} = \min \left\{ \begin{array}{l} 2 \times 36.1 \text{ MPa} \times 12^2 \text{ mm}^2 = 10.4 \text{ kN} \\ 0.5 \times 45 \text{ mm} \times 36.1 \text{ MPa} \times 12 \text{ mm} = 9.7 \text{ kN} \end{array} \right.$$

$$R_{skt} = 2 \times R_{kt} \times 1.25 = 2 \times 9.7 \text{ kN} \times 2 \text{ bolts} \times 1.25 = 48.5 \text{ kN}$$

(steel plate)

$$\phi R_{skt} = 0.8 \times 48.5 \text{ kN} = 38.8 \text{ kN}$$

COLUMN



2/190x4S
360x12w steel plate $f_y = 250 \text{ MPa}$

$$R_{kt} = \min \left\{ \begin{array}{l} k_{tt} f_y d_o^2 \\ 0.5 b_e f_y d_o \end{array} \right.$$

$$d_o = 12 \text{ mm}$$

$$b_e = 45 \text{ mm}$$

$$R_{kt} = 9.7 \text{ kN}$$

$$\phi R_{skt} = 38.8 \text{ kN}$$



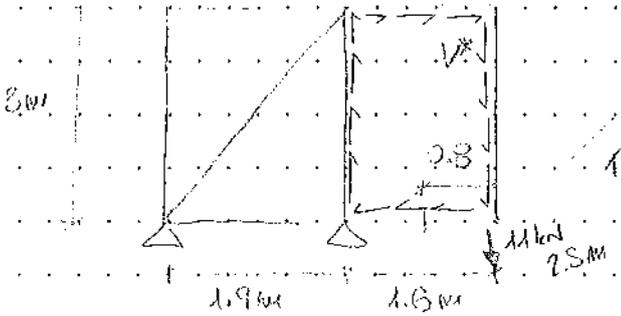
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwotn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	



$$1.26 + 1.5 Q$$

$$0.8 \text{ m} / 2.8 \text{ m} = (1.2 \times 0.4 \text{ kN} + 1.5 \times 1.5 \text{ kN}) / 2.8 \text{ m} = 11 \text{ kN}$$

$$V^* = \frac{11 \text{ kN}}{3 \text{ m}} = 3.7 \frac{\text{kN}}{\text{m}}$$

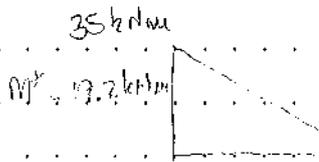
$$3.7 \frac{\text{kN}}{\text{m}} \times 0.15 \text{ m} = 0.555 \text{ kN} / \text{section}$$

$$S = \frac{P \times L}{E \times I}$$

$$I = 9100 \text{ M}^4$$

$$I = 10 \times 3000^4 = 2.25 \times 10^{13} \text{ mm}^4$$

$$V = \frac{11 \text{ kN} \times 0.15 \text{ m}}{3 \times 9100 \text{ M}^4 \times 2.25 \times 10^{13} \text{ mm}^4} = 0.07 \text{ mm}$$





**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz

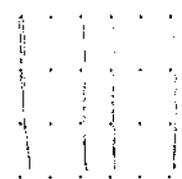


CALCULATIONS

JOB NAME:	7 TUTERC ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	11 - 2013	

SECK

40 20 40

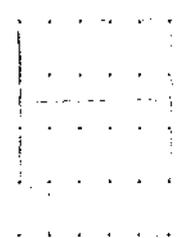


$$C_{kP} = C_{PM} \cdot k_P$$

$$\delta = \frac{40}{60} = 0.67$$

$$k_P = 1 - (1 - \delta)^2 = 0.89$$

9m



$$b = 9m$$

$$c = 2.7m$$

$$h = (4 \cdot 2.7)m = 8.1m$$

$$b/c = 1.85$$

$$c/h = 0.33$$

$$d = 0.5$$

$$C_{PM} = 1.5 \cdot 0.5 \times (0.3 + \log_{10} \left(\frac{b}{c} \right) \cdot (2.8 - \frac{c}{h})) =$$

$$= 1.43$$

$$C_{kP} = 1.43 \times 0.89 = 1.27$$

$$P_u = 1.57 \text{ kPa} \times 1.27 = 2.06 \text{ kPa} \quad \text{ULS}$$

ULS

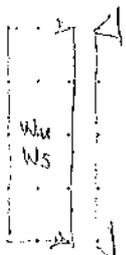
$$P_s = 1.16 \text{ kPa} \times 1.27 = 1.47 \text{ kPa} \quad \text{SLS}$$

SLS

STUD 90x45 @ 600 cts

$$W_u = 2.06 \text{ kPa} \times 0.6m = 1.24 \text{ kN/m}$$

$$W_s = 1.47 \text{ kPa} \times 0.6m = 0.88 \text{ kN/m}$$



$$\Delta = \frac{2700}{300} = 9mm$$

$$M^* = \frac{1.24 \text{ kN/m} \times 2.7m^2}{8} = 1.13 \text{ kNm}$$

8



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dclwgt@DunningThornton.co.nz



CALCULATIONS

JOB NAME:	7 TOTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	11 - 2013	

$$\phi M_u = \phi k_1 k_2 k_3 k_8 f_b Z$$

840

$$\phi = 0.8$$

$$k_1 = 1 \text{ wind}$$

$$k_2 = 1$$

$$k_3 = 1$$

$$S_1 = 1.35 \left[\frac{450}{45} \times \left[\left(\frac{90}{45} \right)^2 - 1 \right]^{0.5} \right]^{0.5} = 5.6 \rightarrow k_8 = 1$$

$$f_b = 14 \text{ MPa}$$

$$Z = \frac{45 \times 90^2}{6} = 60750 \text{ mm}^3$$

$$\phi M_u = 0.8 \times 14 \text{ MPa} \times 60750 \text{ mm}^3 = 0.7 \text{ kNm} \leq 1.13 \text{ kNm} \text{ NO}$$

$$S_{max} = \frac{5}{384} \frac{wL^4}{EI}$$

$$E = 8000 \text{ MPa}$$

$$I = \frac{45 \times 90^3}{12} = 2733750 \text{ mm}^4$$

$$S_{max} = \frac{5 \times 0.83 \text{ N/mm} \times 2700^4 \text{ mm}^4}{384 \times 8000 \text{ MPa} \times 2733750 \text{ mm}^4} = 27 \text{ mm} \geq 9 \text{ mm} \text{ NO}$$

STUD 45x140 @ 600 c/s

$$\phi M_u = 0.8 \times 14 \text{ MPa} \times \frac{45 \times 140^2}{6} \text{ mm}^3 = 1.64 \text{ kNm} \geq 1.13 \text{ kNm} \text{ ok}$$

$$S_{max} = \frac{5 \times 0.83 \text{ N/mm} \times 2700^4 \text{ mm}^4}{384 \times 8000 \text{ MPa} \times \frac{45 \times 140^3}{12} \text{ mm}^4} = 7 \text{ mm} \leq 9 \text{ mm} \text{ ok}$$

I.L-2 $\frac{1}{500} \sqrt{500} = 0.14 \text{ m/s}$ I.L-1 $\frac{1}{100} \sqrt{100} = 0.1 \text{ m/s}$ $(\frac{0.1}{0.14})^2 = 0.85$

Category 1 $M_{z,red} = 1.05$ Cat. 2 $M_{z,red} = 0.91 \left(\frac{0.9}{1.05} \right)^2 = 0.75 \text{ (ULS)}$

IL1 Cat. 2
 $M^* = 1.13 \text{ kNm} \times 15\% \times 25\% = 0.18 \text{ kNm} \sim 0.7 \text{ kNm}$

0.1695 0.2825

70x45 @ 600 c/s



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	11-2013	

ESAM

2/140x45 MSG8 @ 1200mm c/s.

$$G = 0.3 kPa \rightarrow 0.3 kPa \times 1.2 m = 0.36 kN/m$$

$$R = 0.25 kPa \rightarrow 0.25 kPa \times 1.2 m = 0.3 kN/m$$

SLS: $G + 0.4Q$

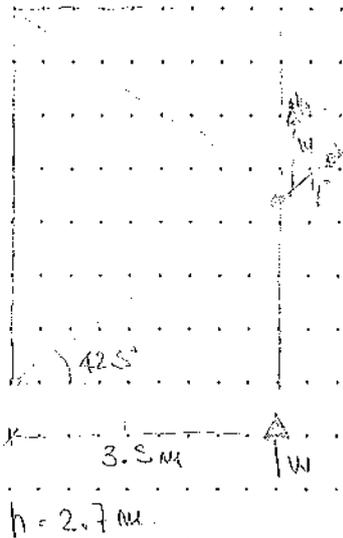
$$0.36 kN/m + 2.4 \times 0.3 kN/m$$

$$= 2.43 kN/m$$

$$\Delta = \frac{3500}{250} = 14 \text{ mm}$$

$$I = \frac{bh^3}{12} = \frac{90 \times 140^3}{12} = 20580000 \text{ mm}^4$$

$$d. k_2 \times \frac{5 \times WL^4}{384 \times EI} = 2 \times \frac{5 \times 0.48 \text{ N/mm} \times 3500^4}{384 \times 80000 \text{ N/m}^2 \times 20580000 \text{ mm}^4} = 11.4 \leq 14 \text{ mm} \text{ ok}$$



$$V_{100} = 41 \text{ m/s} \times 0.91 = 42.71 \text{ m/s}$$

$$P = 0.6 \times 42.71^2 = 1.27 = 1.39 \text{ kPa}$$

$$W = 1.39 \text{ kPa} \times 3.5 \text{ m} \times 2.7 \text{ m} = 3.3 \text{ kN}$$

$$T = W \cos^2(2.5^\circ) = 3.3 \text{ kN} \times \cos^2(2.5^\circ) = 2.4 \text{ kN}$$

$$\phi_{N_{tot}} = \phi_k k_4 / EA$$

20x50 MSG8

STRUCTURAL CABLE OPTIONS

SS GS Construction Options

SS Stainless Steel Open Strands

Material: Grade 316



1x19



1x61



1x91

NOMINAL CABLE DIAMETER		CABLE CONSTRUCTION	METALLIC CROSS SECTION AREA mm ²	MINIMUM BREAKING LOAD			WEIGHT APPROX kg/m
mm	in.			kN	kg	lb	
2.5	-	1 x 19	3.7	4.9	500	1100	0.031
3.0	1/8	1 x 19	5.4	7.0	720	1580	0.045
4.0	5/32	1 x 19	9.6	12.6	1280	2830	0.079
-	3/16	1 x 19	13.5	18.9	1930	4255	0.113
5.0	-	1 x 19	15.0	19.6	2000	4410	0.124
-	7/32	1 x 19	18.0	24.2	2470	5440	0.145
6.0	-	1 x 19	21.5	28.0	2870	6340	0.178
-	1/4	1 x 19	24.1	34.0	3440	7584	0.198
7.0	9/32	1 x 19	29.2	35.0	3540	7800	0.243
8.1	5/16	1 x 19	38.2	45.4	4640	10220	0.317
-	3/8	1 x 19	54.2	64.0	6546	14434	0.446
10.0	-	1 x 19	59.7	71.0	7250	15980	0.495
-	7/16	1 x 19	73.7	86.0	8770	19335	0.624
12.0	-	1 x 19	86.0	102.0	10400	22930	0.713
-	1/2	1 x 19	96.3	119.0	12101	26678	0.804
14.0	9/16	1 x 19	117.0	139.0	14170	31240	0.971
16.0	5/8	1 x 19	153.0	182.0	18550	40910	1.270
19.0	3/4	1 x 19	215.0	212.0	21610	47660	1.780
22.0	7/8	1 x 19	289.0	285.0	29060	64070	2.360
26.0	1	1 x 19	404.0	398.0	40580	89470	3.300
28.6	-	1 x 61	477.0	578.0	58970	129870	3.700
32.1	-	1 x 91	602.0	730.0	74480	164020	4.700
36.6	-	1 x 91	780.0	945.0	99420	212330	6.100

GS GALVANNE COATED STEEL Open Strand

THE FIELD



1x19



1x37



1x61

Modulus of Elasticity: 160 ± 10 kN/mm²
Tolerance Cable Diameter: +3%
Corrosion Protection: GALFAN coated without inner filling

NOMINAL CABLE DIAMETER		CABLE CONSTRUCTION	METALLIC CROSS SECTION AREA mm ²	MINIMUM BREAKING LOAD			WEIGHT APPROX kg/m
mm				kN	kg	lb	
8.1		1 x 19	39.0	59	6020	13250	0.3
10.1		1 x 19	60.0	93	9480	20890	0.5
12.2		1 x 19	87.0	134	13670	30100	0.7
14.1		1 x 37	117.0	181	18460	40660	0.9
17.0		1 x 37	168.0	260	26530	58420	1.3
20.1		1 x 37	237.0	367	37440	82460	1.9
24.4		1 x 37	347.0	537	54790	120660	2.7
28.3		1 x 37	467.0	722	73670	162220	3.7
31.3		1 x 61	572.0	884	90204	198620	4.5
36.3		1 x 61	769.0	1189	121320	267160	6.1



Dunning
Thornton
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwin@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERO ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	11 - 2013	

$$\phi = 0.8$$

k_1 : 4 (wind)

k_2 : 4 (element)

$$f_t = 4 \text{ MPa}$$

$$A = 50 \times 50 = 2500 \text{ mm}^2$$

$$\phi N_t = \frac{0.8 \times 4 \text{ MPa} \times 2500 \text{ mm}^2}{1000} = 8 \text{ kN} \geq 3.4 \text{ kN} \quad \text{ok}$$



$$W = 3.3 \text{ kN, ULS.}$$

$$\text{SWL} : 3.3 \text{ kN} \times 1.5 = 5 \text{ kN}$$

720 kg SWL cable.



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERU ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

S.M.

4 TIMBER & STEEL FRAMES

S.34

10.3 kNm

$$\beta_m = \frac{S.34}{10.3} = 0.52 \quad 0 \leq \beta_m \leq 0.45$$

$$\lambda'_{m1} = 1.13 + 0.13 \beta_m$$

$$= 1.19$$

$$I_y = \frac{12 \times 500^3}{12} = 125000000 \text{ mm}^4$$

500x12 steel plate $I_y = 25000000$

$$M_b = \sqrt{\frac{10^2 \times 200000 \text{ mm}^4 + 125 \times 10^9 \text{ mm}^4 + 80000 \text{ mm}^2 \times 35 \times 10^3 \text{ mm}^3}{500^2 \text{ mm}^2}}$$

$$= 259$$

$$M_{ex} = \frac{1}{6} \times 10$$

$$I_o = \frac{12 \times 500^4}{6} = 500000000 \text{ mm}^4$$

$$M_{ex} = 250 \text{ MPa} \times 5000000 \text{ mm}^3 = 125 \text{ kNm}$$

$$\phi M_{ex} = 0.9 \times 125 \text{ kNm} = 112.5 \text{ kNm} > 10.3 \text{ kNm} \quad \text{OK}$$

$$\lambda_s = 0.6 \times \sqrt{\frac{(125)^2}{259^2} + 3} = \frac{(125)}{259} = 0.78$$

$$\phi M_{bx} = 0.9 \times 1.19 \times 0.78 \times 125 \text{ kNm}$$

$$104 \text{ kNm} > 10.3 \text{ kNm} \quad \text{OK}$$



**Dunning
Thornton**
consultants

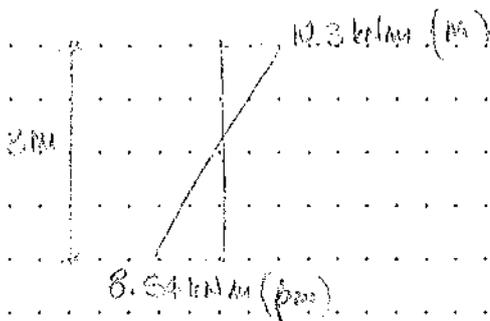
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Oct - 2013	

COLUMN



$P_{max} = 8.54 \cdot 0.85$
 7.26

$N_{max} = 8.54$

340x12 steel plate ($E = 200 \text{ MPa}$)

$$I_y = \frac{12 \times 340^3}{12} = 39304000 \text{ mm}^4$$

$$M_{sx} = f_y Z_e$$

$$Z_e = \frac{12 \times 340^2}{6} = 231200 \text{ mm}^3$$

$$M_{sx} = 250 \text{ MPa} \times 231200 \text{ mm}^3 = 57.8 \text{ kNm}$$

$$M_0 = \sqrt{\left[\frac{\pi^2 E I_y}{L_e^2} \cdot GJ \right]}$$

$$= \sqrt{\frac{\pi^2 \times 200000 \text{ MPa} \times 39304000 \text{ mm}^4 \times 80000 \text{ MPa} \times 196 \times 10^3 \text{ mm}^4}{3000^2 \text{ mm}^2}} = 367 \text{ kNm}$$

$$\alpha_s = 0.6 \times \left\{ \sqrt{\left(\frac{57.8}{367} \right)^2 + 3} - \left(\frac{57.8}{367} \right) \right\} = 0.94$$

$$\phi M_{sx} = 0.9 \times 57.8 \text{ kNm} = 52 \text{ kNm} \quad \underline{NO} < 55 \text{ kNm}$$

$$\phi M_{bx} = 0.9 \times 2.5 \times 0.94 \times 57.8 \text{ kNm} = 122 \text{ kNm}$$

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 4 steel frames
7370 131001 steel frame

29/10/2013
04:46:57 p.m.

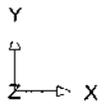
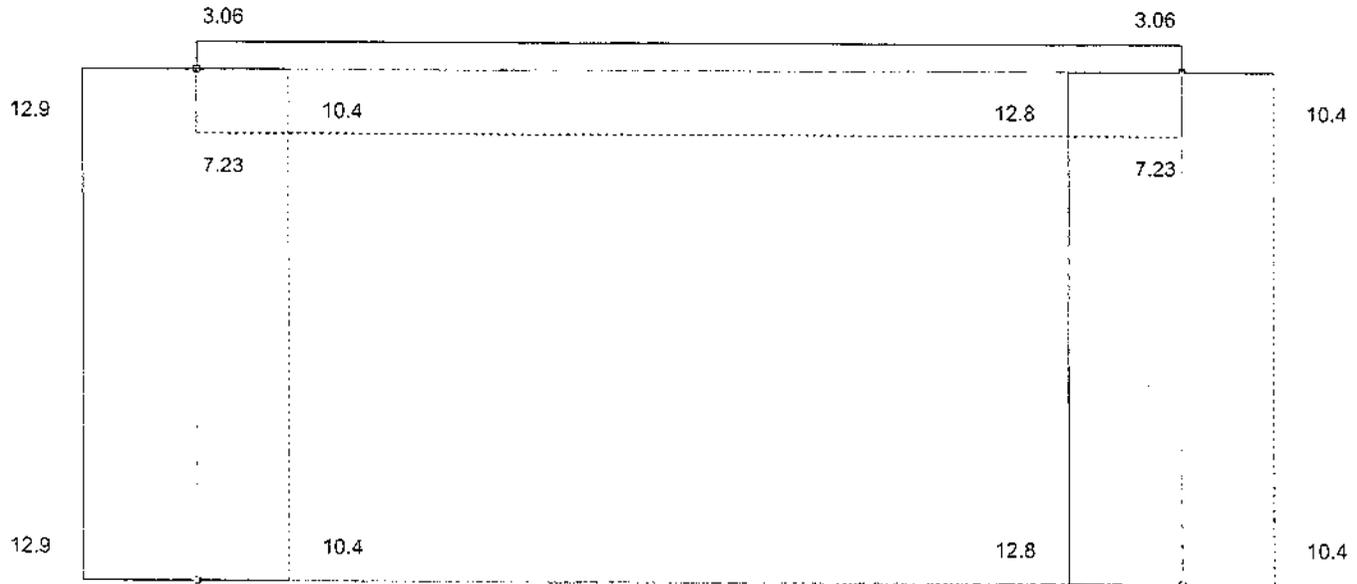
Envelope for Axial Force

— Maximum

— Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



theta: 270 phi: 0

4 frames

Axial Force, Fx

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131025 4 steel frames
7370 131001 steel frame

29/10/2013
04:47:06 p.m.

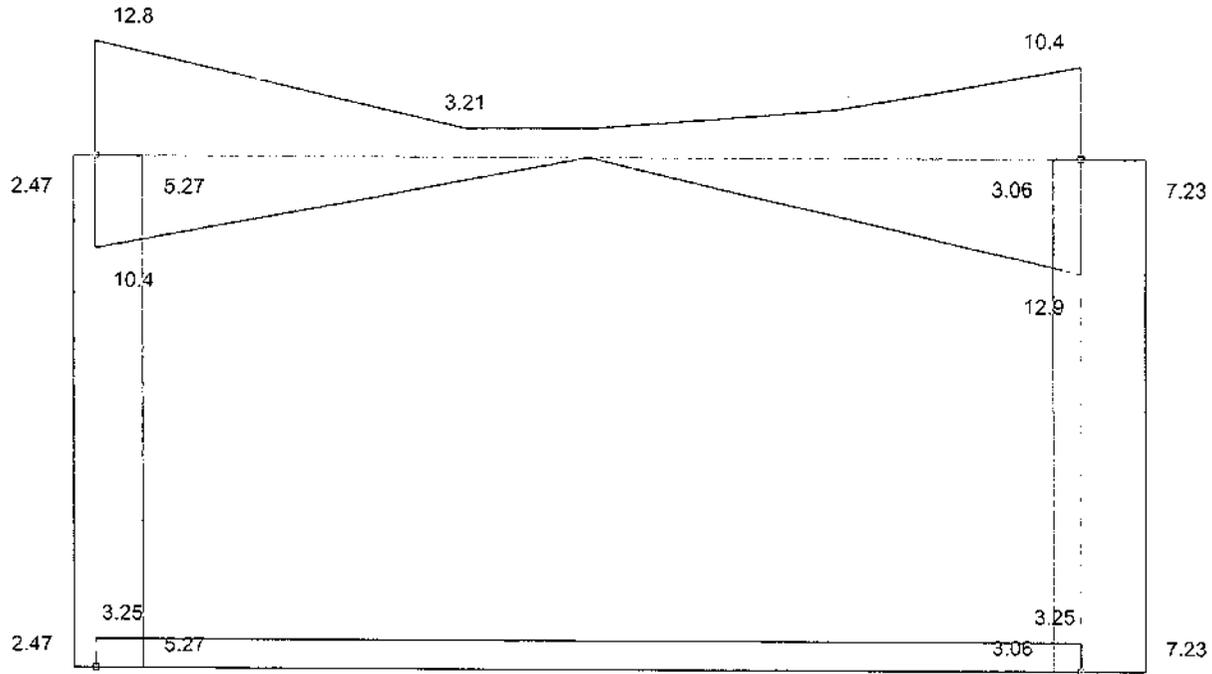
Envelope for Shear Fy

— Maximum

— Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



Y
↑
Z ← X
theta: 270 phi: 0

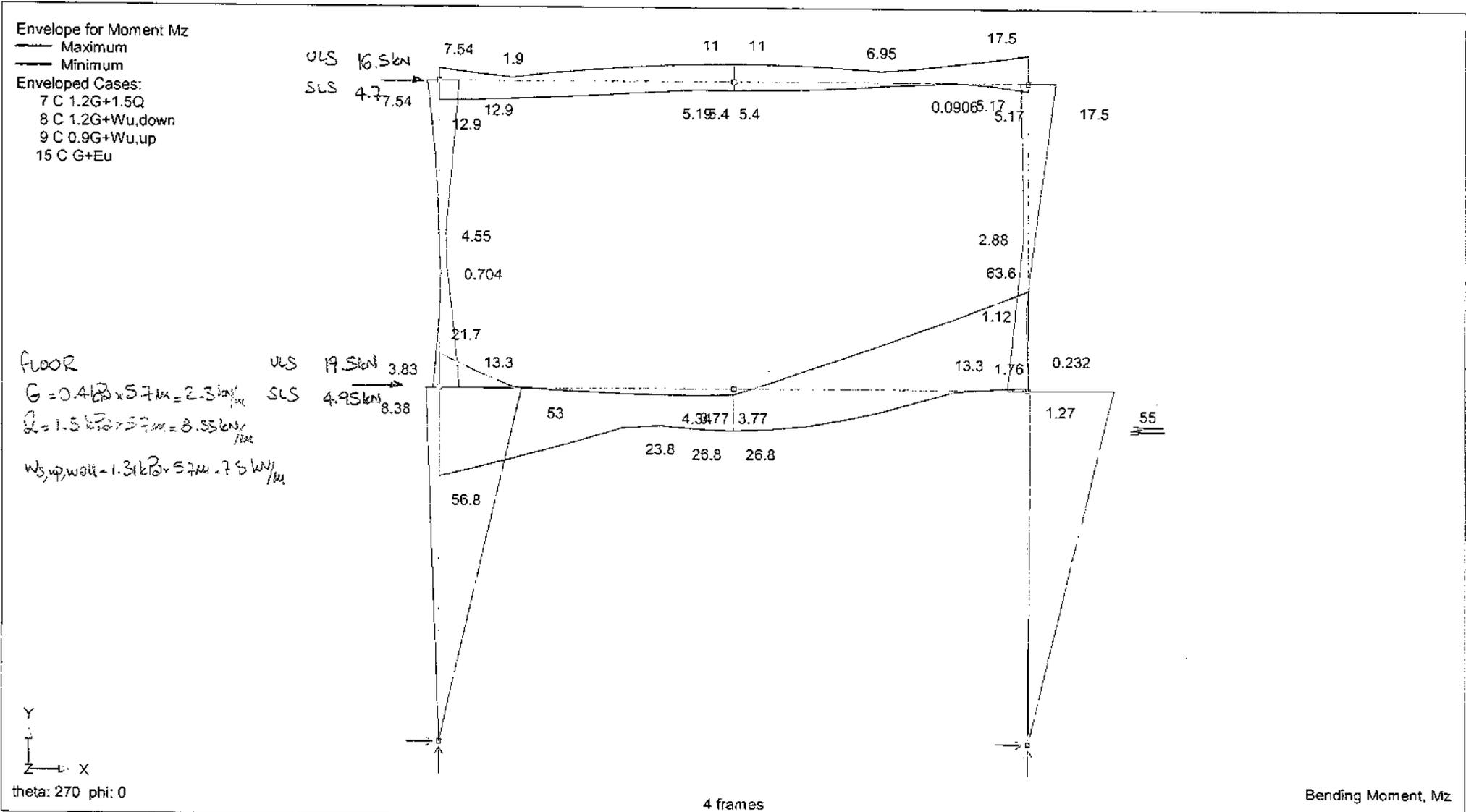
4 frames

Shear Force, Fy

Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131024 4 timber frames
 7370 131001 steel frame

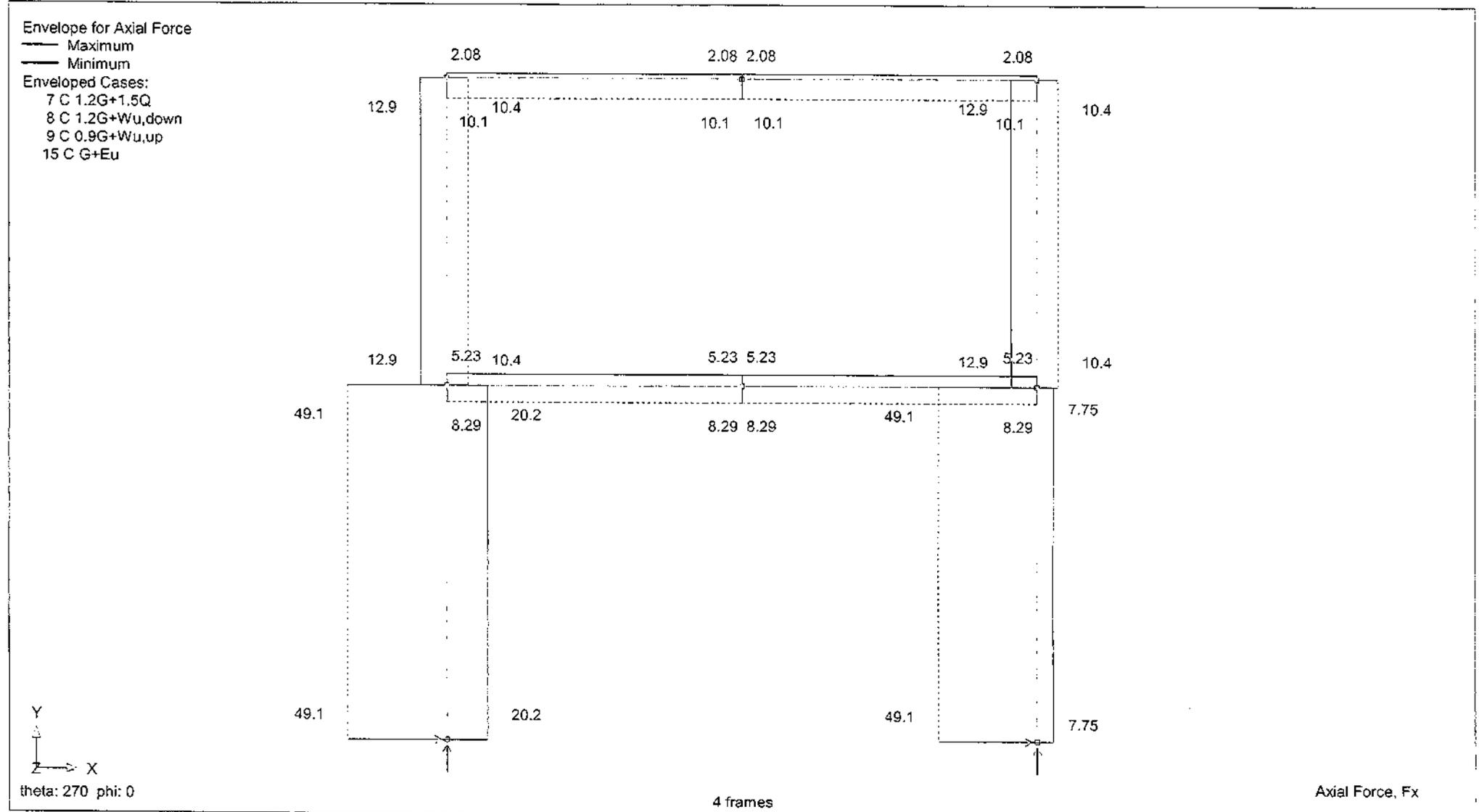
29/10/2013
 05:02:34 p.m.



Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131024 4 timber frames
7370 131001 steel frame

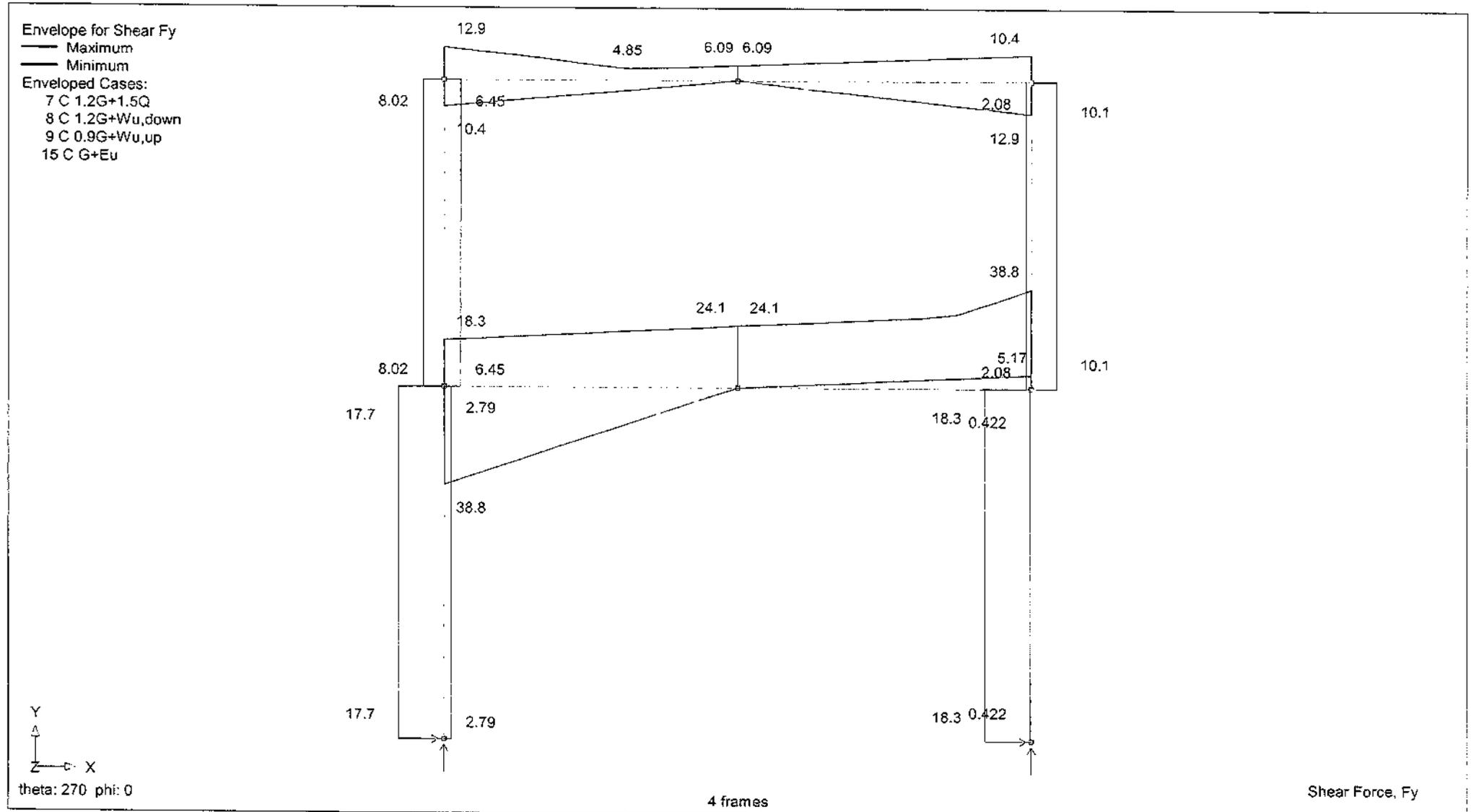
29/10/2013
05:02:49 p.m.



Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131024 4 timber frames
 7370 131001 steel frame

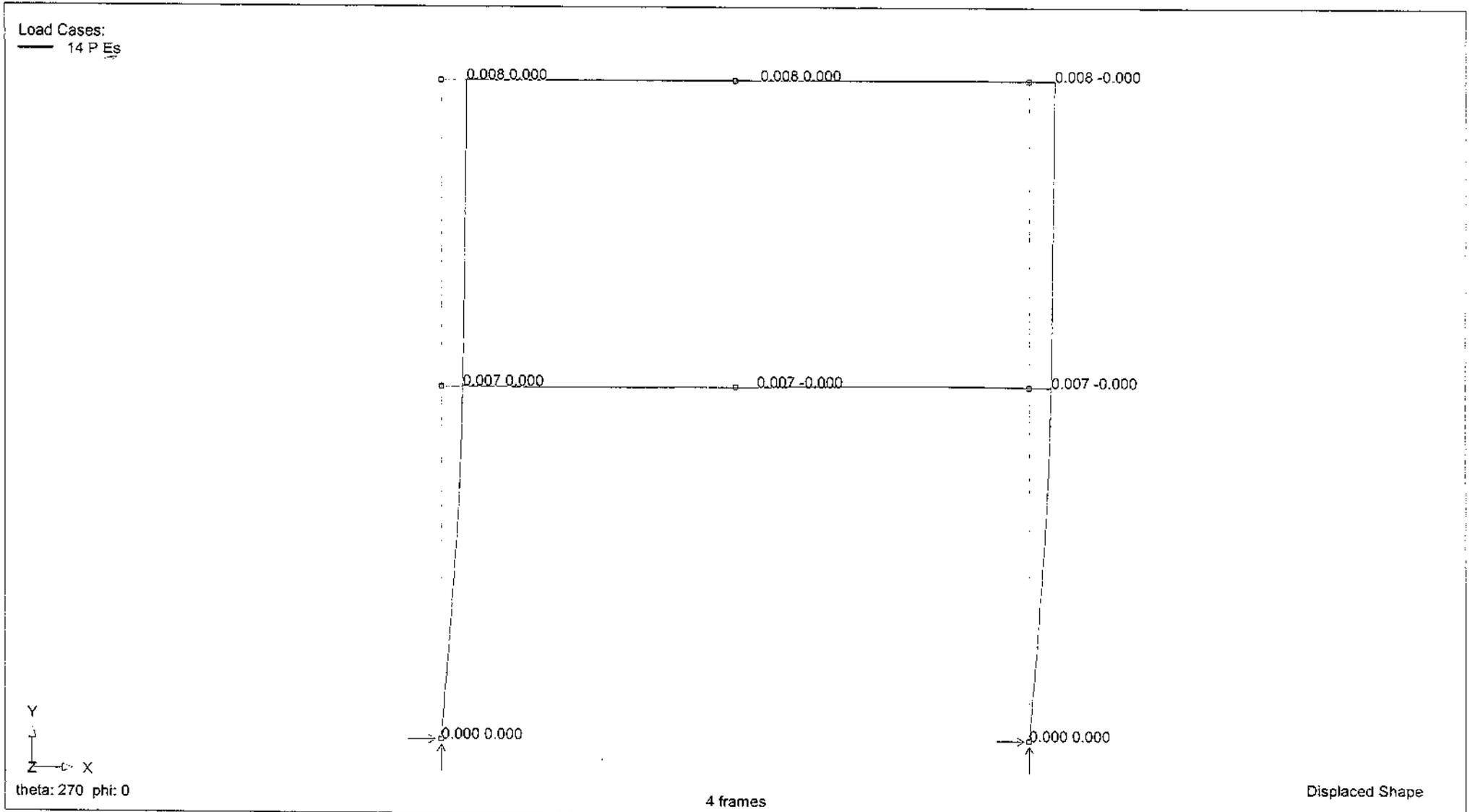
29/10/2013
 05:02:59 p.m.



Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131024 4 timber frames
7370 131001 steel frame

29/10/2013
05:03:20 p.m.

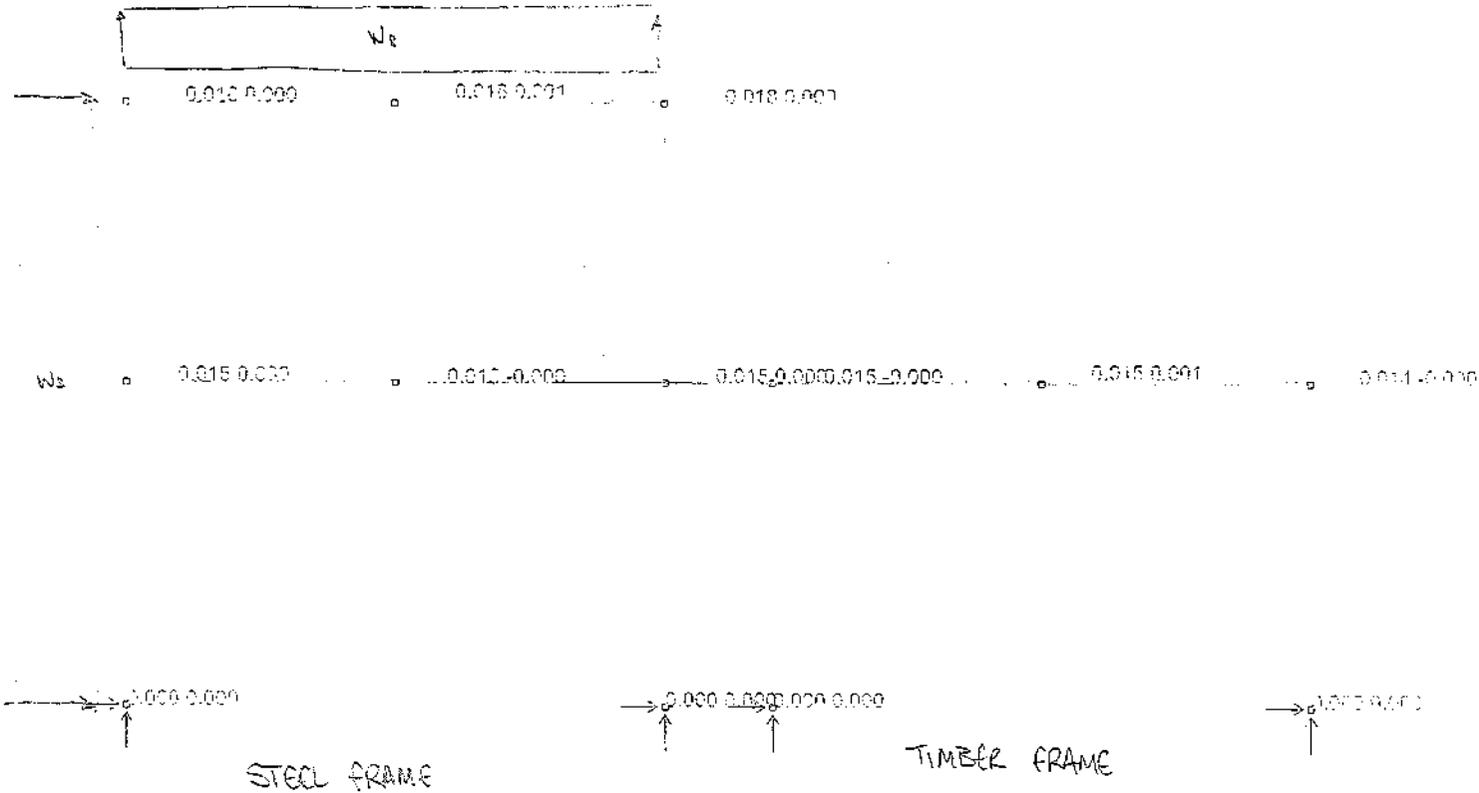


Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131024 4 timber frames
7370 131001 steel frame

02/12/2013
12:57:44 p.m.

Load Cases:
10 C Ws, up

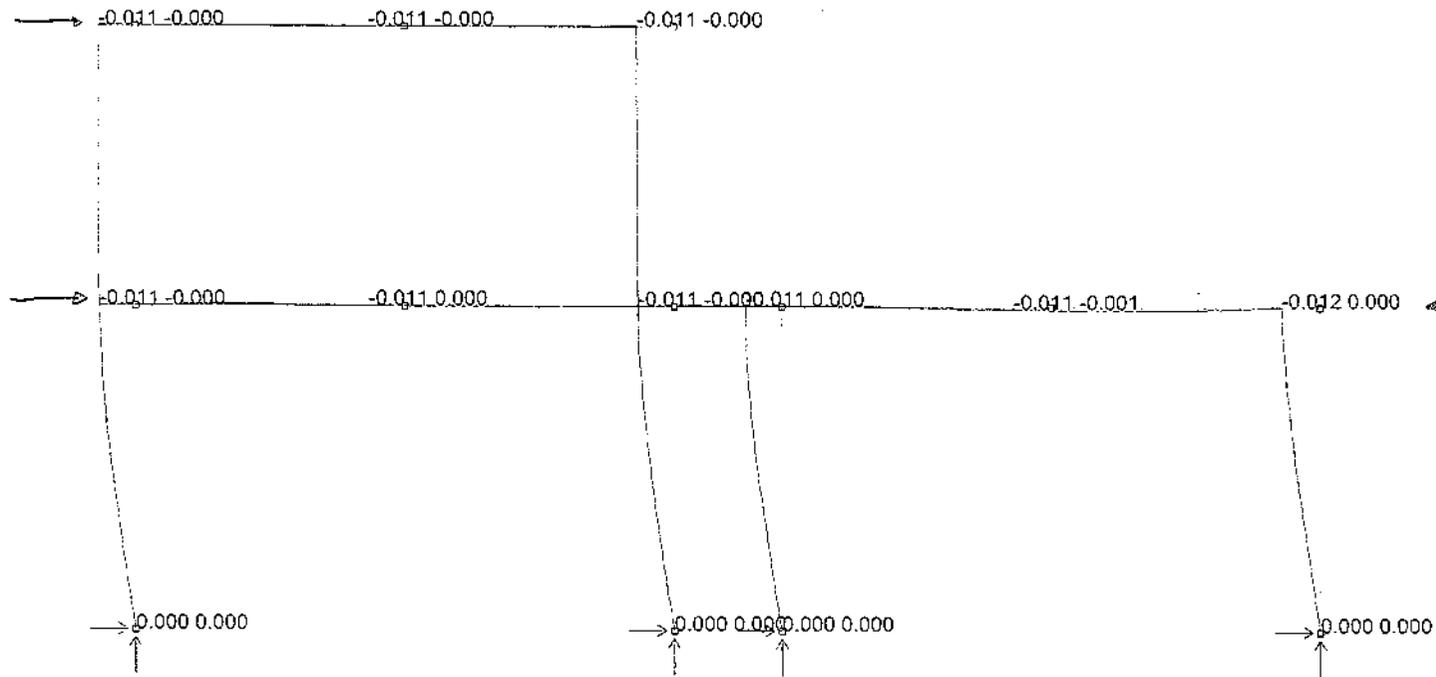


Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131024 4 timber frames
7370 131001 steel frame

02/12/2013
12:58:21 p.m.

Load Cases:
— 14 P Es



Y
Z
X
theta: 270 phi: 0

Displaced Shape

Microstran V9

Dunning Thornton Consultants Ltd
 Job: 7370 131024 4 timber frames
 7370 131001 steel frame

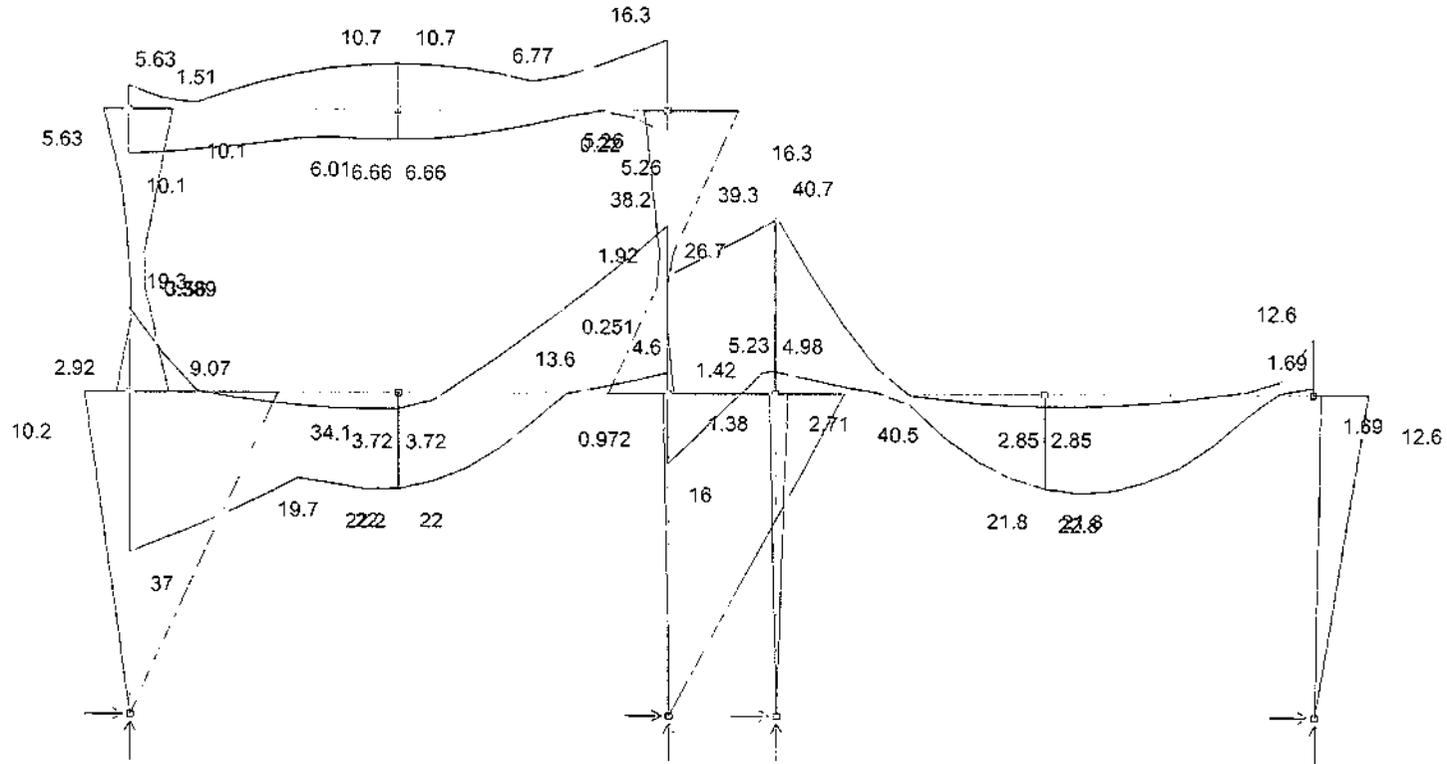
02/12/2013
 12:57:30 p.m.

Envelope for Moment Mz

- Maximum
- Minimum

Enveloped Cases:

- 7 C 1.2G+1.5Q
- 8 C 1.2G+Wu,down
- 9 C 0.9G+Wu,up
- 15 C G+Eu



Y
 ↑
 Z → X
 theta: 270 phi: 0

Bending Moment, Mz



**Dunning
Thornton**
consultants

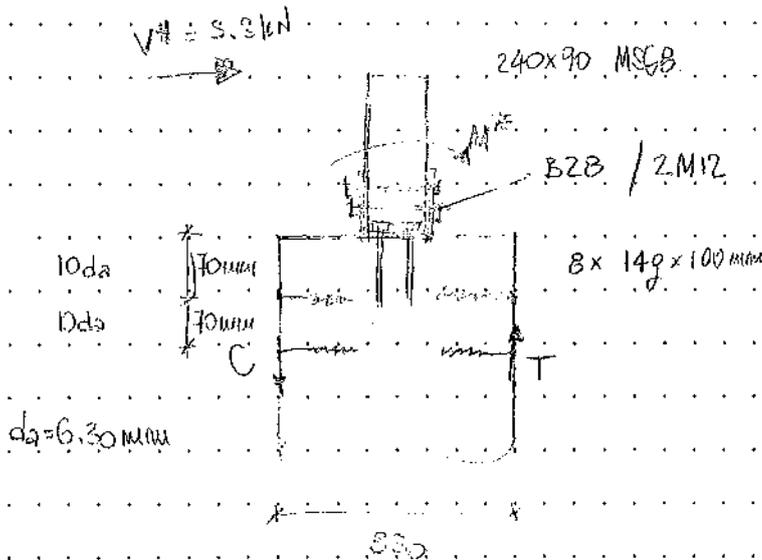
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:			
JOB NO:	CALC BY: CaS	DATE: Dec - 2013	PAGE NO.

JOINT : TIMBER JOIST - FOUNDATION PILE



DOWN AND UP LIFT

$$\phi N = 26 \text{ kN} \geq N^* = 25.3 \text{ kN}$$

$$N^* = 5.3 \text{ kN} \times 0.24 \text{ m} = 1.32 \text{ kN}$$

$$T = \frac{C - 1.32 \text{ kN}}{0.178 \text{ m}} = 7.5 \text{ kN}$$



$$\phi Q_u = \phi m k Q_u$$

$$\phi = 0.7$$

$$m = 1 + \frac{1}{2} + \frac{1}{2} = 2 \times 2 \text{ layers} = 4$$

$$Q_u = 2.663 \text{ kN}$$

$$\phi Q_u = 0.7 \times 4 \times 2.663 \text{ kN} = 7.5 \text{ kN}$$

B2B in B2BMAC (structural bracket)



**Dunning
Thornton**
consultants

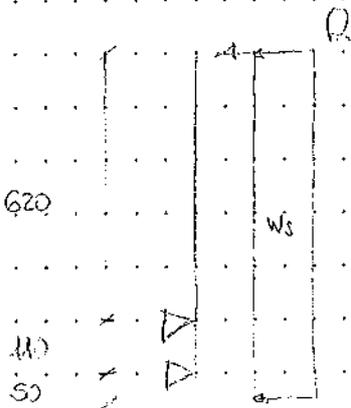
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7870	CaS	Nov - 13	

GLASS BALUSTRADE

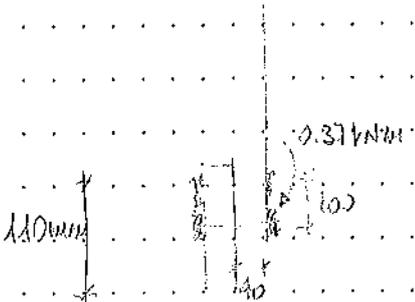


$E = 70 \text{ GPa}$
 $\Delta_{\text{max}} = 10 \text{ mm}$

to meet
0.2
1.5
0.25 m

fixing @ 720 mm

$Q = 2.6 \text{ kN}$
 $W_s = 1.16 \text{ kPa} \times 0.72 \text{ m} = 0.84 \frac{\text{kN}}{\text{m}}$



0.37 kN/m
 0.04 m
 9.25 kN

$R_{\text{req}} = \text{min} \left\{ \begin{array}{l} k_n f_y d_s^2 \\ 0.5 b_e f_y d_s \end{array} \right.$

$k_{11} = 2$
 $f_y = 32 \text{ MPa}$
 $d_s = 12 \text{ mm}$
 $b_e = 90 \text{ mm}$
JS timber post

$R_{\text{req}} = \text{min} \left\{ \begin{array}{l} 2 \times 36.1 \text{ MPa} \times 12^2 \text{ mm}^2 = 10.4 \text{ kN} \checkmark \\ 0.5 \times 90 \text{ mm} \times 36.1 \text{ MPa} \times 12 \text{ mm} = 19.5 \text{ kN} \end{array} \right.$



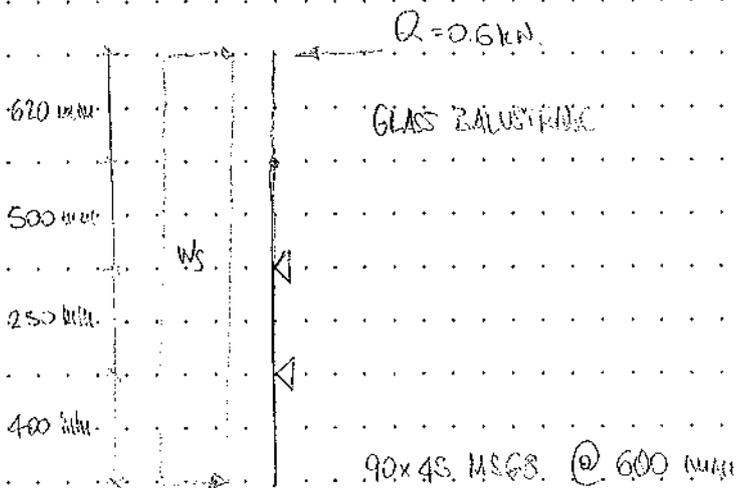
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwglh@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUROI ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
1370	CaS	Dec - 2013	



$$W_s = 1.16 \text{ kPa} \times 0.6 \text{ m} = 0.7 \text{ kN/m}$$

$$W_u = 1.62 \text{ kPa} \times 0.6 = 0.97 \text{ kN/m}$$

$$\phi M_m = \phi k_1 k_2 k_3 k_4 k_5 \frac{Z}{b}$$

$$\phi = 0.8$$

$$k_1 = 1$$

$$k_2 = 1 \quad \text{1 element}$$

$$k_3 = 1$$

$$k_4 = 1 \quad S_1 = \frac{3d}{b} = 6 < 10$$

$$b = 14 \text{ MPa}$$

$$Z = \frac{bd^2}{6} = \frac{45 \times 90^2}{6} = 60750 \text{ mm}^3$$

$$\phi M_m = 0.8 \times 14 \text{ MPa} \times 60750 \text{ mm}^3 \times 0.63 \text{ kN/m} > 0.60 \text{ kN/m} = M^* \quad \text{ok}$$

$$s = 20 \text{ mm} \leq 30 \text{ mm}$$

$$\Delta_{max} = 10 \text{ mm}$$

$$35 \text{ mm} \checkmark$$

$$\frac{H}{60} \leq \frac{L}{240} \leq \frac{3800}{240} = 15.8 \text{ mm}$$

3.5 Deflection

General

Beyond the NZBC requirements for barriers to be of adequate strength and stiffness to sustain the applied loads without causing loss of amenity through undue deflection, there are no further mandatory requirements for deflections. Therefore, the key requirement for deflections of barriers is that deflections are limited to prevent people becoming apprehensive or distressed due to excessive movement of the barrier when in normal use.

Note that the commentary to AS/NZS 1170.1 includes guidance on deflections of barriers.

Deflections due to wind and infill loads

Wind load deflections occur frequently for external barriers and are often critical for the design of impermeable material barriers such as those of glass or with glass infills. In windy locations and high rise buildings, the wind load deflection may exceed deflection caused by top edge and concentrated loads. For low-rise buildings, sheltered and internal barriers, deflections caused by barrier infill loads are more critical than deflections due to wind pressures.

Deflections due to top edge loads

Top edge and concentrated load deflections occur when people push or are pushed hard (e.g. in a crowd surge) against the top edge, handrail or corner of a barrier. These loads should not occur on a regular basis, and are perhaps less critical in terms of design for amenity. However, in normal use with people leaning or resting against a barrier the deflection of the barrier should not make the occupant feel uncomfortable.

Recommended deflection limits

When considering deflection limits it is the total horizontal displacement of the barrier at any point from its original unloaded position which is most critical. The total horizontal displacement is recommended not to exceed 30mm under barrier and wind loads described in B1/VM1.

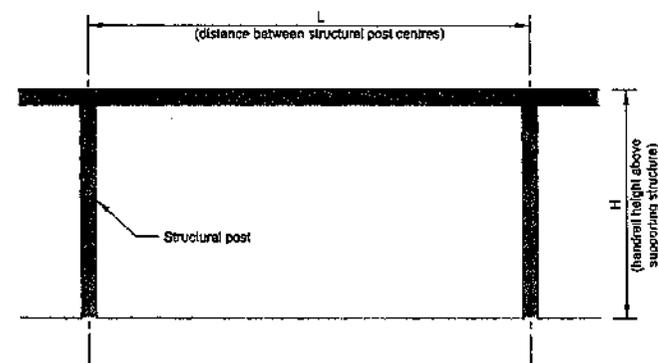
For serviceability, the horizontal deflection of post and rail balustrade systems (measured at the handrail/ top rail) may be considered acceptable if it does not exceed $H/60 + L/240$ or 30mm, whichever is smaller, where H is the height of the handrail/top rail above the top of the supporting structure (deck or slab) and L is the distance between the centres of the supporting posts to the handrail (see Figure 3.10 below).

It is recommended that the deflections of tall barriers are measured at 1200mm above finished floor level to determine the maximum deflection.

When calculating deflections of barrier structures, it is important to make allowance for any twisting and rotating of the supporting structure. This is most important when the barrier is fixed to the perimeter of a cantilevered balcony or timber deck as these structures often deflect and distort to a significant extent. A number of proprietary barrier designs assume zero rotation at the support in their associated documentation. In these cases, the designer must:

- make an assessment of the validity of this assumption in relation to the particular supporting structure under consideration, and
- determine whether the actual deflections will be within acceptable limits.

Figure 3.10 Horizontal deflection of post and rail balustrade

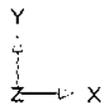
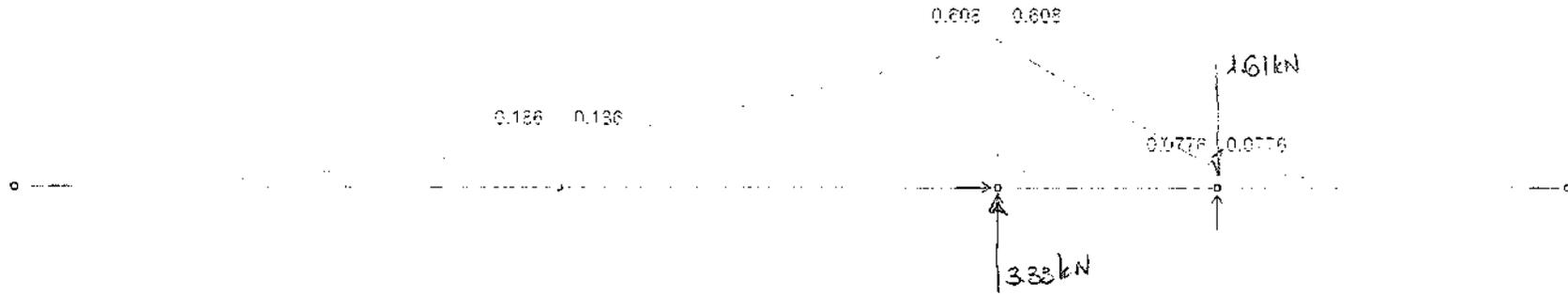


Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131204 balustrade1
7370 131204 balustrade

04/12/2013
02:33:59 p.m.

Load Cases:
4 P Wu



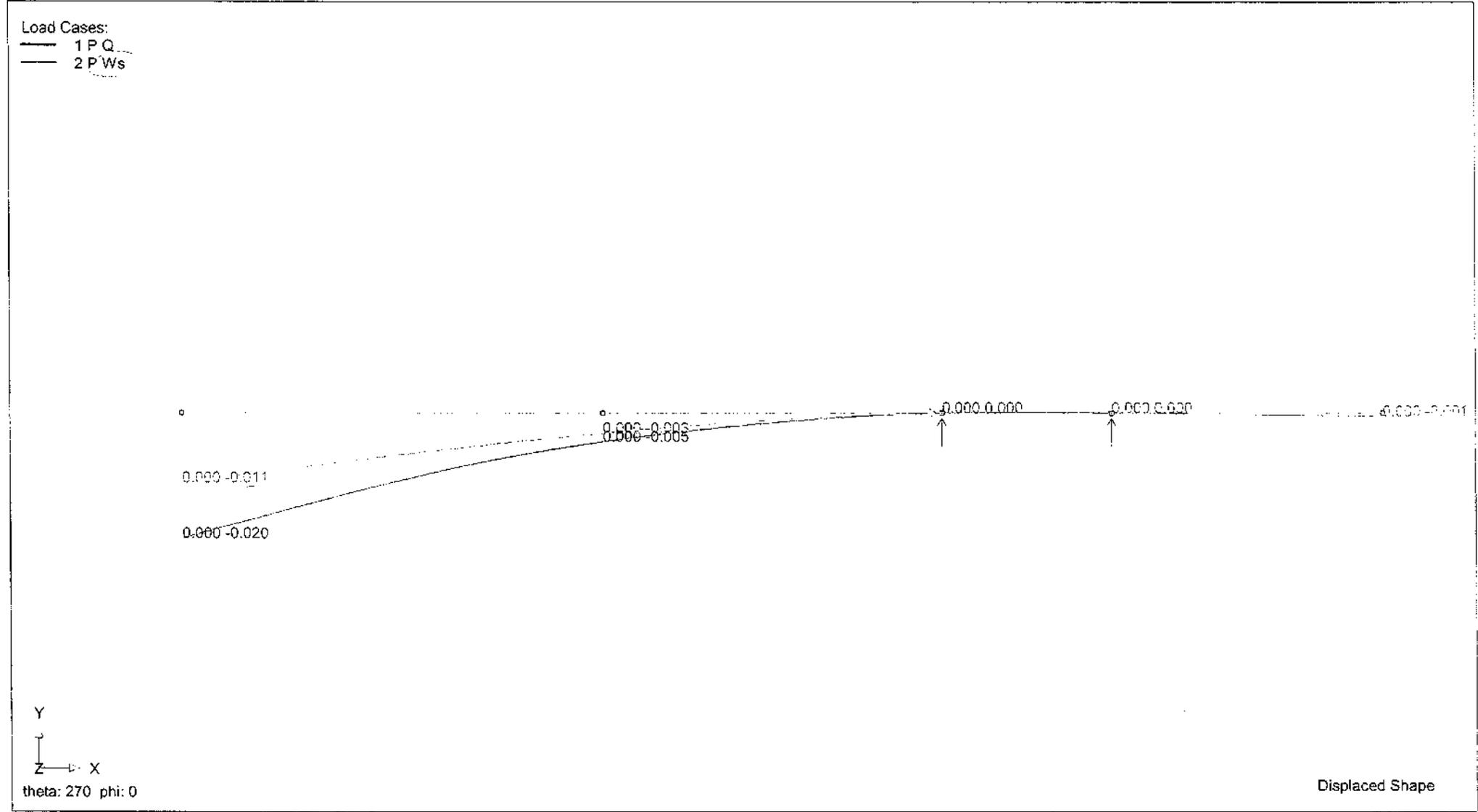
theta: 270 phi: 0

Bending Moment, Mz

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131204 balustrade1
7370 131204 balustrade

04/12/2013
02:34:31 p.m.





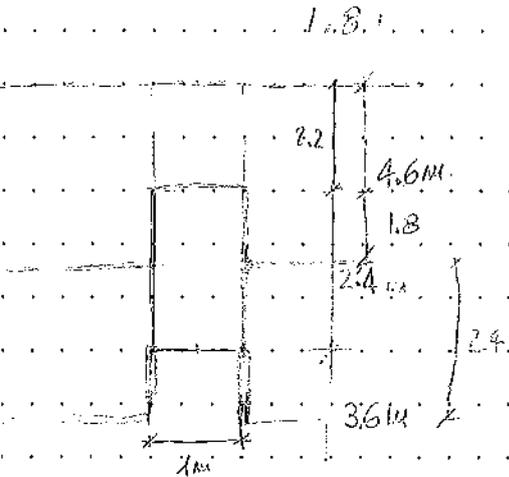
**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dlcwgn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTUKE ST		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Dec - 2013	



$$P_u = 1.62 \text{ kPa}$$

$$P_s = 1.16 \text{ kPa}$$

$$W_u = 1.62 \text{ kPa} \times 0.5 \text{ m} = 0.81 \text{ kN/m}$$

$$W_s = 1.16 \text{ kPa} \times 0.5 \text{ m} = 0.6 \text{ kN/m}$$

$$M^* = \frac{0.81 \text{ kN/m} \times 3.6 \text{ m}^2}{8} = 1.3 \text{ kNm}$$

try 3/140 x 45 MSGB

$$S_y = \frac{3d}{5} = \frac{3 \times 140}{5} = 84 \rightarrow k_o = 4$$

$$f_b = 14 \text{ MPa}$$

$$A_e = \frac{135 \times 140^2}{6} = 441000 \text{ mm}^2$$

$$\phi M_u = 0.8 \times 14 \text{ MPa} \times 441000 \text{ mm}^2 = 4.76 \text{ kNm} \geq M^* = 1.3 \text{ kNm} \quad \text{ok}$$

$$E = 80000 \text{ MPa}$$

$$I_x = \frac{135 \times 140^3}{12} = 3087000 \text{ mm}^4$$

$$d = 2 \times \frac{5}{384} \times \frac{0.6 \text{ kN/m} \times 360^4 \text{ mm}^4}{80000 \text{ MPa} \times 3087000 \text{ mm}^4} = 10 \text{ mm} \quad (\text{long term})$$

$$d_{ave} = 12 \text{ mm} \leq 5 \text{ mm} \quad \text{ok}$$



**Dunning
Thornton**
consultants

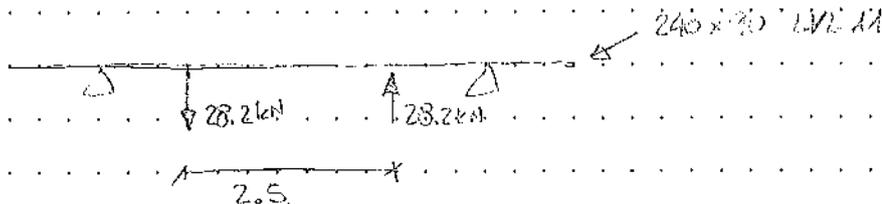
Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	7 TUTERU ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Dec - 2013	

INTERNAL BRACING WAU



$$M^* = 21 \text{ kNm}$$

1/240x63 VL 11

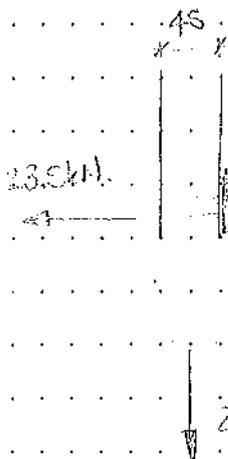
$$S_x = 10.8 \rightarrow k_B = 2.71$$

$$I = \frac{63 \times 2 \times 240^2}{6} = 1209600 \text{ mm}^4$$

$$I_b = 48113$$

$$\phi M_u = 0.8 \times 0.23 \times 297 \times 48113 > 1209600 \text{ mm}^4 = 36 \text{ kNm} \geq 21 \text{ kNm} \text{ ok}$$

WAL : 90x45 @ 600 mm c/s



BOLTS

$$\left\{ \begin{array}{l} k_{II} f_y d_a^2 \\ 0.5 b_e f_y d_a \end{array} \right.$$

$$JS \rightarrow k_{II} = 2 \dots f_y = 36 \text{ MPa}$$

$$b_e = 45 \text{ mm}$$

$$d_a = 8 \text{ mm}$$

$$Q_{kt} = \text{min} \left\{ \begin{array}{l} 2 \times 36 \text{ MPa} \times 8^2 \text{ mm}^2 = 4.6 \text{ kN} \checkmark \\ 0.5 \times 45 \text{ mm} \times 36 \text{ MPa} \times 8 = 6.5 \text{ kN} \end{array} \right.$$

$$\phi Q_{kt} = 0.7 \times 1.25 \times 7 \text{ bolts} \times 4.6 = 28.2 \text{ kN}$$



**Dunning
Thornton**
consultants

Ph: (64 4) 385-0019
Fax: (64 4) 385-0312
PO Box 27 153, Wellington
E-Mail: dtcwqtn@dunningthornton.co.nz



CALCULATIONS

JOB NAME:	F TYPING ST.		
JOB NO:	CALC BY:	DATE:	PAGE NO.
7370	CaS	Dec - 2013	

SCREWS

$$\phi R_n = \phi n k R_k$$

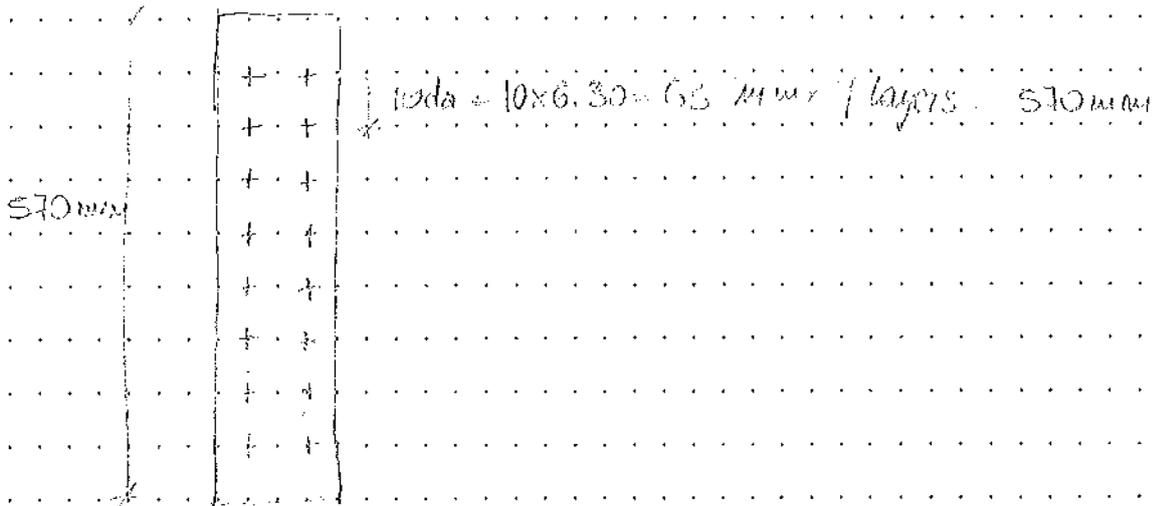
$$\phi = 0.7$$

$n = 16$ screws

$$R_k = 2.663 \text{ kN} \quad (14 \text{ g})$$

$$\phi R_n = 0.7 \cdot 16 \text{ screws} \cdot 2.663 \text{ kN} = 29.3 \text{ kN} \geq 28.2 \text{ kN} \quad \underline{\text{ok}}$$

$$s_b$$



$$s_{da}$$

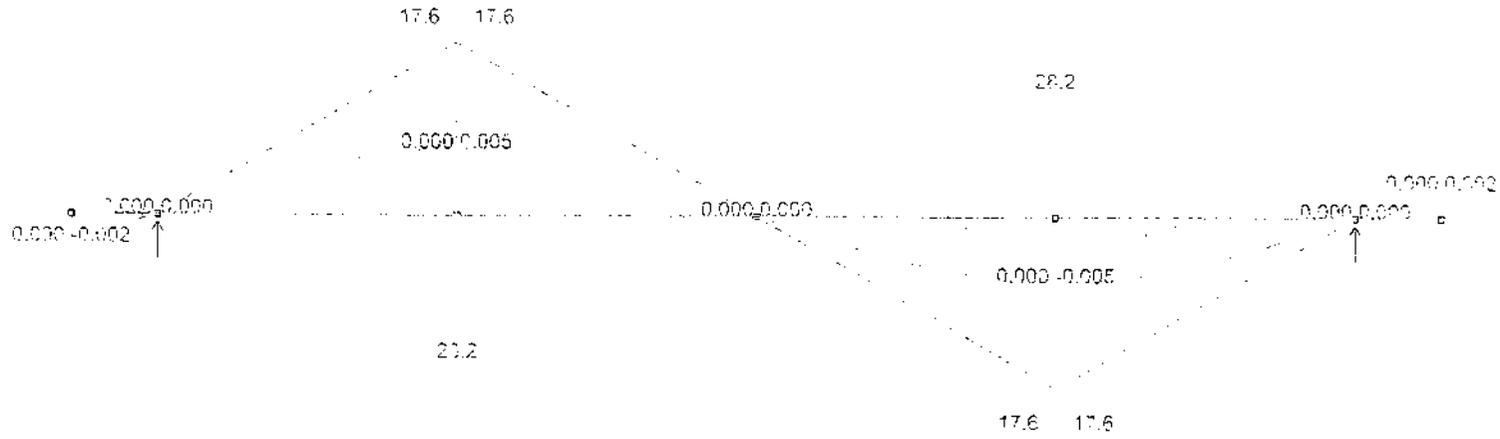
$$s_{da} = 5 \times 6.30 = 30 \text{ mm} \times 3 = 90 \text{ mm}$$

Microstran V9

Dunning Thornton Consultants Ltd
Job: 7370 131210 joist gfloor under the bracing wall
7370 131025 joist gfloor

10/12/2013
01:58:05 p.m.

Load Cases:
6 P Wu



Y
Z
X
theta: 270 phi: 0

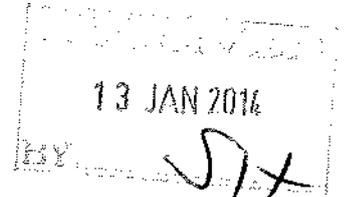
Bending Moment, Mz
Displaced Shape

ASSEMBLY ARCHITECTS LIMITED

600078

FILE: 1307
7 Tutere St, Waikanae-

Tuesday, 10 December 2013

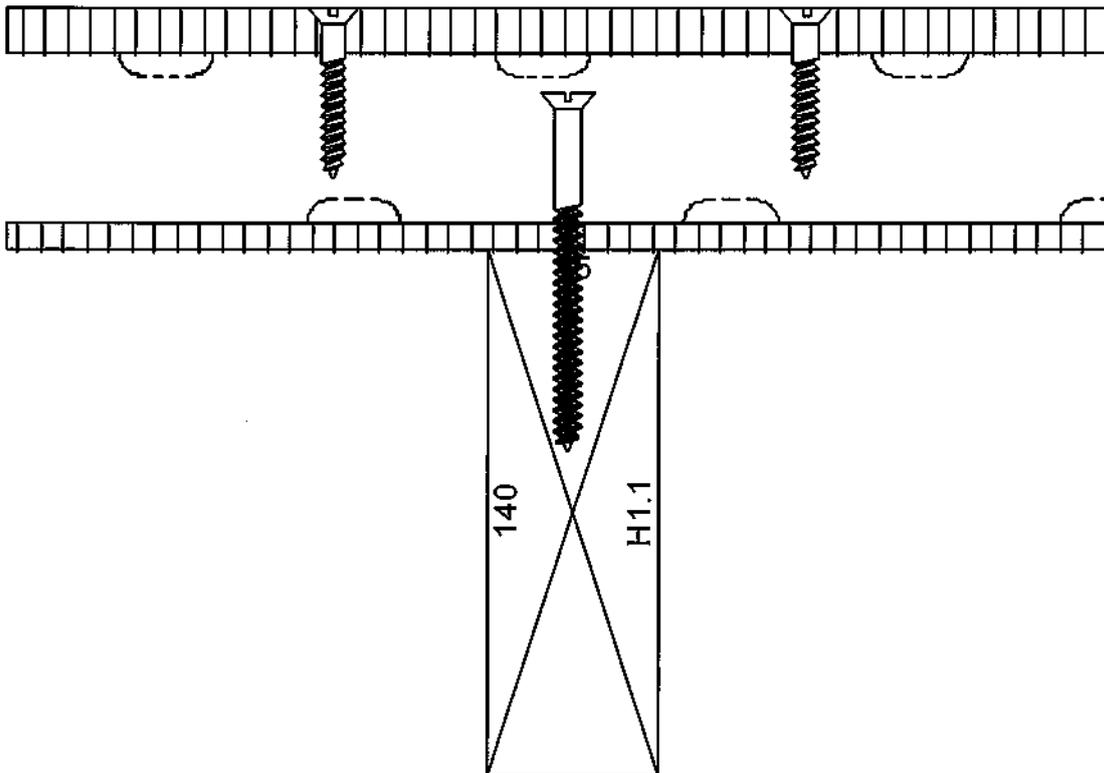


E2 / AS1 Alternative solution.

The proposed cladding system is an alternative solution cladding system to E2/AS1.

E2/AS1 9.1.8.2 Requires a vertical cavity batten. This alternative solution uses a 45mm Horizontal Cavity batten. The propose solution provides a equal if not better performing cladding system in comparison to E2/AS1. The proposed cavity system uses a Structural Castillated Batten to form a 45mm ventilated cavity.

A structural cavity has a clear advantage over the E2/AS1 solution in that the cladding fixings do not penetrate the rigid air barrier or structural timber framing. There is NO direct path of water from the weather exposed face to the structural frame. The structural cavity batten is a product supplied as part of the Rosen Feld Cedar Screen Cladding System.



ASSEMBLY ARCHITECTS LIMITED

The plywood cladding it self is installed as per E2/AS1 in compliance with all flashings covers.. The flashing thickness in general exceeds the min thickness requirements.

SPECIFIC DESIGN FLASHING SYSTEM

A custom double flashing system has been designed to provide improved protection to the head and jamb weather seals by means of rebating the windows into the wall. The inner layer flashing system is compliant with E2/AS1 Fig 72A direct fix requirements. The secondary layer complies with all minim cladding flashing junction requirements. The extend head flashing will provide the greatest level of protection by preventing any face loaded water coming in contact with the window head junction.

DURABILITY B2

The site is subject to wind driven salt and sand spray.

A third layer of protection is provided by a 20mm thick layer of Macrocarpa boards over the top of the plywood. This provide increased protection to the ply wood & stain from exposure to sunlight and salt spray. The application of weather grooved boards is as per E2/AS1 Fig 119.

This specific Design Cladding System thus complies with the performance requirements of the New Zealand Building Code.

Yours sincerely

Justin Wright
Registered Architect

021 565 363 justin@assembly.co.nz

www.assembly.co.nz

PO Box 192 Arrowtown 9302. 24 Essex Avenue, Arrowtown 9351. Tel 03 442 0356

WALL / FLOOR FRAMING:
Refer to GA Drawings and Sections for Framing Details.

FLEXIBLE FLASHING TAPE
BRANZ Appraised & Ecoply Approved. Install to manufacturers instructions. Install to Vertical Sheet Joints of RAB Board.

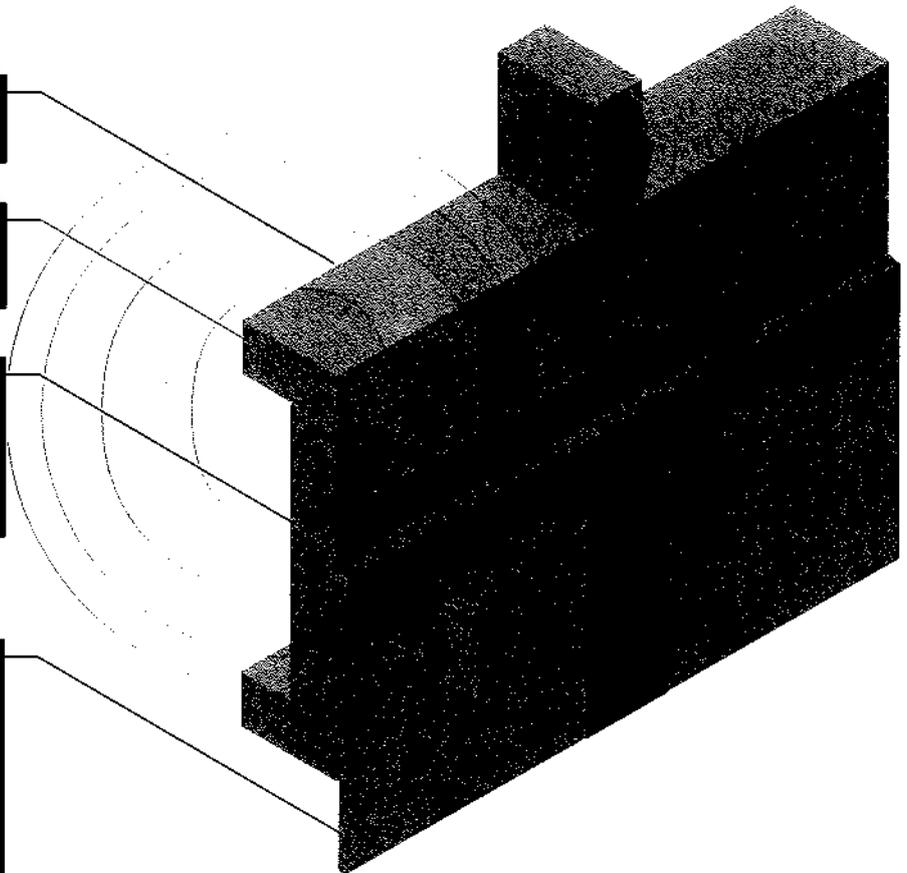
Z FLASHING:
Ecoply Barrier Horizontal Z Flashing, uPVC. Install to Manufacturers Requirements.
35mm Min Cover to RAB above and below.
Maintain 15mm expansion gap between Plywood sheet joints.

RIGID AIR BARRIER
Compliant with requirements of NZBC E2, 9.1.7.2. Ecoply Barrier, Structural Plywood Rigid Air Barrier, meets the NZ Building Code rigid sheathing performance requirements as outlined in Section and Table 23 of E2/AS1, when installed as manufacturers requirements.

SHEET JOINTS:
Vertical joint: 2mm Gap. Sealed with Ecoply Barrier Sealing Tape.
Horizontal Joints: 15mm Gap. Use EcoBarrier PVC Z Flashing

CUT SHEETS:
Where a sheet end is cut, place the cut end to the top. Always have a sealed sheet end at the bottom to avoid potential moisture ingress into the panel. All other cuts and penetrations must be covered by a suitable flexible flashing tape and installed as per Ecoply Barrier literature. (if brush on preservative treatment used, use Holdfast Metalex end seal).

FIXINGS:
As Per Manufacturer Requirements. Stainless Steel Annular grooved Nails in Sea Spray Environments.
Power Driven: 50 x 2.8.
Hand Driven: 40 x 2.5.



RAB INSTALL

TYPICAL RAINSCREEN DETAIL

REVISION A 3D DETAIL 10
04 / 12 / 2013

LICENCE TO

Jill & Shane O'Brien

7 Tutere Street, Waikanae

RAB NO CLIENT NAME

PROJECT ADDRESS

ASSEMBLY

VERTICAL SHEET JOINT: 2-3MM

FLEXIBLE FLASHING TAPE
BRANZ Appraised & EcoPLY Approved. Install to
manufacturers instructions. Install to Vertical Sheet
Joints of RAB Board.

WALL / FLOOR FRAMING:
Refer to GA Drawings and Sections for Framing
etc.

FLEXIBLE FLASHING TAPE
BRANZ Appraised & EcoPLY Approved. Install to
manufacturers instructions. Install to Vertical Sheet
Joints of RAB Board.

Z FLASHING:
EcoPLY Barrier Horizontal Z Flashing. uPVC.
Install to Manufacturers Requirements.

35mm Upstand and Overlap

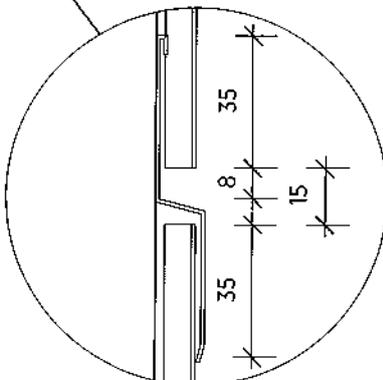
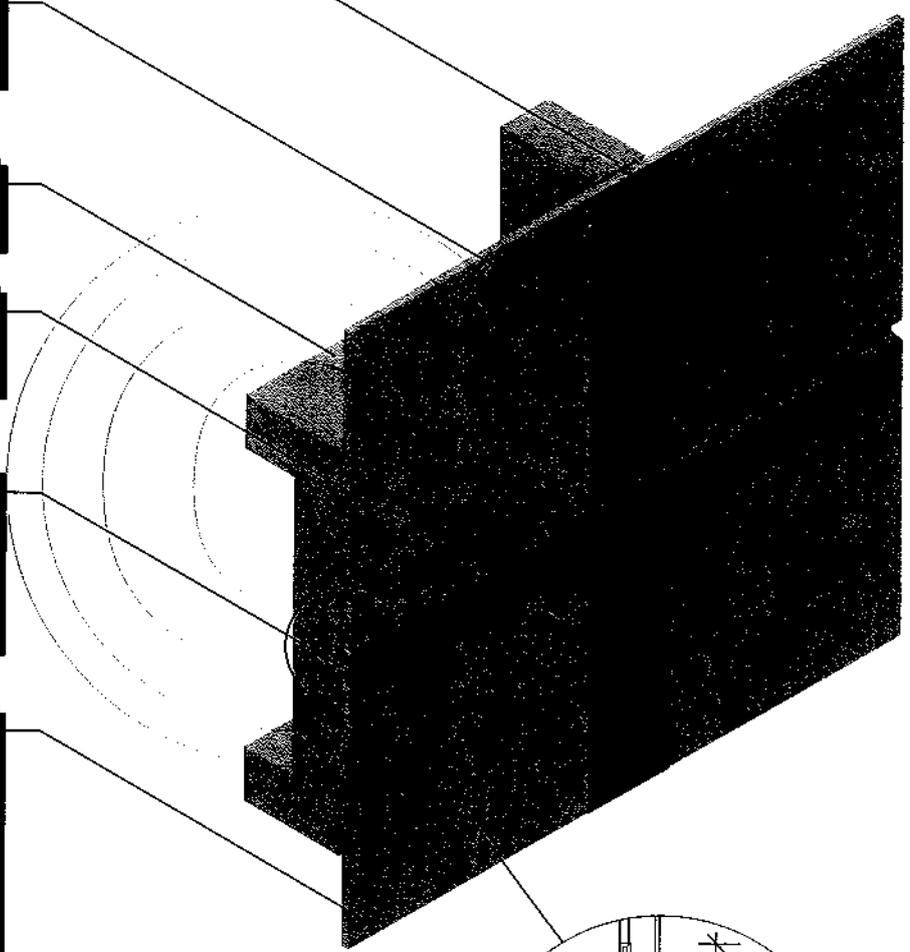
Maintain 15mm expansion gap between Plywood
sheet joints.

RIGID AIR BARRIER
Compliant with requirements of NZBC E2, 9.1.7.2.
EcoPLY Barrier, Structural Plywood Rigid Air Barrier,
meets the NZ Building Code rigid sheathing
performance requirements as outlined in Section
and Table 23 of E2/AS1, when installed as
manufacturers requirements.

SHEET JOINTS:
Vertical Joint: 2mm Gap. Sealed with EcoPLY Barrier
Sealing Tape.
Horizontal Joints: 15mm Gap. Use EcoBarrier PVC
Z Flashing

CUT SHEETS:
Where a sheet end is cut, place the cut end to the
top. Always have a sealed sheet end at the bottom
to avoid potential moisture ingress into the panel.
All other cuts and penetrations must be covered by
a suitable flexible flashing tape and installed as per
EcoPLY Barrier literature. (if brush on preservative
treatment used, use Holdfast Metalex end seal).

FIXINGS:
As Per Manufacturer Requirements. Stainless Steel
Annular grooved Nails in Sea Spray Environments.
Power Driven: 50 x 2.8.
Hand Driven: 40 x 2.5.



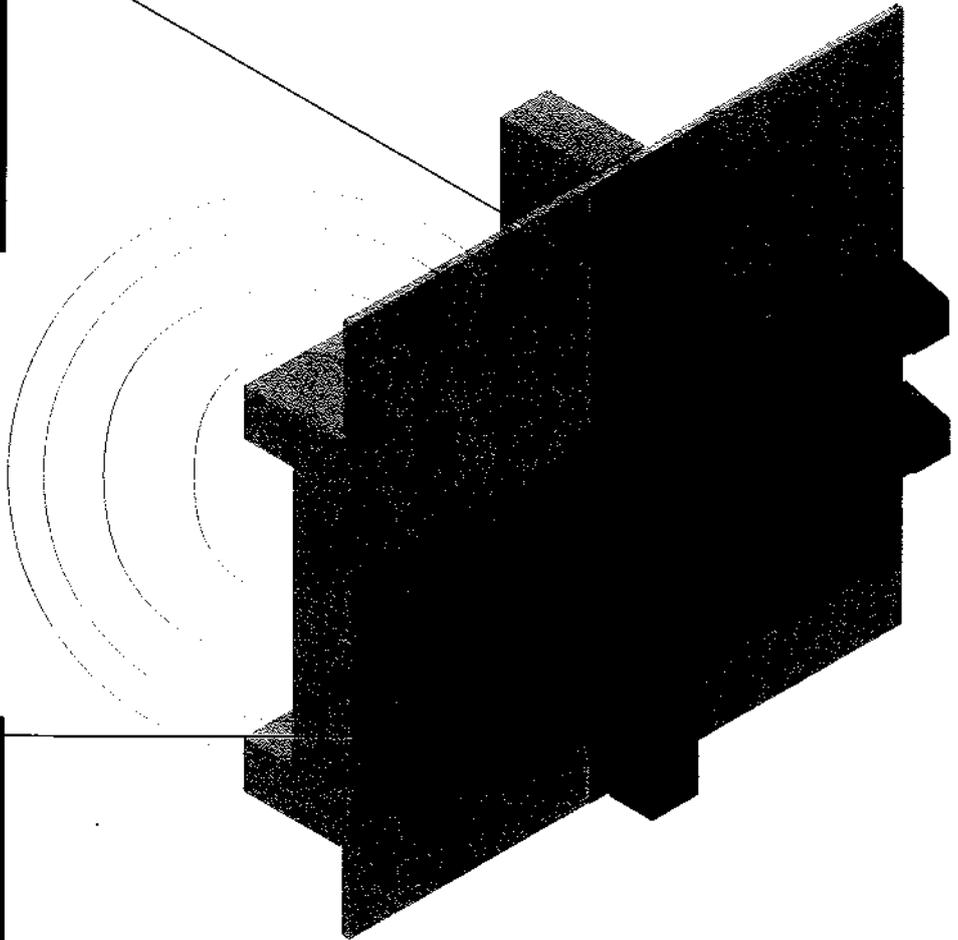
FLASH OPENING

RAB JOINT

TYPICAL RAINSCREEN DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 11



VERTICAL CAVITY BATTEN
 45 x 45 Cavity Battens, forming nominal 45mm Cavity.
 Vertical at Sheet Cladding Vertical Joints, over Studs.

Forms drained and ventilated Cavity meeting requirements of NZBC E2, 9.1.8.

H3.2 Treated to meet requirements for 50 year durability as per B2/AS1 TABLE 1.

Cladding Fixed to Cavity Battens, not Framing.
 Hence Structural Battens.
 Fixings into framing by Structural Engineer.

CASTELLATED CAVITY BATTEN
 Structural Cavity Battens, forming nominal 45mm Cavity. Castellated Battens with 15 Degree Falls to Top surface and drip edge to base.

Installed Horizontally @ 600 Ctrs. Forms drained and ventilated Cavity meeting requirements of NZBC E2, 9.1.8.

H3.2 Treated to meet requirements for 50 year durability as per B2/AS1 TABLE 1.

Cladding Fixed to Cavity Battens, not Framing.
 Hence Structural Battens.
 Fixings into framing by Structural Engineer.

CAVITY FORMATION

TYPICAL RAINSCREEN DETAIL

REVISION **A** 3D DETAIL 12
 04 / 12 / 2013

LICENCE TO		7 Tutere Street, Waikanae		ASSEMBLY
RAB NO	CLIENT NAME	PROJECT ADDRESS		

These drawings are copyright of Assembly Architecture Ltd. Use of these drawings for publication or as part of a building consent without a licence agreement will result in legal action.

SHEET JOINT

Z FLASHING:
Ecopoly Barrier Horizontal Z Flashing, uPVC.
Install to Manufacturers Requirements.

35mm Min Upstand and Overlap

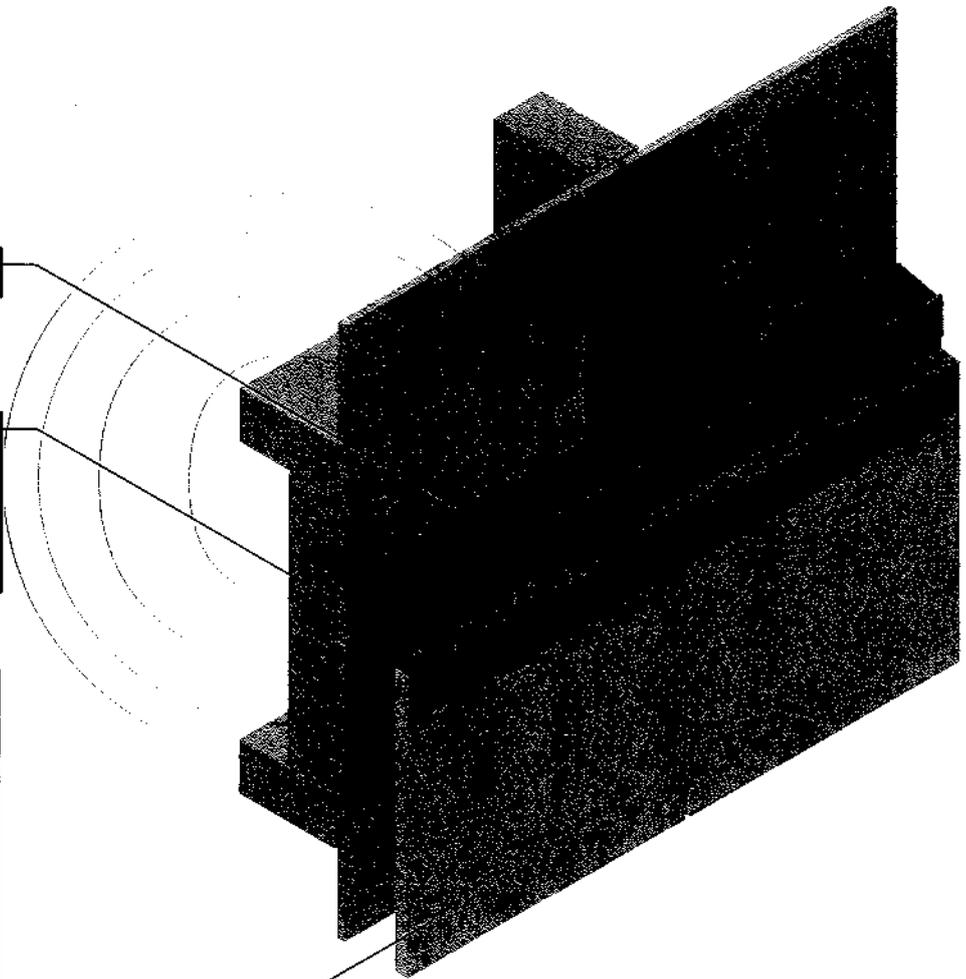
Maintain 15mm expansion gap between Plywood sheet joints.

PLYWOOD SHEET CLADDING:
Installed as per NZBC E2, Section 9.8.
Plywood manufactured to NZS 2269, grade CD, min 5 ply, 12mm thickness. Fixed into Structural Cavity Battens.

Vertical Joints: Battened as per E2 Figure 119. Fixed battens with 2mm nominal gap between sheets.
Horizontal Joints: Incorporate 10mm expansion gap and fitted with Z Flashing as per E2 figure 121. 35mm upstand and overlap.

TREATMENT: H3.1 LOSP
FINISH: Pre-primed off-site. Painted on site. Any Cut Edges Must be coated with envelope preservative, such as Holdfast Metalex before installation.

FIXING: As Per E2, Table 24 Requirements. Min Framing Penetration 30mm into Structural Batten. Use 50x2.8 FH Nail, Stainless Steel, Annular Grooved. 150mm fixing ctrs to edges. 300 fixing ctrs to middle.



PLYWOOD INSTALL

TYPICAL RAINSCREEN DETAIL

REVISION A 3D DETAIL 13
04 / 12 / 2013

LICENCE TO
RAB NO

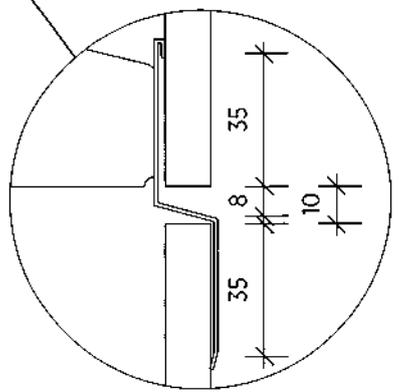
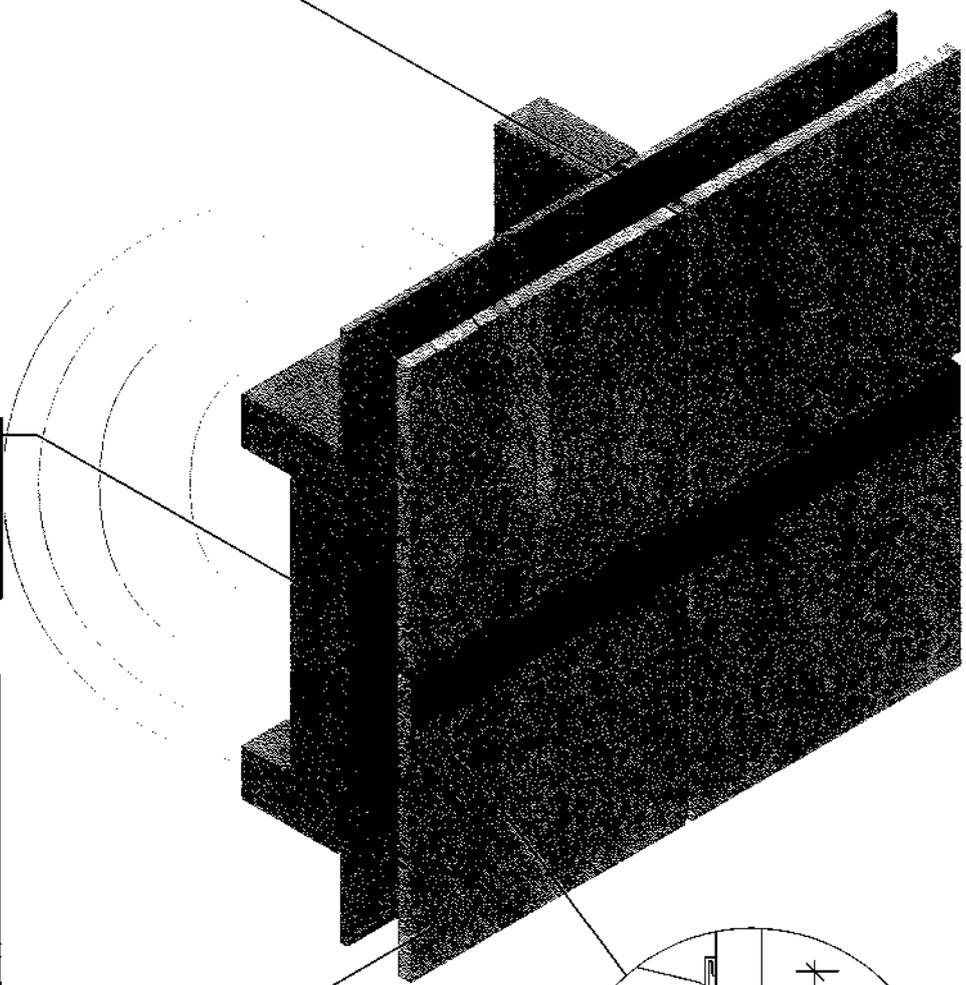
Jill & Shane O'Brien	7 Tutere Street, Waikanae
CLIENT NAME	PROJECT ADDRESS

ASSEMBLY

SHEET JOINT: 2-3mm Gap

Z FLASHING:
 Ecoply Barrier Horizontal Z Flashing, uPVC.
 Install to Manufacturers Requirements.
 35mm Min Upstand and Overlap
 Maintain 15mm expansion gap between Plywood sheet joints.

PLYWOOD SHEET CLADDING:
 Installed as per NZBC E2, Section 9.8.
 Plywood manufactured to NZS 2269, grade CD, min 5 ply, 12mm thickness. Fixed into Structural Cavity Battens.
 Vertical Joints: Battened as per E2 Figure 119. Grooved battens with 2mm nominal gap between sheets.
 Horizontal Joints: incorporate 10mm expansion gap and fitted with Z Flashing as per E2 figure 121. 35mm upstand and overlap.
TREATMENT: H3.1 LOSP
FINISH: Pre-primed off-site. Painted on site. Any Cut Edges Must be coated with envelope preservative, such as Holdfast Metalex before installation.
FIXING: As Per E2, Table 24 Requirements. Min Framing Penetration 30mm Into Structural Batten. Use 50x2.8 FH Nail, Stainless Steel, Annular Grooved. 150mm fixing ctrs to edges. 300 fixing ctrs to middle.



PLYWOOD JOINT

TYPICAL RAINSCREEN DETAIL

REVISION A 04 / 12 / 2013 3D DETAIL 14

LICENCE TO	Jill & Shane O'Brien	7 Tutere Street, Waikanae	ASSEMBLY
RAB NO	CLIENT NAME	PROJECT ADDRESS	

These drawings are copyright of Assembly Architecture Ltd. Use of these drawings for publication or as part of a building consent without a licence agreement will result in legal action.

MACROCARPA BATTEN
 OVER Plywood Vertical Sheet Join.
 EX 150 Board with 6mm Weather Grooves.
 As Per NZBC E2, Figure 119.

Fixing: Countersunk HexHead or Square Drive
 Stainless Steel Screws.
 Finish: None.
 Untreated, acceptable for 15 year durability, NZBC
 B2, Table 2A.

NOTE: Boards set out at 1200 Module to Cover Ply
 Sheet Joints.

5mm Min Gap between Boards.

PLYWOOD SHEET CLADDING:
 Installed as per NZBC E2, Section 9.8.
 Plywood manufactured to NZS 2269, grade CD, min
 5 ply, 12mm thickness. Fixed into Structural Cavity
 Battens.

Vertical Joints: Battened as per E2 Figure 119.
 Grooved battens with 2mm nominal gap between
 sheets.

Horizontal Joints: Incorporate 10mm expansion gap
 and filled with Z Flashing as per E2 figure t21,
 35mm upstands and overlaps.

TREATMENT: H3.1 LOSP
 FINISH: Pre-primed off-site. Painted on site.
 Any Cut Edges Must be coated with envelope
 preservative, such as Holdfast Metalex before
 installation.

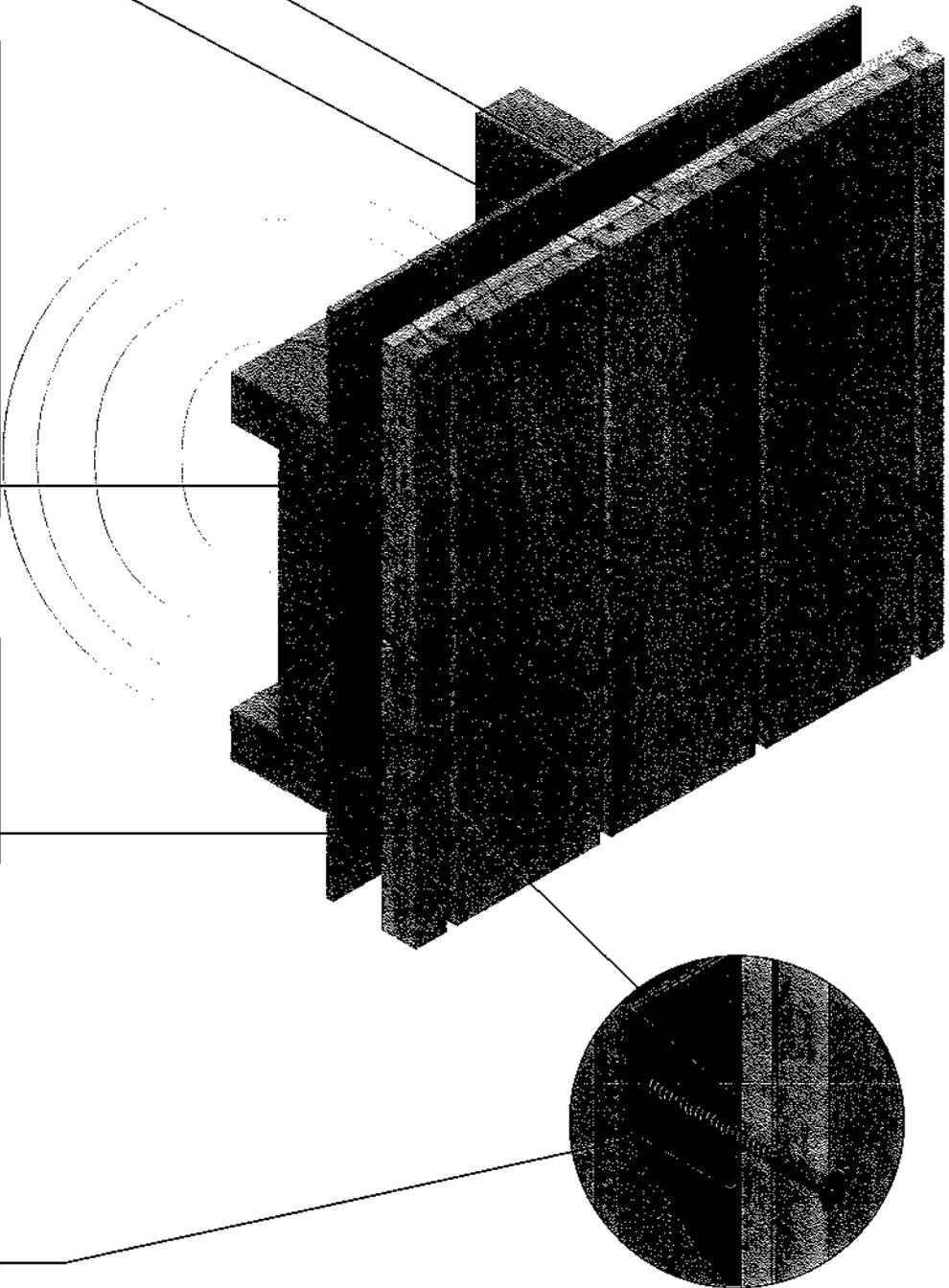
FIXING: As Per E2, Table 24 Requirements. Min
 Framing Penetration 30mm into Structural Batten.
 Use 50x2.8 FH Nail, Stainless Steel, Annular
 Grooved.
 150mm fixing ctrs to edges.
 300 fixing ctrs to middle.

MACROCARPA DECORATIVE RAINSCREEN.
 Macrocarpa Vertical Boards with 6mm Weather
 Grooving.
 Rainscreen Fixed over Plywood sheet Cladding.
 Removeable

Fixing: Countersunk HexHead or Square Drive
 Stainless Steel Screws.
 Finish: None.
 Untreated, acceptable for 15 year durability, NZBC
 B2, Table 2A.

RAINSCREEN FIXING
 Countersunk HexHead or Square Drive Stainless
 Steel Screws.

Note: Screws do not penetrate RAB
 Fixings into Structural Battens @ 600 ctrs



TYPICAL RAINSCREEN DETAIL

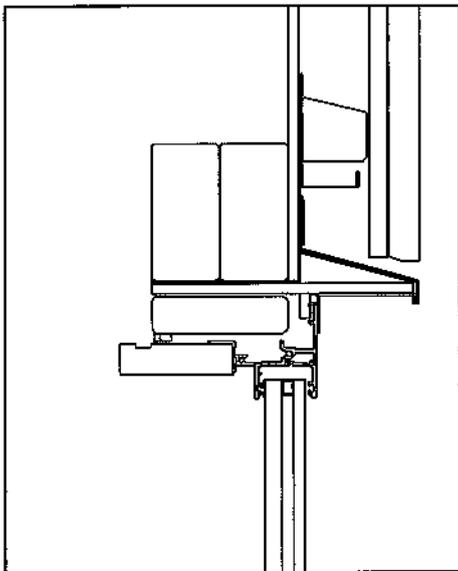
RAINSCREEN

REVISION A 3D DETAIL 15
 04 / 12 / 2013

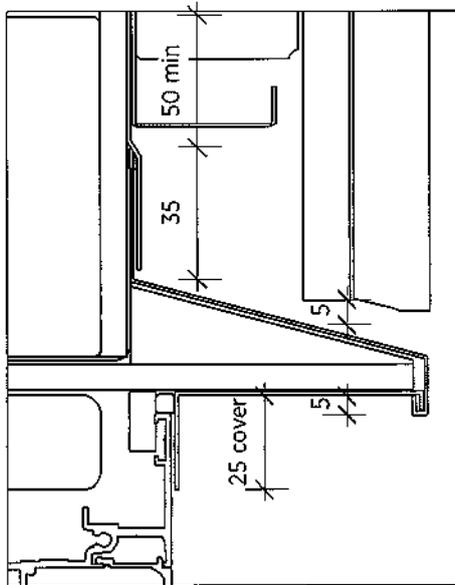
LICENCE TO	Jill & Shane O'Brien	7 Tutere Street, Waikanae
RAB NO	CLIENT NAME	PROJECT ADDRESS



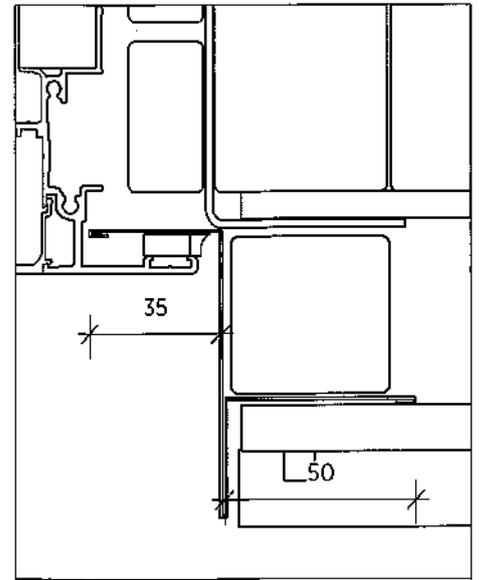
These drawings are copyright of Assembly Architecture Ltd. Use of these drawings for publication or as part of a building consent with out a licence agreement will result in legal action.



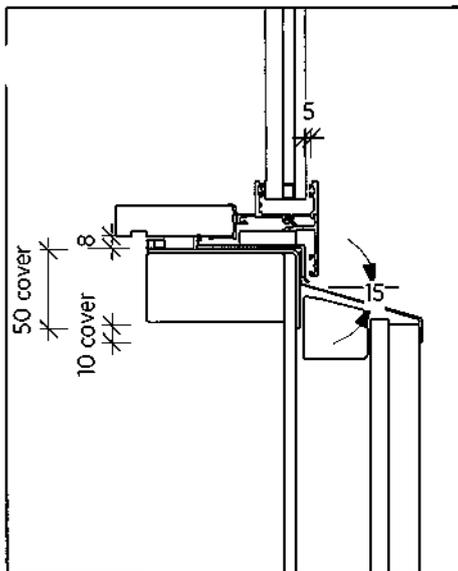
1 HEAD DETAIL
Scale: 1:5



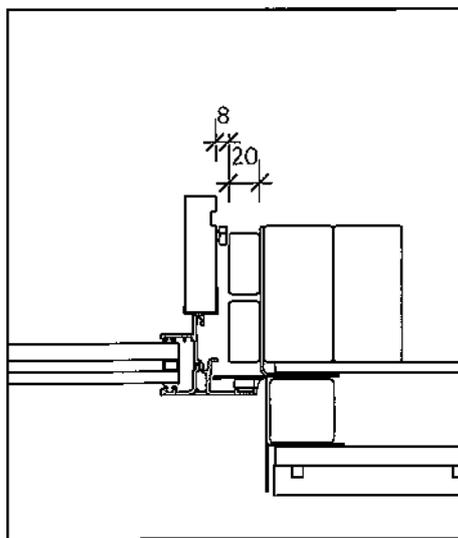
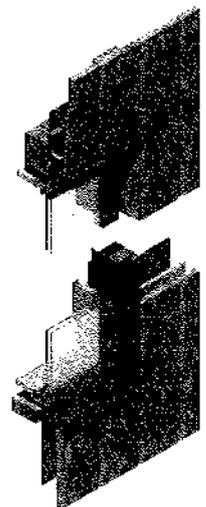
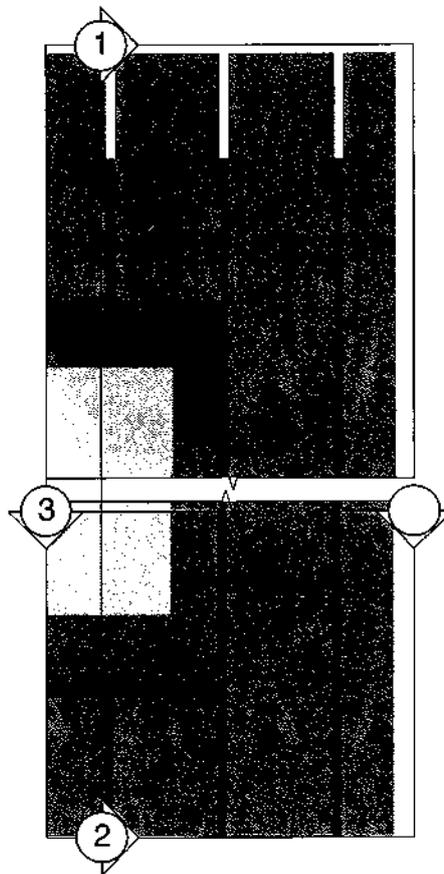
4 FLASHING DETAIL
Scale: Half Actual Size



5 FLASHING DETAIL
Scale: Half Actual Size



2 SILL DETAIL
Scale: 1:5



3 JAMB DETAIL
Scale: 1:5

2D Detail Sections
Recessed Window

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 00

LICENCE TO	
RAB NO	

Jill & Shane O'Brien	7 Tutere Street, Walkanae
CLIENT NAME	PROJECT ADDRESS

ASSEMBLY

RIGID AIR BARRIER

Compliant with requirements of NZBC E2, 9.1.7.2. EcoPoly Barrier, Structural Plywood Rigid Air Barrier, meets the NZ Building Code rigid sheathing performance requirements as outlined in Section 9.1.4 and Table 23 of E2/AS1, when installed as per manufacturers requirements.

SHEET JOINTS:

Vertical joints sealed with EcoPoly Barrier Sealing Tape.

Horizontal Joints, use EcoBarrier PVC Z Flashing

CUT SHEETS:

Where a sheet end is cut, place the cut end to the top. Always have a sealed sheet end at the bottom to avoid potential moisture ingress into the panel. All other cuts and penetrations must be covered by a suitable flexible flashing tape and installed as per EcoPoly Barrier literature. (if brush on preservative treatment used, use Holdfast Metalex end seal).

FIXINGS:

As Per Manufacturer Requirements. Stainless Steel Annular grooved Nails in Sea Spray Environments. Power Driven: 50 x 2.8. Hand Driven: 40 x 2.5. Install min 7mm from sheet edges. fixing ctrs 150mm at sheet edges, 300mm within sheet.

WALL FRAMING:

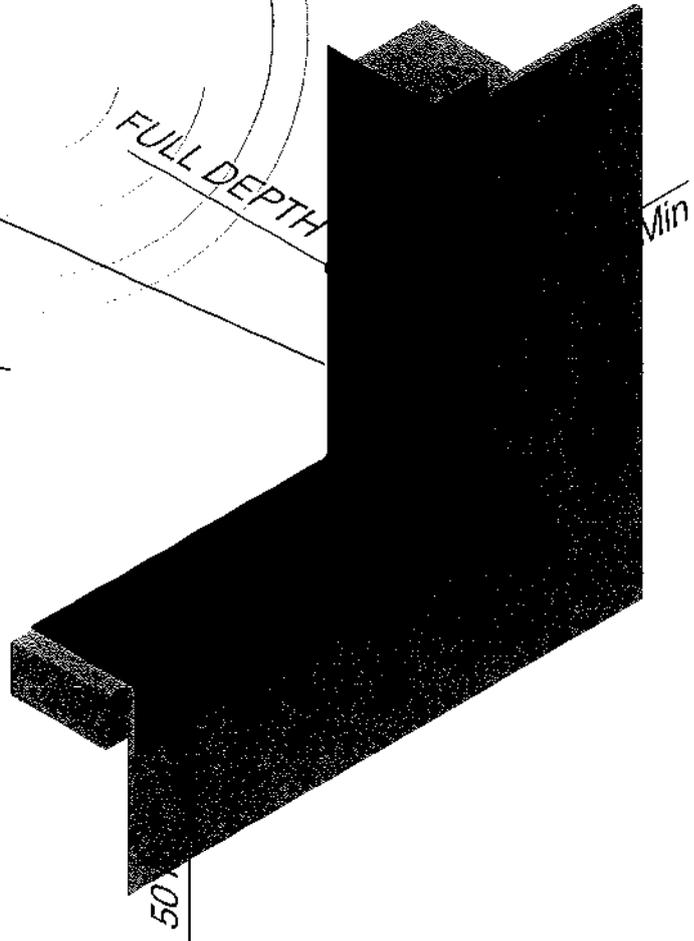
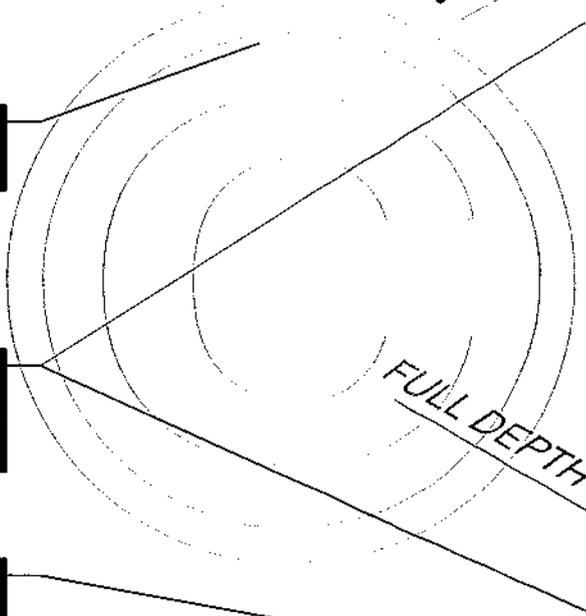
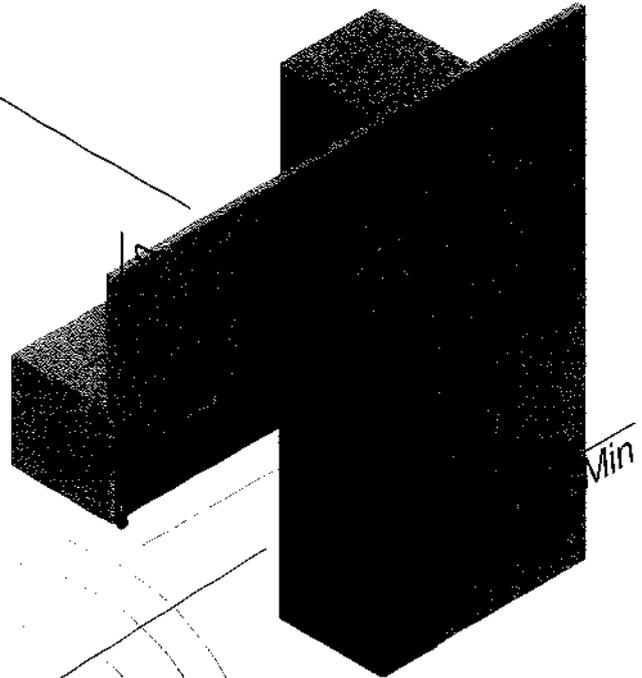
Refer to GA Drawings and Sections for Framing Details.

FLEXIBLE FLASHING TAPE

BRANZ Appraised and Manufacturer Approved Flashing Tape. Install to manufacturers instructions. Install to entire opening: Sill, Jamb and Head.

WALL FRAMING:

Refer to GA Drawings and Sections for Framing Details.



	OPENING PREP

Wraps & Tape

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 01

LICENCE TO	Jill & Shane O'Brien
RAB NO	CLIENT NAME

7 Tutere Street, Waikanae
PROJECT ADDRESS

ASSEMBLY

HEAD FLASHING

Aluminium Head Flashing as per Requirements of NZBC E2, Section 9 for direct fixed sheet claddings, and durability requirements of NZBC E2, Table 20.

1mm thickness 5000 series aluminium. Min 35mm upstand with ends folded as per details to form cap. 15 degree falls and formed drip edges.

Powdercoat to match window joinery.
2 Part Head flashing. 1st part shown only.



CAVITY JAMB BATTEN

H3.2 Vertical Timber Cavity Batten to Jamb. Install bond-breaker PVC tape between batten and flashing.

HEAD FLASHING

Timber Fillet Support to Flashing. H3.1

HEAD BATTEN

H3.1 Timber Batten to Head.

PLYWOOD FILLET

H3.1 18mm Plywood Fillet to Window Head, supporting Head Flashing.

all Cut Edges with Holdfast Metalex End Seal Preservative.

JAMB FLASHING

JAMB BATTENS

H3.1 Timber Jamb Battens, as per requirements of NZBC E2, Section 9 for Direct Fixed Claddings.

Timber Battens to finish clear of sill tray flashing.

JAMB FLASHING

Aluminium Jamb Flashing as per Requirements NZBC E2, 4.3.2 and Table 20 for Exposure Zone D (NZS 3604)

1mm thickness 5000 series, Custom Folded as shown. Min 35mm lap to Window and Cladding. Bond Breaker tape between Flashing and Batten. Powdercoat to match window Joinery.

SILL FLASHING

Aluminium Sill Flashing as per Requirements of NZBC E2, Section 9 for direct fixed sheet claddings, and durability requirements of NZBC E2, Table 20.

1mm thickness 5000 series aluminium. Extend behind back of window frame. Min 8mm upstand to back with sloping end dams. Maintain 5mm clearance to window facing. Powdercoat to match window joinery.

Sill Flashing installed to lap over 2nd flashing. Care taken by Installer to ensure Sill flashing does not slope backwards into building. Test water flows to building exterior before progressing with window install.

SILL FLASH 2

1mm thickness 5000 series aluminium, 15 degree Falls. Lap under Sill Flash 01 and over Cladding with 10mm min lap over cladding.

Install with full support by sloped Castellated Cavity Batten under. Bond Breaker Tape between.

Powdercoat to match window joinery.

CASTELLATED CAVITY BATTEN

Supporting Sill Flash. Install Bond Breaker PVC Tape under Flashing

FLASH OPENING

UPSTAND (DASHED)

RECESSED / EXPRESSED T
WINDOW FLASHINGS

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 02

LICENCE TO
RAB NO

Jill & Shane O'Brien
CLIENT NAME

7 Tutere Street, Waikanae
PROJECT ADDRESS

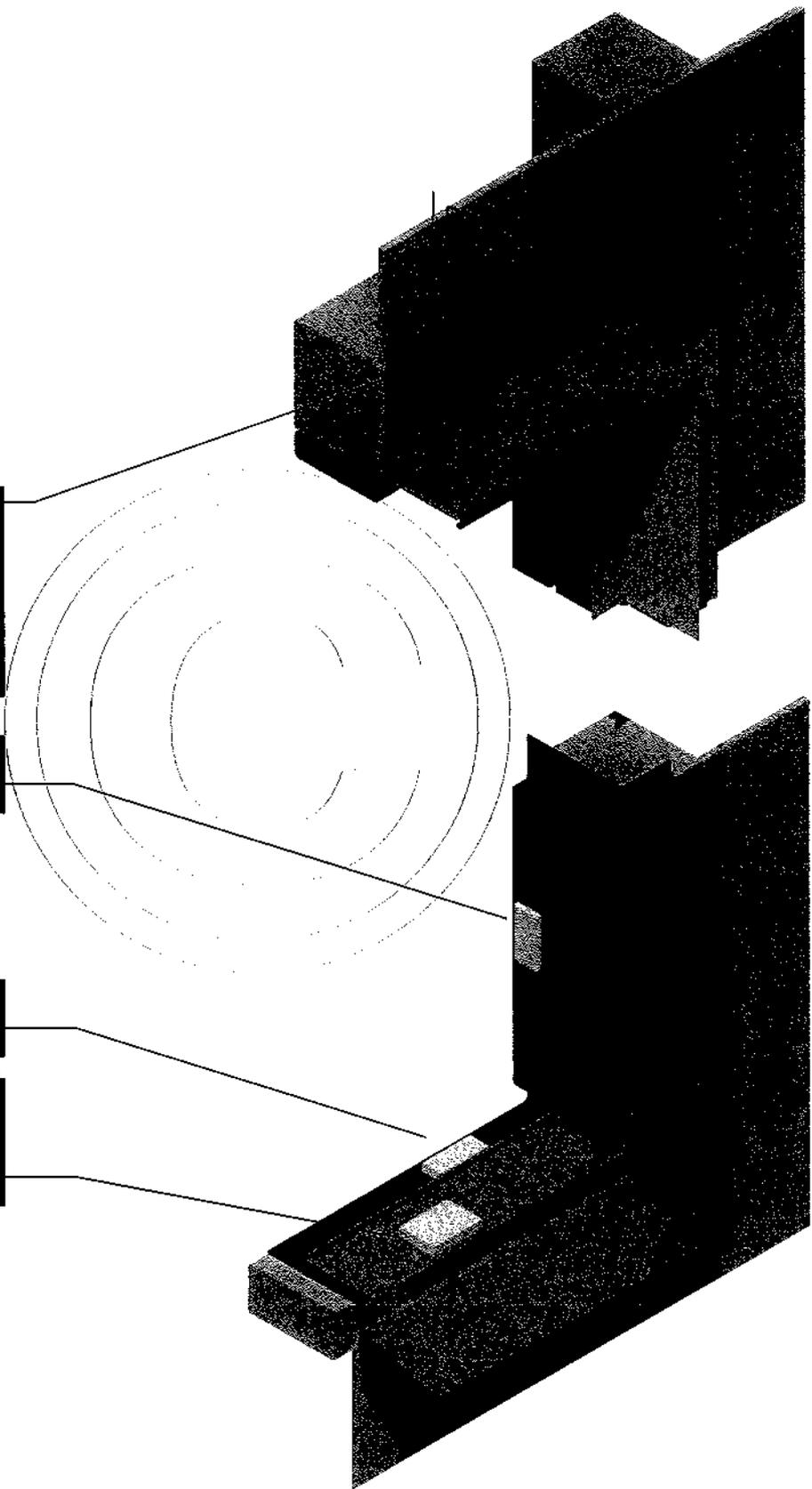
ASSEMBLY

EXIBLE FLASHING TAPE
 BRANZ Appraised and RAB Manufacturer Approved Flashing Tape. Install to manufacturers instructions, as per Requirements of NZBC E2, Figure 71 (B)
 Install Full width of Head flash, sealing Head Flashing, flashing Upstands and Jamb Flashing to RAB and Battens.
 Min 50mm upstand.

WINDOW PACKERS
 Install WANZ approved packers to sills and Jambs as per WANZ requirements.

WINDOW PACKERS
 Install WANZ approved packers to sills and Jambs as per WANZ requirements.

FRAME BLOCK
 Install WANZ approved Frame Block to support Joinery unit as per Requirements of NZBC E2, Figure 72A.
 Supports by Window Joinery Manufacturer.



WINDOW PREPARATION

TYPICAL WINDOW DETAIL

REVISION A 3D DETAIL 03
 04 / 12 / 2013

LICENCE TO	Jill & Shane O'Brien	7 Tutere Street, Waikanae	ASSEMBLY
RAB NO	CLIENT NAME	PROJECT ADDRESS	

These drawings are copyright of Assembly Architecture Ltd. Use of these drawings for publication or as part of a building consent with out a licence agreement will result in legal action.

COMPRESSIBLE FOAM TAPE
Install behind Window Head and Jamb Facings

Foam Tape to be Closed Cell PVC Foam to meet Requirements of NZBC E2, clause 9.1.10.7.

PROTECTIVE SEALANT:
Continuous line of protective Sealant to seal window facing to Flashing. OVER compressible foam bond breaker tape.

Sealant as per requirements of NZBC E2, Figure 83.

Sealant to Comply with:
a. Type F, Class 20LM or 25LM of ISO 11600, or
b. low modulus Type II Class A of Federal Specification TT-S-00230C

HEAD FLASHING: PART 2

AIR SEAL:
Foam backing rod and continuous seal around entire window.

HEAD FLASHING: PART 2
Aluminium Head Flashing as per Requirements of NZBC E2, Section 9 for direct fixed sheet claddings, and durability requirements of NZBC E2, Table 20.

1mm thickness 5000 series aluminium. Folded drip edges. Lapped Over and sealed to Window Facing, per requirements of NZBC E2, Figure 71 (c).

Powdercoat to match window joinery.

SELECTED ALUMINIUM WINDOW/DOOR:
Window Frames to meet Requirements of NZBC E2, 9.1.10 and Installed as per WANZ Guidelines. EXPOSURE ZONE: D / Sea Spray. FINISH: Duratec PowderCoating

DOUBLE GLAZING:
Glazing contractor to select glazing to comply with NZS4223 safety requirements.

Glazing Selected to Maximise Energy Efficiency of Glazing. Generally Argon Filled and Low-E coated.

Glass supplier to coordinate with window and door manufacturers to ensure window bead suits thickness of units. Ensure the double glazing spacer and sealant are fully protected from direct UV.

AIR SEAL:
In accordance with E2/AS1 Section 9.1.6
Air seal with PEF backing rod. Installed continuous to jamb, sill and frame.

Air Seal shall be made of either:
1. self-expanding polyurethane foam, or
2. Sealant complying with:
a. Type F, Class 20LM or 25LM of ISO 11600, or
b. low modulus Type II Class A of Federal Specification TT-S-00230C

PROTECTIVE SEALANT:
Continuous line of protective Sealant to seal edge of window facing to Flashing. OVER compressible foam bond breaker tape.

As per requirements of NZBC E2, Figure 83.
Sealant to Comply with:
a. Type F, Class 20LM or 25LM of ISO 11600, or
b. low modulus Type II Class A of Federal Specification TT-S-00230C

COMPRESSIBLE FOAM TAPE
Install behind Window Facings to Head and Jamb

Foam Tape to be Closed Cell PVC Foam to meet Requirements of NZBC E2, clause 9.1.10.7.

SEAL FLASH TO WINDOW FRAME

DO NOT SEAL SILL JUNCTION

SEAL FLASH TO WINDOW FRAME

WINDOW INSTALL

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 04

LICENCE TO

Jill & Shane O'Brien

7 Tutere Street, Waikanae

PROJECT ADDRESS

RAB NO

CLIENT NAME

ASSEMBLY

CASTELLATED CAVITY BATTEN

Structural Cavity Battens, forming nominal 45mm Cavity. Castellated Battens with 15 Degree Falls to Top and drip edge to base.
Install @ 600 Ctrs.

H3.2 Treated to meet requirements for 50 year durability as per B2/AS1 TABLE 1.

Forms drained and ventilated Cavity meeting requirements of NZBC E2, 9.1.8.

Cladding Fixed to Cavity Battens, not framing.
Hence Structural Battens.
Fixings into framing by Structural Engineer.

VERMIN PROOF CAVITY CLOSER

In accordance with E2/AS1 9.1.8.3 Vermin-proofing Vermin-proofing shall be provided above window heads and at the base of the drained cavity.

Preferred Material: uPVC in accordance with paragraph E2/AS1/4.1.
Alternative Material: Powder Coated Aluminium.

Vermin-proofing shall:

- a) Provide holes or slots between 3 mm and 5 mm,
- b) Provide an area of opening of 1000 mm per lineal metre of wall, and
- c) Be positioned to allow a minimum drip edge to the wall cladding of:
 - i) 10 mm at the base of walls, and
 - ii) 15 mm above window head flashings

CASTELLATED CAVITY BATTEN

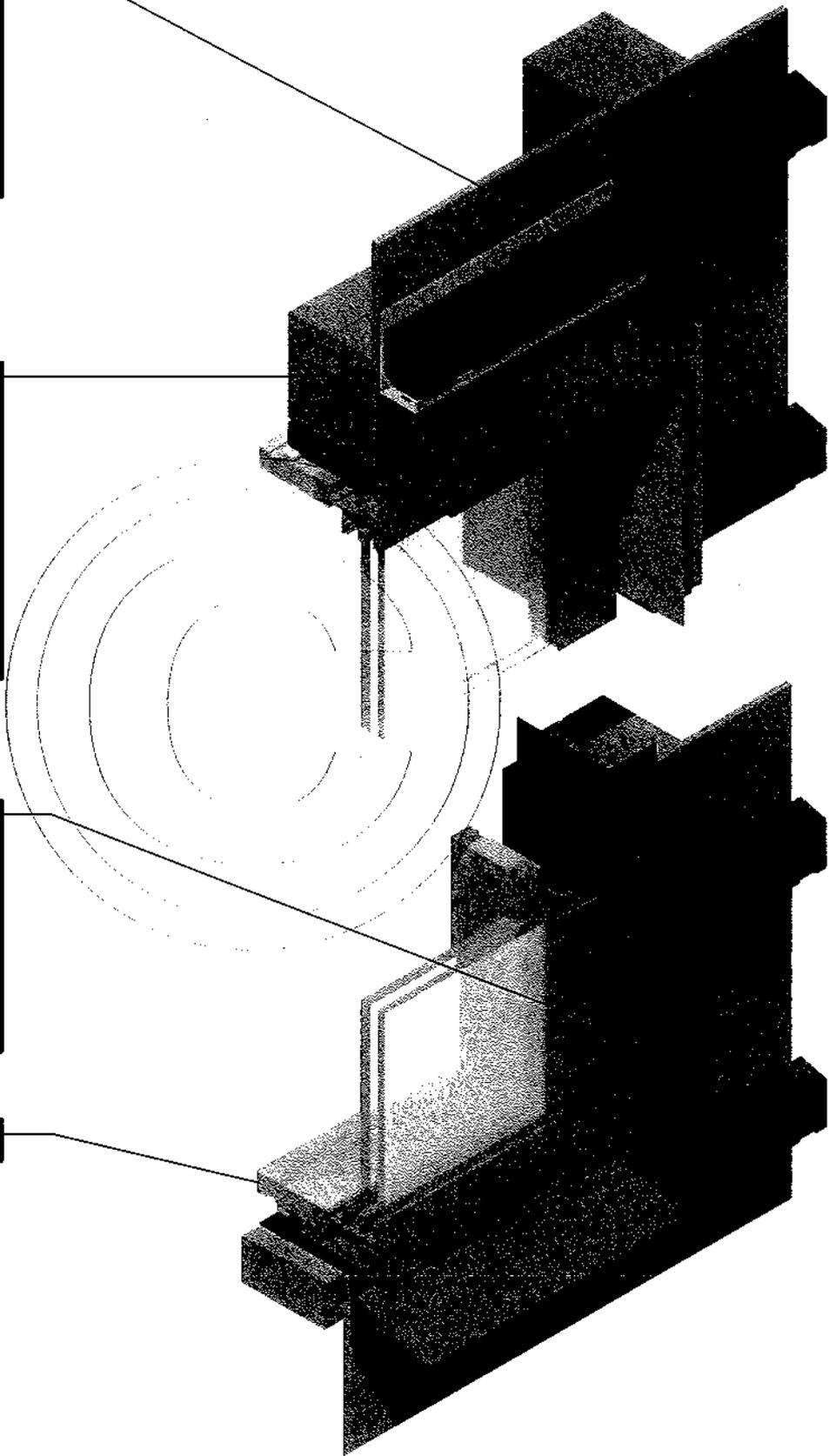
Structural Cavity Battens, forming nominal 45mm Cavity. Castellated Battens with 15 Degree Falls to Top and drip edge to base.
Install @ 600 Ctrs.

H3.2 Treated to meet requirements for 50 year durability as per B2/AS1 TABLE 1.

Forms drained and ventilated Cavity meeting requirements of NZBC E2, 9.1.8.

Cladding Fixed to Cavity Battens, not framing.
Hence Structural Battens.
Fixings into framing by Structural Engineer.

PAINT QUALITY PINE LINERS



CAVITY CONSTRUCTION

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 05

LICENCE TO
RAB NO

Jill & Shane O'Brien
CLIENT NAME

7 Tutere Street, Waikanae
PROJECT ADDRESS

ASSEMBLY

PLYWOOD SHEET CLADDING:
 Installed as per NZBC E2, Section 9.8.
 Plywood manufactured to NZS 2269, grade CD, min
 5 ply, 12mm thickness.
 Fixed into Structural Cavity Battens.

Vertical Joints: Battened as per E2 Figure 119.
 Grooved battens with 2-3mm nominal gap between
 ply sheets.
 Horizontal Joints: Incorporate 10mm expansion gap
 and filled with Z Flashing as per E2 figure 121.
 35mm upstands and overlaps.

TREATMENT: H3.1 LOSP
FINISH: Pre-primed off-site. Painted on site.
 Any Cut Edges Must be coated with envelope
 preservative, such as Holdfast Metalex before
 installation.

FIXING: As Per E2, Table 24 Requirements. Min
 Framing Penetration 30mm into Structural Batten.
 Use 50x2.8 FH Nail, Stainless Steel, Annular
 Grooved.
 150mm fixing ctrs to edges.
 300 fixing ctrs to middle.

PLYWOOD SHEET CLADDING:
 Installed to form drip edge.

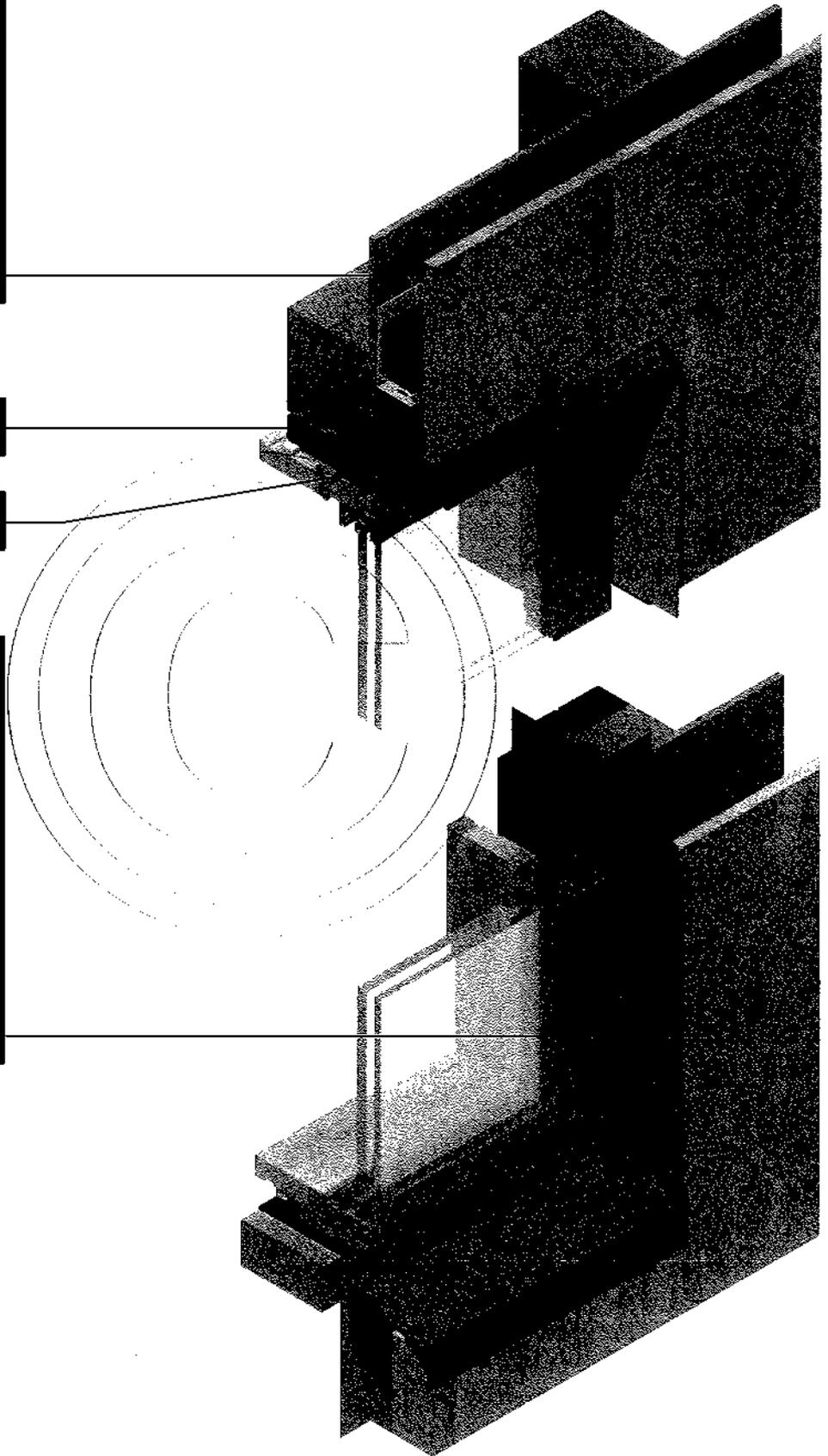
Maintain 5mm clearance gap from cladding to Head
 Flashing Below

PLYWOOD SHEET CLADDING:
 Installed as per NZBC E2, Section 9.8.
 Plywood manufactured to NZS 2269, grade CD, min
 5 ply, 12mm thickness.
 Fixed into Structural Cavity Battens.

Vertical Joints: Battened as per E2 Figure 119.
 Grooved battens with 2-3mm nominal gap between
 ply sheets.
 Horizontal Joints: Incorporate 10mm expansion gap
 and filled with Z Flashing as per E2 figure 121.
 35mm upstands and overlaps.

TREATMENT: H3.1 LOSP
FINISH: Pre-primed off-site. Painted on site.
 Any Cut Edges Must be coated with envelope
 preservative, such as Holdfast Metalex before
 installation.

FIXING: As Per E2, Table 24 Requirements. Min
 Framing Penetration 30mm into Structural Batten.
 Use 50x2.8 FH Nail, Stainless Steel, Annular
 Grooved.
 150mm fixing ctrs to edges.
 300 fixing ctrs to middle.



CLADDING

TYPICAL WINDOW DETAIL

REVISION A
 04 / 12 / 2013

3D DETAIL 06

LICENCE TO	
RAB NO	CLIENT NAME

Jill & Shane O'Brien

7 Tutere Street, Waikanae

PROJECT ADDRESS

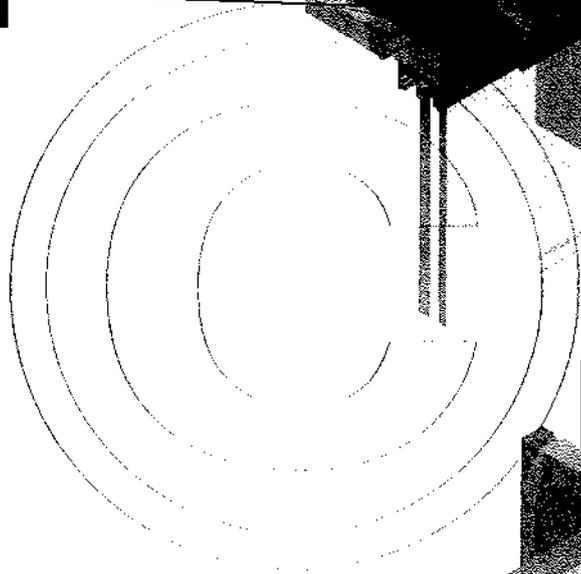
ASSEMBLY

MACROCARPA DECORATIVE RAINSCREEN.
Macrocarpa Vertical Boards with Weather Grooving.

Rainscreen Fixed over Plywood sheet Cladding.
Removeable

Fixing: Countersunk HexHead or Square Drive
Stainless Steel Screws.
Finish: None.
Untreated, acceptable for 15 year durability, NZBC
B2, Table 2A.

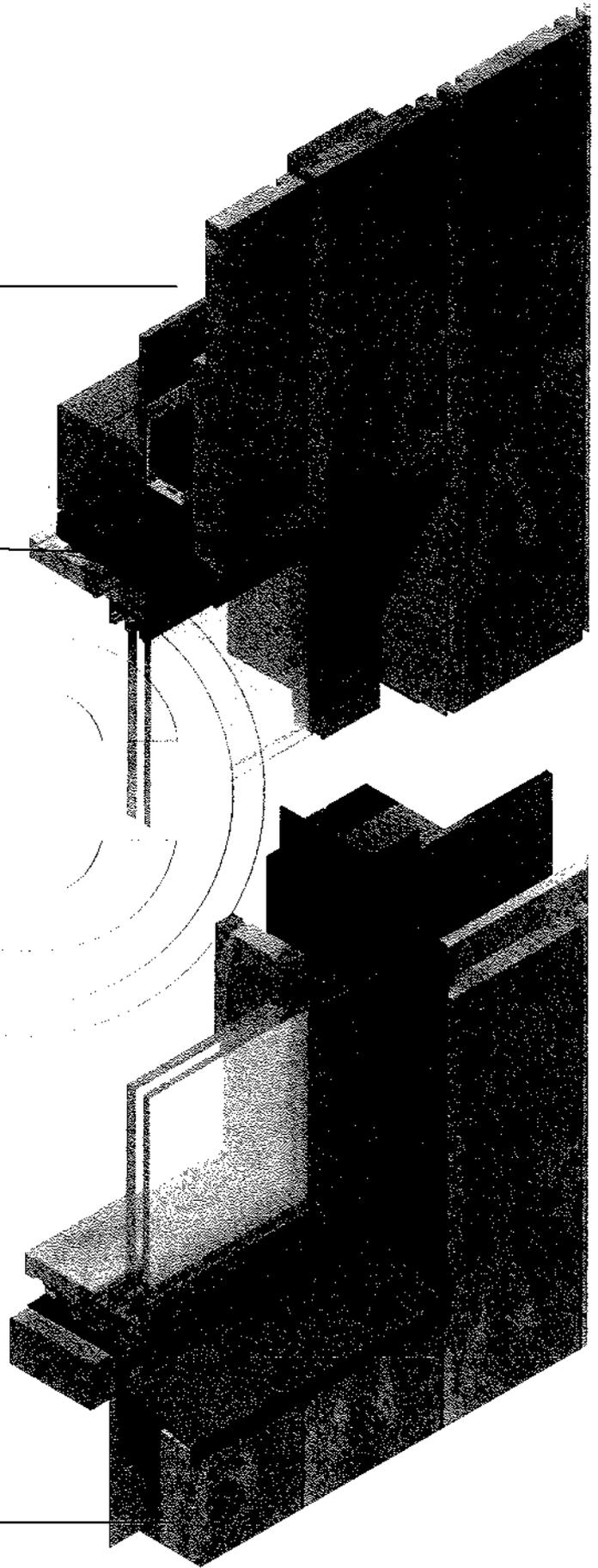
Maintain 5mm clearance gap from cladding to Head
Flashing Below



MACROCARPA DECORATIVE RAINSCREEN.
Macrocarpa Vertical Boards with Weather Grooving.

Rainscreen Fixed over Plywood sheet Cladding.
Removeable

Fixing: Countersunk HexHead or Square Drive
Stainless Steel Screws.
Finish: None.
Untreated, acceptable for 15 year durability, NZBC
B2, Table 2A.



RAINSCREEN

TYPICAL WINDOW DETAIL

REVISION A
04 / 12 / 2013

3D DETAIL 07

LICENCE TO

Jill & Shane O'Brien

7 Tutere Street, Waikanae

PROJECT ADDRESS

RAB NO

CLIENT NAME

ASSEMBLY

000077

RECEIVED

13 JAN 2000

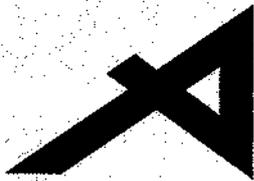
SH

PRODUCT MANUAL



 **bituFLAME**[®]
TORCH-ON MEMBRANE

 **waterproofing systems**
KEEPING YOU WATER TIGHT



BRANZ Appraised
Appraisal No.404 [2008]

BRANZ Appraisals

Technical Assessments of products
for building and construction

**BRANZ
APPRAISAL
No. 404 (2008)**

This Appraisal replaces BRANZ
Appraisal No. 404 (2005) issued
9 August 2005.

**bituFLAME®
ROOF MEMBRANE
SYSTEMS**

Waterproofing Systems Ltd
P O Box 1113
Palmerston North

Tel: 06 357 9148
Fax: 06 357 9410

Email: info@waterproofing.co.nz
www.waterproofing.co.nz



BRANZ

BRANZ Limited
Private Bag 50 908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1111
www.branz.co.nz



1.1 bituFLAME® Roof Membranes are waterproofing membranes for nominally flat, pitched and curved roofs, gutters and parapets. They are installed as a single or multi-layer system with either a mineral chip finished product (bituFLAME® CS Granule) or a fleece finished layer (bituFLAME® CS Mat) with UV protective paint as the top layer, or as a single layer system (bituFLAME® BS) under heavy protection such as paving slabs or a topping screed.

1.2 Both the products are supplied as torch-on, reinforced, polymer-modified bitumen sheets in roll form. The membranes can be fully torched, mechanically or adhesive fixed.



2.1 bituFLAME® Roof Membranes have been appraised as roof waterproofing membranes on buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1 with respect to building height and maximum floor plan areas; and,
- with building structures designed and constructed to meet the requirements of the NZBC; and,
- with roof supporting structures of timber framing with substrates of plywood; and,
- with substrates of suspended concrete slabs; and,
- situated in NZS 3604 Building Wind Zones, up to, and including 'Very High'.

2.2 bituFLAME® Roof Membranes have also been appraised for use as roof waterproofing membranes on specifically designed buildings within the following scope:

- with building structures designed and constructed to comply with the NZBC; and,
- with roof supporting structures of timber framing with substrates of plywood; and,
- with substrates of suspended concrete slab; and,
- subjected to maximum wind pressures (Refer Paragraph 8.2); and,
- with the weathertightness design of all junctions being the subject of specific design by the designer.

Note: The design of these junctions has not been appraised by BRANZ and is outside the scope of this Appraisal.

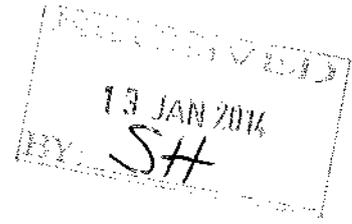
2.3 Roofs waterproofed with bituFLAME® Roof Membranes must be designed and constructed in accordance with the following limitations:

- nominally flat, curved or pitched roofs constructed to drain water to gutters and drainage outlets complying with the NZBC; and,
- constructed to suitable falls (Refer Paragraph 14.3 and 14.4); and,
- with no integral roof gardens.

Readers are advised to check the validity of this Appraisal by referring to the Valid Appraisals listing on the BRANZ website, or by contacting BRANZ.



000000



ARDEX WPM 750

Undertile Butynol®

Rubber Membrane Waterproofing System

DISCLAIMER The technical details, recommendations and other information contained in this data sheet are given in good faith and represent the best of our knowledge and experience at the time of printing. It is your responsibility to ensure that our products are used and handled correctly and in accordance with any applicable New Zealand Standard, our instructions and recommendations and only for the uses they are intended. We also reserve the right to update information without prior notice to you to reflect our ongoing research and development program. Country specific recommendations, depending on local standards, codes of practice, building regulations or industry guidelines, may effect specific installation recommendations. The supply of our products and services is also subject to certain terms, warranties and exclusions, which may have already been disclosed to you in prior dealings or are otherwise available to you on request. You should make yourself familiar with them.

Undertile Butynol® - Rubber Membrane Waterproofing System

UNDERTILE BUTYNOL® SPECIFICATION

Ardex WPM 750 (Undertile Butynol®) is made up of synthetic rubber with properties which resist ageing from heat, sunlight and ozone and is heat weldable. Polypropylene filaments are welded onto both sides of the membrane for better wetting by water based adhesives. It has excellent gas impermeability and toughness and remains flexible at low temperatures.

Laps and corners are to be heat formed and/or welded. Tiling can be done directly on the membrane after 60 minutes with common Ardex tiling adhesives like X77, X56 STS8/E90, Quickbond/Abalastic, 2 part Optima or ABAFLEX.

Undertile Butynol® is marketed by Ardex as a warranted undertile waterproofing product using solvent free adhesives and fixed by their trained and experienced approved Applicators.

UNDERTILE BUTYNOL® MATERIAL SPECIFICATIONS

Our requirements for long term warranty necessitate that the Undertile Butynol® meets these typical technical requirements:

Specific Gravity to ASTM D297	1.30±0.05
Hardness IRHD to ASTM D1415	65±5
Tensile Strength to ASTM D412	4.86 MPa min
Elongation at break to ASTM D412	300% min
Water Absorption to ASTM D471	1.65% (by mass)
(for 1mm Butynol®)	0.72% (by volume)
Water Permeability to ASTM E96-92	
Vapour Flow Resistance (for 1mm Butynol®)	12414 (MNs/g)
Vapour Flow Rate (for 1mm Butynol®)	0.013 (g/m ² d)

Note: Interesting comparable figures for water permeability are –

Polythene 156, Asphalt 1830, P.V.C. 4900

K Values on 1mm Butynol® sheeting

K Value (Thermal Conductivity): 7.4 x 10³ Cal/cm/sec/deg C

UNDERTILE BUTYNOL® GAUGES

Standard 0.5mm – For undertile waterproofing

RESISTANCE

Undertile Butynol® resists tearing, flex cracking, bubbling and abrasion. It is extremely strong, has a long life and is versatile.

PACKAGING

Rolls of nominal 1.4m x 20m long. Rolls are packed in polythene wrapper trademarked Undertile Butynol®.

SUBSTRATE SPECIFICATION

Plywood & Timber Substrates must be dry when Undertile Butynol® is applied. The plywood and timber substructure shall have a maximum moisture content of 20% when Undertile Butynol® is adhered.

NOTE: The use of LOSP (Light Organic Solvent Preservative) treated plywood must NOT be used under Undertile Butynol® in any circumstances or conditions.

OTHER SUBSTRATE TYPES

Fibre cement compressed sheet, closed cell polyurethane foam, wet wall linings i.e. Gib Aqualine, VillaBoard.

New Concrete

Must be cured for a minimum of 28 days and all curing compounds removed prior to application. A reduction in cure time can be achieved by utilising the Ardex HydrEpoxy System (consult Ardex Technical Department for details)

Old Concrete

Must be clean from any contaminants prior to application

ADHESIVES FOR USE WITH UNDERTILE BUTYNOL®

WPM 09A The standard contact brushing, spray grade and rolling solvent free adhesive for fixing to the substrate. Supplied in 20L plastic containers.

WPM 09C Catalyst to assist adhesion in adverse conditions.

DURABILITY

Undertile Butynol® when fixed according to Ardex instruction will meet the NZBC requirements of B2.3.1(b) 15 years.

Refer BRANZ Appraisal Certificate No 727 2011.

PRODUCT WARRANTY

When laid by an approved Applicator in accordance with Ardex's specifications, a material warranty for up to 20 years is available. Ardex is not responsible for any costs arising from installation of the Membrane and does not provide any warranty other than where a written Ardex material warranty has been issued.

WORKMANSHIP

A warranty for workmanship shall be provided directly by the approved Applicator. The period and terms of the workmanship warranty shall be determined by the conditions of the contract or the approved Applicator.

TYPICAL ARCHITECTURAL UNDERTILE BUTYNOL® SPECIFICATION

1. Preliminary

Refer to the Preliminary & General Clauses of this specification and to the General Conditions of Contract which are equally binding on all trades. This section of the specification shall be read in conjunction with all other sections.

2. Scope

This section of the contract consists in general of the provision and laying of the Undertile Butynol® in wet areas.

3. Workmanship

The whole of the work shall be carried out by skilled tradesmen using adequate and proper equipment and methods in accordance with best trade practice, and following the specifications, methods and recommendations as laid down by the manufacturers.

4. Sub-contractors

The work included in this section of the contract shall be carried out by a firm of waterproofing experts conversant with and specialising in the supply and fixing of this materials and shall be a firm approved by Ardex.

5. Warranty

When laid by an approved Applicator in accordance with Ardex's specifications, a written material warranty of up to 20 years is available. It is the responsibility of the approved Applicator to confirm proper installation and to request Ardex to issue a material warranty on behalf of the customers following completion of installation. Ardex is not responsible for any costs arising from installation and does not provide any warranty other than where a written Ardex material warranty has been issued.

6. Materials

6.1 Undertile Butynol® Membrane

Shall be 0.5mm thick Undertile Butynol® in all wet area surfaces, where membrane is to be overlaid with tiles.

6.2 Adhesives

Shall be recommended by Ardex specially formulated for Undertile Butynol® and suitable for the particular application and the relevant temperature and conditions applicable.

7. Laying of Undertile Butynol®

The Undertile Butynol® installer shall check the substrate before laying any membrane to ensure that the surface is completely sound, screw fixed to specifications: screw heads flush, sheets spaced to provide for thermal movement or shock.

8. Completion

On completion carefully and thoroughly clean off and remove all scraps and other rubbish from finished surfaces and leave in tidy order.

9. Extent of Work

Observe the foregoing specification and supply and lay Undertile Butynol® sheeting to all wet areas as shown and detailed in the drawing and in accordance with AS/NZS3740. Failure to comply with the above specifications will result in all warranties being null and void.

LAYING SPECIFICATION

The sub-contractor for the work called for in this trade will be a Company or Person approved by Ardex. The approved installer shall examine all drawings and provide for the surface to which Undertile Butynol® is to be fixed shall be clean, smooth, dry and free from sawdust, grit or sharp objects. Membrane laying shall not start until defects have been corrected. On completion the installer will provide the owner with a Workmanship Warranty and obtain from Ardex a Materials Warranty. Failure to comply with the above specifications will result in all warranties being null and void.

INSTALLATION

Roll out Undertile Butynol® and cut to the measured length. Smooth Undertile Butynol® on contact to minimise air entrapment beneath the membrane. Floor sheets of Undertile Butynol® must extend up the wall at least 150mm. Make sure the Undertile Butynol® is laid tightly into all corners. Wall sheets of Undertile Butynol® should overlap the 150mm upstand. Weld seams and laps with the Leister Triac S Hot Air Gun. Roll with a rubber roller to ensure seams and laps are secure.

Walls, internal corners & transitions

Apply the Undertile Butynol® membrane 1800mm up the walls or to a height of 150mm above the shower rose. For unenclosed showers the membrane must extend a minimum of 1500mm out from the shower rose.

PROTECTION

Undertile Butynol® is not suitable as a trafficable surface.

Undertile Butynol® is compatible with undertile heating systems. For electric undertile heating, the wire must be laid under the membrane.

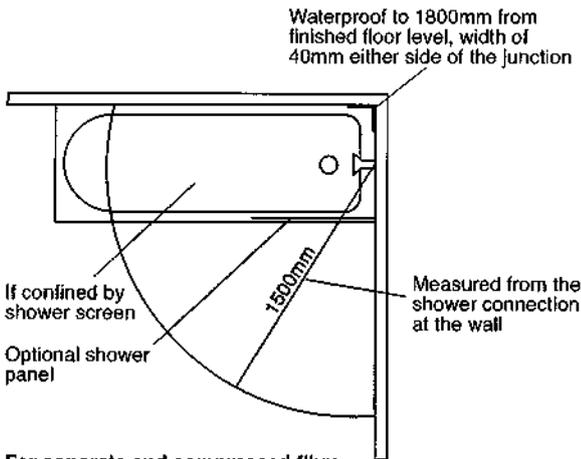
It is the responsibility of the main building contractor to ensure all sub-trades likely to be working in the vicinity of the membrane are aware that a waterproofing membrane has been installed and all care must be taken to protect the membrane from damage. The tiler must lay tiles in accordance with best practice guidelines.

UNDER TILE BUTYNOL® WATERPROOFING SYSTEM

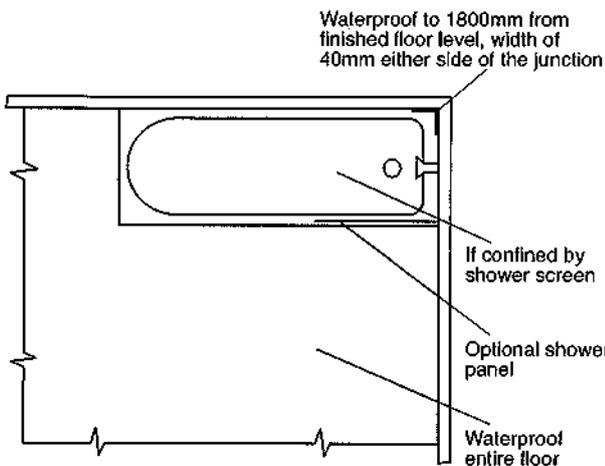
Undertile Butynol® - Rubber Membrane Waterproofing System

LAYING UNDERTILE BUTYNOL® IN BATHROOM WET AREAS in accordance with AS/NZS 3740

Extent of treatment of wet areas - shower area over bath - unenclosed shower

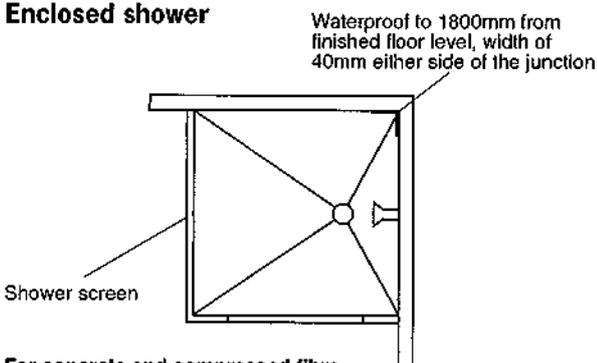


For concrete and compressed fibre cement sheet floors



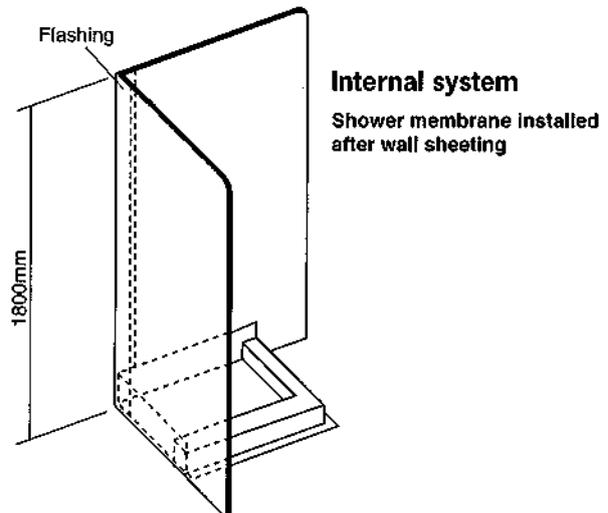
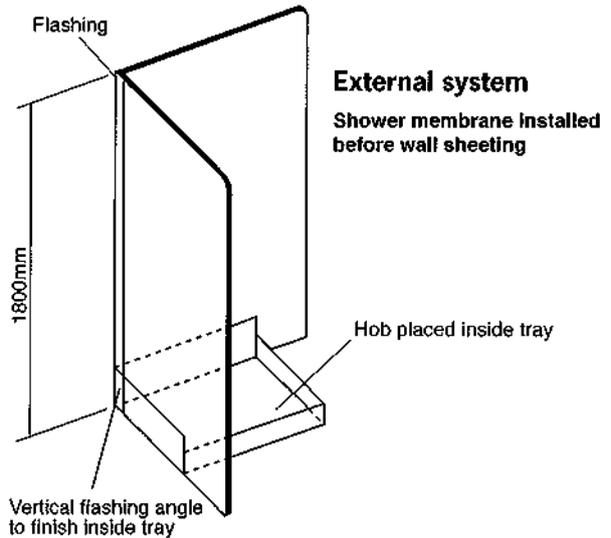
For timber floors including particleboard, plywood and other flooring materials apply Undertile Butynol® waterproofing membrane to entire floor

Enclosed shower

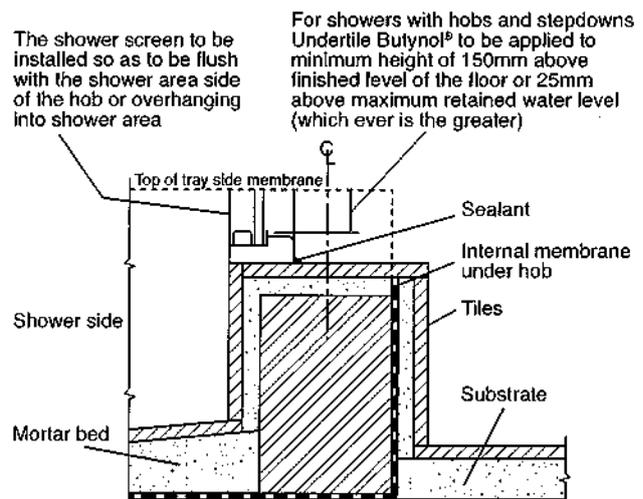


For concrete and compressed fibre cement sheet floors

TYPICAL SHOWER CONSTRUCTION



TYPICAL HOB CONSTRUCTION



Drainage Channel Installation Guidelines

We highly recommend reading through these instructions before starting installation of any of these systems. Please, contact us if you are unsure of any details.

Allproof Industries has a range of linear drainage channel systems that share the same fundamental installation method. This includes waterproofing (or tanking) the wet area on to the leak control flange first, then using the channel system to guide water into the waste.

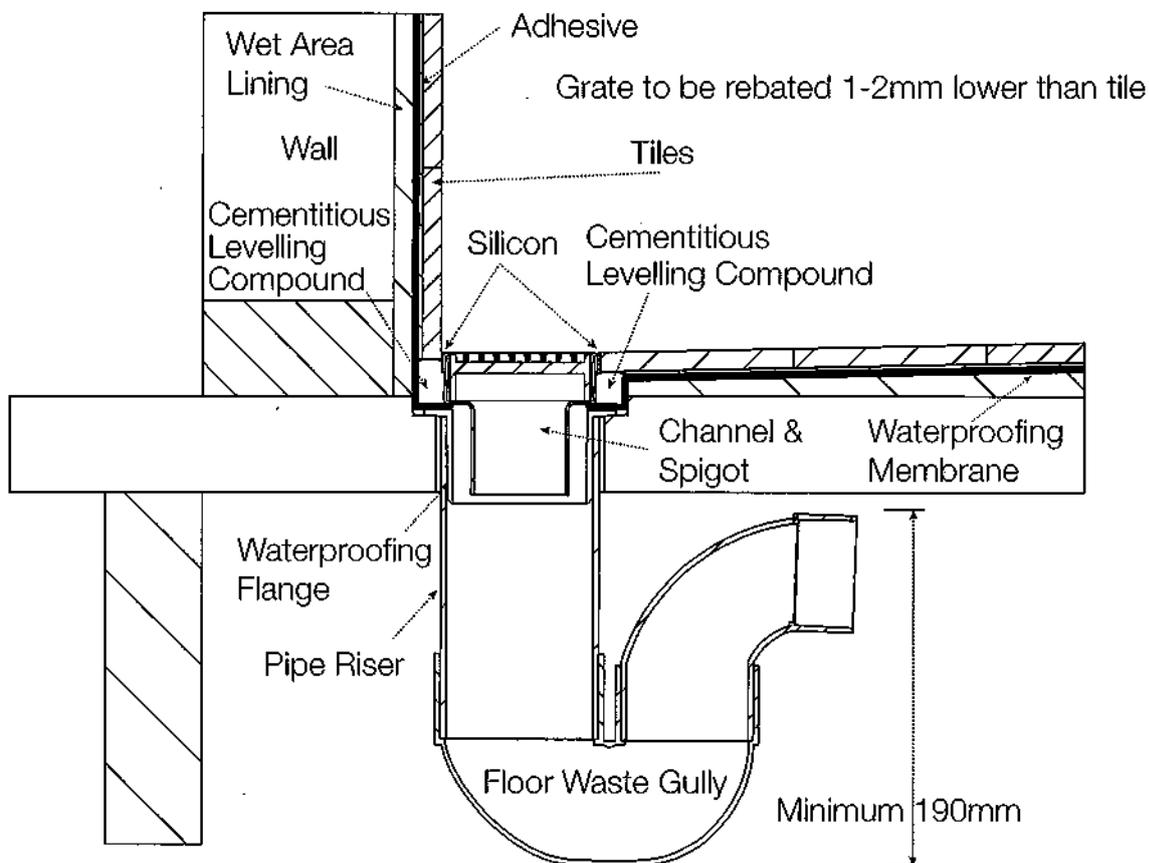
Allproof Industries linear shower channels have developed out of many years of knowledge of installing these channels, and provides the simplest, safest method of draining an indoor wet area.

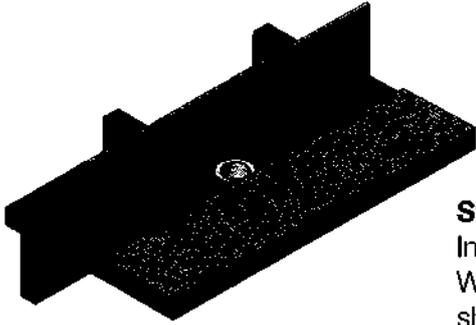
Key Points

- The preformed trench that the channel will sit in needs to allow for some movement, both lateral and vertical - this allows the channel to be raised or lowered relative to the final tile height.
- The waterproofing is dressed onto the leak control flange, not the channel itself, effectively tanking the entire wet area before the channel itself is installed.

Trench Requirements

For 38G and 65G Slimline channels the preformed trench should be made 100mm wide and a minimum of 35mm deep. For the 100G Slimline channel, the preformed trench should be made 135mm wide and a minimum of 10mm deep. For the Vision Series, the preformed trench should be made 100mm wide and a minimum of 15mm deep.





Step 1.

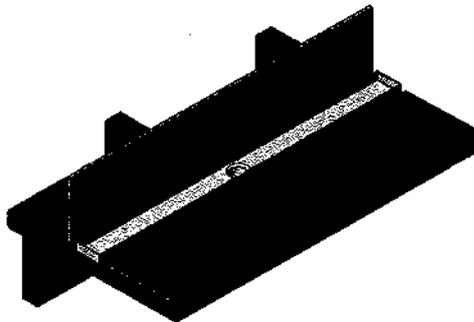
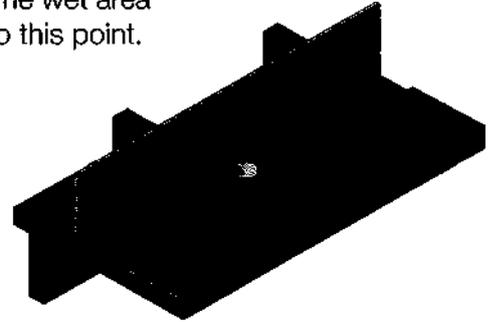
Create the trench that the channel system is going to be installed into. Refer to reverse of guidelines for recommended minimums.

Step 2.

Install Leak Control Flange in bottom of trench. Waterproof to Leak Control Flange. The wet area should now be completely 'tanked' to this point.

Step 3.

If using PVC channel, cut to required length allowing 5mm for stop ends and attach stop ends with clear solvent cement cut outlet and attach spigot to bottom of channel.

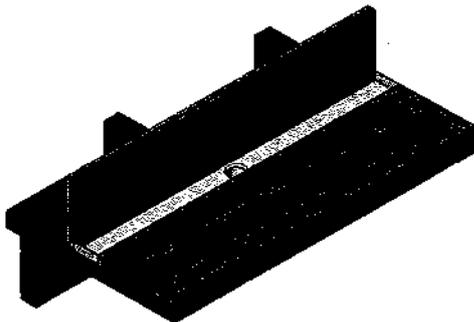
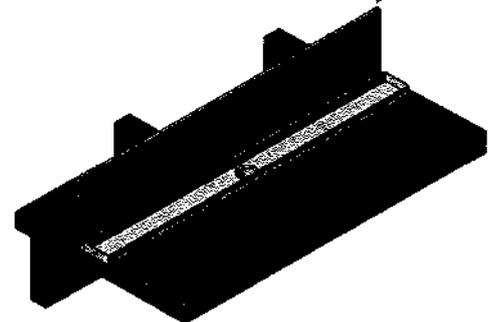


Step 4.

Sit channel into trench, using a cementitious levelling compound to achieve a level installation at the appropriate height. We recommend having PVC channel 1-2mm below the final height of the tiles or floor surface and stainless channel flush to the tiles.

Step 5.

Backfill the trench with a cementitious compound, taking care not to block the flow of sub-tile moisture to the leak control flange.

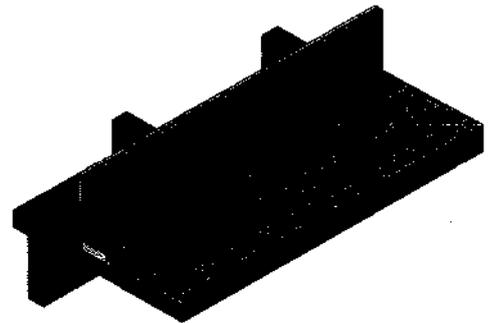


Step 6.

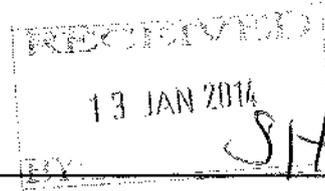
The floor can now be finished by tiling up to the channel, laying down a bead of silicone either alongside or on top of the channel - depending on the channel used.

Step 7.

If needed, the grate can now be cut down to size, using a 32 tooth hacksaw to cut by hand, or a metal cutting blade on a drop saw. Ensure cut is square. Gently file back rough edges for safety. Cut a couple of millimetres shorter than the channel to ensure easy removal for cleaning.



Contents



Introduction	5	
Installation: Roofing & Decks		000032
Roofing applications	10	
ecoROOF™ green roof system	18	
Deck applications	20	
Flashing Drawings	22	
Detail Drawings	24	
Maintenance	38	
Quality Control	39	
Installation: Tanking	47	
Detail Drawings	50	
Quality Control	54	

THIS PUBLICATION

This manual provides the technical information necessary to correctly specify the bituFLAME® system. It has also been designed for use by Waterproofing Systems Ltd (WPS) approved applicators, for training and quality management purposes.

This manual may also be used by main contractors and Building Consent Authorities (BCA's) for quality management and inspection purposes.

NOTE TO APPLICATORS

As an approved applicator you are required to fully comply with the contents of this manual. Where a specific situation arises on a particular project that makes it difficult for you to follow the published procedure or comply with a particular detail drawing, you are required to communicate this to WPS for an approved solution.

TRADEMARKS

bituFLAME®, bituBOND®, epiROOF®, duroQIK®, duroFIX® and duroTUF® are registered trademarks of Waterproofing Systems Ltd.

COPYRIGHT

Copyright © 2005-2008 Waterproofing Systems Ltd. All rights reserved. No part of this publication may be copied, reproduced by any means, or amended in any way without prior written permission from Waterproofing Systems Ltd.

FOR FURTHER INFORMATION, CONTACT:

Waterproofing Systems Ltd
PO Box 1113
Palmerston North
Phone: 06 357 9148
Fax: 06 357 9410
Web: www.waterproofing.co.nz

USING THE ICONS

Four different visual icons have been created for this manual to draw the reader's attention to important pieces of information.



1. QUALITY CONTROL ICON

Information about warranties, quality control checks and related information.



2. USEFUL TIPS ICON

Helpful advice to make the applicator's job easier and successful installation more likely.



3. CRITICAL ICON

Vital information about job specifications and installation methodology. It is crucial that the applicator is aware of these facts.



4. HEALTH & SAFETY ICON

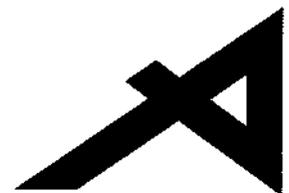
Information about the importance of safety checks and ensuring that the work environment is always safe with potential hazards identified and minimised.

BRANZ APPRAISED

The bituFLAME® system has been BRANZ appraised as an Alternative Solution in terms of New Zealand Building Code compliance.

Please contact Waterproofing Systems Ltd for a copy of this BRANZ Appraisal Certificate.

You can also download the certificate on our website www.waterproofing.co.nz



BRANZ Appraised
Appraisal No.404 [2008]

Introduction

PRODUCT DESCRIPTION

The bituFLAME® membrane system is comprised of a full range of torch-on membranes used in a wide range of waterproofing applications, including roofing, below ground tanking, planterboxes and green roof systems.

The bituFLAME® system may be fully-torched, mechanically-fixed or cold-applied using a bitumen adhesive, depending on the specific requirements of the project.

WHY BITUFLAME®

bituFLAME® has many outstanding product features, making it the ultimate choice when selecting torch-on products. Its superior qualities of tensile strength, puncture and tear resistance sets bituFLAME® apart as the ideal durable solution for your waterproofing requirements.

IN PARTICULAR, BITUFLAME®...

- Has high tensile strength and tear resistance.
- Has excellent puncture resistance.
- Is BRANZ Appraised.

AREAS OF USE

The bituFLAME® membrane system is used in a variety of waterproofing applications including;

- Flat roofs and gutters
- Below ground tanking
- Decks and balconies (protected)
- Podiums
- Watertanks
- Retaining walls and planters
- Roof gardens and ballast roofs

PRODUCT LIMITATIONS

TRAFFICABLE DECKS

bituFLAME® is not designed for use as an exposed trafficable membrane. The duroTUF® trafficable deck membrane, or 1.5mm epiROOF® EPDM membrane should be used in these situations.

TILED APPLICATIONS

Tiling directly onto torch-on membranes is not recommended. A concrete screed should be installed over the bituFLAME® membrane first. Alternatively, a loose-laid timber decking or paver system can be installed using the Eterno paver stands.

PLYWOOD ROOFS

A fully-torched single-layer system should not be used on plywood substrates, as peaking across plywood joints will occur. We recommend our two-layer bituFLAME® system, or our epiROOF® EPDM membrane in these applications.

bituFLAME® MATERIAL OPERATIONAL DATA (TYPICAL VALUES)

Flow Resistance	140°C
Tensile Strength Longitudinal Transverse	800 N/5cm 750 N/5cm
Elongation (%) Longitudinal Transverse	45% 45%
Lap Joint Strength (N/5cm)	20N
Tear Resistance (N) Longitudinal Transverse	150 N 150 N
Puncture Resistance (N) Static Indentation (at 25kg) Dynamic Indentation (at 25kg)	20 kg 15mm
Watertightness	≥ 60 kpa

MEMBRANE GROUP OF NEW ZEALAND INC.

Waterproofing Systems is a foundation member of the Membrane Group of New Zealand and has played an active role in the development of the Code of Practice for Torch-On Membranes.

This product manual complies fully with this code of practice.



In roof applications with numerous penetrations and lots of complex detailing (such as in curved roof lines), consider using duroTUF® acrylic membrane as an alternative to the bituFLAME® torch-on system. In doing so however, ponding must not be present.

Introduction

DURABILITY

ROOFING APPLICATIONS

When fixed according to specification, the bituFLAME® system will meet the NZBC B2.3.1(b) requirements, being durable for 15 years.

The durability opinion given by BRANZ for the bituFLAME® system states that when subjected to normal conditions of environment and use, the system is expected to have a service life of at least 15 years.

TANKING APPLICATIONS

When fixed according to specification, the bituFLAME® system will meet the NZBC B2.3.1(a) requirements of 50 year durability.

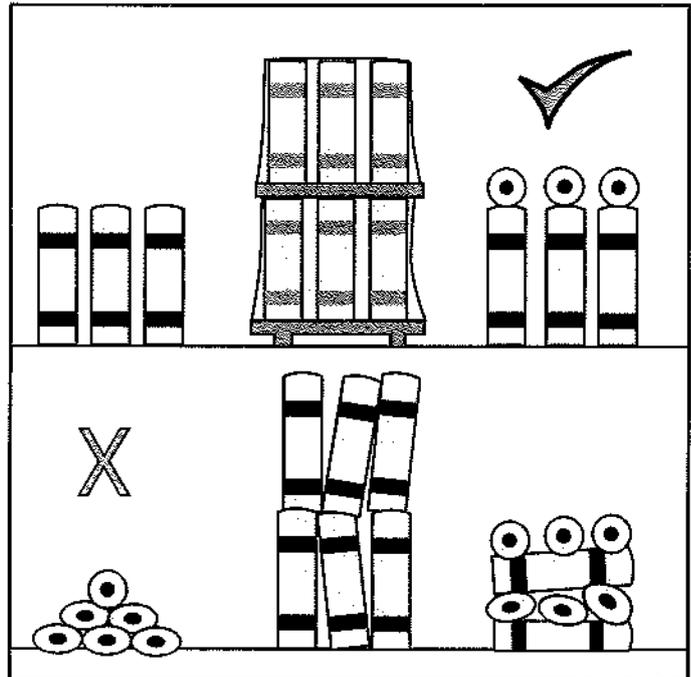
PLEASE ALSO REFER TO:

- BRANZ Bulletin No. 345 "Flat Membrane Roofs - Design and Installation" published June 1996.
- BRANZ Bulletin No. 397 "Waterproofing Basements" published 2000.
- BRANZ Appraisal Cert. 404 (2005) bituFLAME® Roof Membrane Systems.
- Department of Building and Housing Acceptable Solution E2/AS1, Third Edition dated July 2005.
- Torch-on Membrane Code of Practice, published October 2008 by the Membrane Group of New Zealand Inc.

STORAGE

Store all rolls vertically on ends on a flat surface in a dry ventilated area. For best results, rolls should not be laid flat until ready for installation. Rolls should not be stored in direct sunlight as overheating can affect the membrane. Similarly, rolls should be stored above 10°C for 48 hours before laying.

Ensure that rolls are not crushed by incorrect storage and transportation.



WEATHER

The bituFLAME® system can only be applied in dry conditions. Note that a temperature of at least 6°C is required before laying the membrane and the substrate must have a maximum moisture content of no more than 20% at the time of laying.

MATERIAL ACCEPTANCE

Ensure that the bituFLAME® rolls, primers and accessories are correct in quantity, colour and are received in good condition. Only sign the consignment note when satisfied.

HEALTH & SAFETY

The primers and aluminum UV coatings used in the bituFLAME® system are Class 3 flammable goods. Contractors should be aware of the Health & Safety precautions identified in the Material Safety Data Sheets.

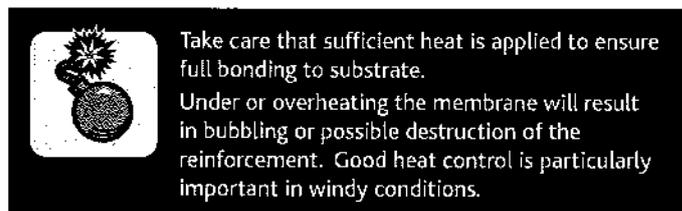
Ensure you display appropriate signage, as shown below.

Keep well away from flame and heat sources and use only in ventilated areas with suitable safety equipment.



DANGER OF FIRE - GAS TORCHES/GAS BOTTLES

- Identify the presence of particularly flammable items such as building paper.
- Display suitable "no smoking" signs.
- Have a minimum number of gas bottles on the roof at one time.
- Keep all gas bottles at least 6m from flames, and store upright and away from pedestrian walkways or vehicle access areas.
- Guard cylinders from being knocked or from falling.
- Have fire extinguishers readily available at all times.
- Turn torches and gas bottles off when not in use and release the LPG pressure from the supply hoses.
- Have the gas bottle and connections checked regularly and make sure that the valves are turned off when moving a cylinder.
- Keep full and empty cylinders separate.
- Never use force when opening or closing valves.
- Know where the nearest fire hose is located.
- Gas bottles should be fitted with a regulator or anti-flashback device.



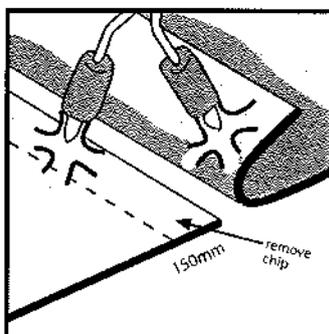
FORMING LAPS

On plain-finished membranes all laps must be bonded the full width of the lap and then seamed off. To do this, run a hot trowel or torch down the face-edge of the lap, to ensure a bead of molten bitumen forms a fillet in the lap area.

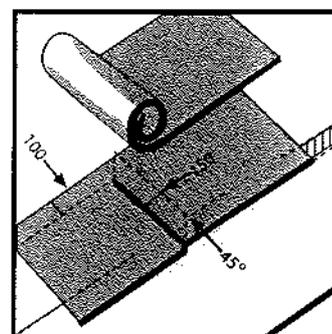
With granule-finished membranes, ensure a small bead of bitumen forms at the side lap edge, but don't over seam. This gives a better visual finish. Use the selvedge as a guide to form the side laps. When forming the end laps, heat the top of the membrane 150mm wide and remove the granules, to give bitumen-to-bitumen contact in the end lap area.

Where laps coincide giving a build up of three or more layers, cut the outside edge of the lower membrane layers at a 45° angle. This gives a better visual finish.

Ensure all laps are fully torched their full width; 100mm (side laps) or 150mm (end laps).



Forming end laps



Unsightly lap build up

HEAT CONTROL

Good heat control is essential for effectively bonding the membrane to the substrate, and forming laps. Factors such as wind and membrane thickness determine the amount of heat required to form an adequate bond.

When torching down, heat both the substrate and the membrane. In particular, ensure sufficient heat is applied to the roll to burn off the PE film and create a constant small bead of bitumen at the base of the roll. Install the membrane sheet to the substrate first and then form the lap separately. This enables you to focus on ensuring that you have full lap integrity, and gives better heat control.

Introduction

SINGLE OR TWO-LAYER SYSTEMS?

Long term performance and durability are our over-riding goals, therefore we strongly recommend two-layer systems be installed wherever possible.

In roofing applications, fully-torched single-layer systems may only be used on cast in-situ concrete substrates that are cast over profiled metal or permanent formwork. In all other applications a two-layer system is required.

In below ground tanking applications, a two-layer system is also strongly recommended as it provides greater protection against mechanical damage by steel fixers, and other trades.

By definition, a two-layer system must comprise two waterproofing layers of membrane. For this reason a base sheet that is mechanically fixed, or a vented base sheet with its perforations, is not considered a layer.



When using multi-layer systems, it is important that each layer is fully bonded to each other to prevent the likelihood of water being able to track between the layers.

RELAXING ROLLS

Unroll the material and leave to relax for at least 30 mins. In cooler conditions it may take some time for the material to relax adequately. If not relaxed properly, the rolls may wrinkle badly or shrink after laying, popping the laps.

In cool conditions, take care not to bang the rolls or handle them roughly. Unroll with care, as the material is inclined to be quite stiff in cold conditions.

In order to adequately relax the rolls in very cold, icy conditions the rolls may need to be stored and relaxed in a heated room.

At this point, inspect the roll carefully to ensure that there are no defects and that the material is suitable to install.

TOOLS REQUIRED

- LPG torch handle with accelerator and idle burner.
- Short stem tube (300mm) with a 20mm head.
- Long stem tube (750mm) with a 50mm head.
- Gas bottle (9.0kg bottle is ideal for carrying onto roofs etc) and 20m approved hose complete with regulator.
- LPG flint lighter.
- Stanley knife.
- Pointing trowel.
- Chalk line.
- Measuring tape.
- Leather gloves.
- Paint roller, tray and 4 inch brush.
- Kerosene for clean up.
- Fire extinguisher.
- Substrate moisture metre.

The short stem tube with the 20mm burner head needs to be set up to be interchangeable with the long stem fitting. The short stem burner is used for detailing work and the long stem burner is used for laying the rolls of membrane. Roofers must wear flat-soled shoes to reduce possible footprints on the membrane.



Always have a fire extinguisher on each roof area you are working on. Locate the nearest fire hose if one is available. Identify any particular fire hazards such as building paper.

Roofing & Deck applications

Introduction

PRODUCT OVERVIEW

BITUPRIME PRIMER

A solvent-based, bituminous primer designed to penetrate concrete or ply surfaces and provide a bondable surface. Supplied in 20ltr metal pails.

BITUBOND® ADHESIVE

A water-based bitumen adhesive used for glue-fixing torch-on membranes to gutters, parapets and other tricky detailing areas. It is also used to fix single-layer bituFLAME® systems. Supplied in a 20ltr plastic pail.

BITUFLAME® BASE SHEET

An APP-modified bitumen membrane with a glassfibre mat reinforcement. bituFLAME® BS has a thin torch-off polyethylene film or polyester mat on the underside, and polyethylene film on the top surface. bituFLAME® BS is used as the base sheet in two-layer systems or as the underflashing membrane.

A variety of bituFLAME® BS base sheets are available as outlined in table 1 below.

BITUFLAME® CAP SHEET

An APP-modified bitumen membrane with a 180gm/m² spunbond composite polyester reinforcement. bituFLAME® CS has a thin torch-off polyethylene film on the under side, and polypropylene mat or mineral chip finish on the top surface.

A variety of bituFLAME® CS cap sheets are available as outlined in table 1 below.

PLURA R RE-ROOF MEMBRANE

A specifically designed re-roof membrane compatible with SBS and APP modified bitumen membranes. Plura comprises a low viscosity bitumen, enabling it to be used directly over old granule-finished torch-on membranes.

Available in 1m x 8m rolls in mineral finish.

ALUGARD UV COATING

A fortified liquid membrane containing polished aluminium flakes. It is applied to bituFLAME® CS MAT as a UV coating. Supplied in a 20ltr metal pail.

SUNGARD UV COATING

A non-fibred aluminium paint to protect bituFLAME® CS MAT from the effects of UV. Supplied in a 20ltr metal pail.

DUROTUF® UV COATING

An acrylic membrane used as a UV coating for bituFLAME® CS MAT where a specific colour finish is required.

It is important that light colours only are used. Colours with a light reflective value (LRV) of less than 40, should not be used as the substrate will draw too much heat and cause substrate movement.

Water must not be allowed to pond on the surface of any duroTUF® coating.

TABLE 1: OVERVIEW OF THE BITUFLAME® TORCH-ON MEMBRANES

Base-sheets	bituFLAME® BS		bituFLAME® BS Mat	bituFLAME® VBS
Description	Standard base-sheet used in fully torched applications		Base-sheet used in cold applied applications using bituBOND®	Perforated base-sheet for vented applications - 119 holes/m ²
Finish	PE film on both sides		Polypropylene fleece on the underside with PE film on the top surface	PE film on both sides
Nominal thickness	2mm	3mm	2mm	0.74kg/ m ²
Nominal roll size	1m x 15m	1m x 10m	1m x 15m	1m x 30m

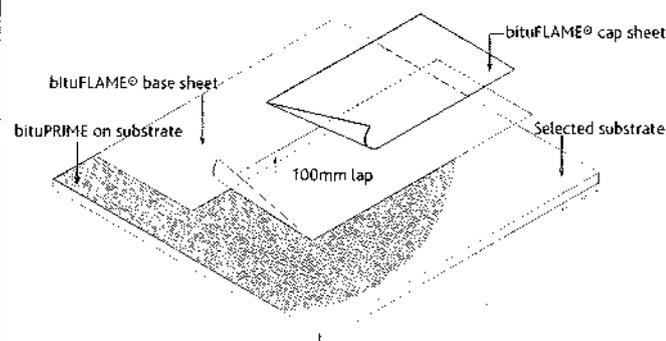
Cap-sheets	bituFLAME® CS	bituFLAME® CS MAT	bituFLAME® T
Description	Standard polyester reinforced cap-sheet	Cap-sheet used when coating with aluminium or acrylic coat	Cap-sheet in covered applications
Finish	Mineral chip	Polypropylene mat	PE film
Nominal thickness	4mm (4.5kg/m ²)	4mm	3mm
Nominal roll size	1m x 10m	1m x 10m	1m x 10m
Colour	white, green, black, terracotta	N/A	N/A

ROOFING SYSTEMS AVAILABLE

Four primary bituFLAME® roofing installation options are available as follows; depending on the specific requirements of the project.

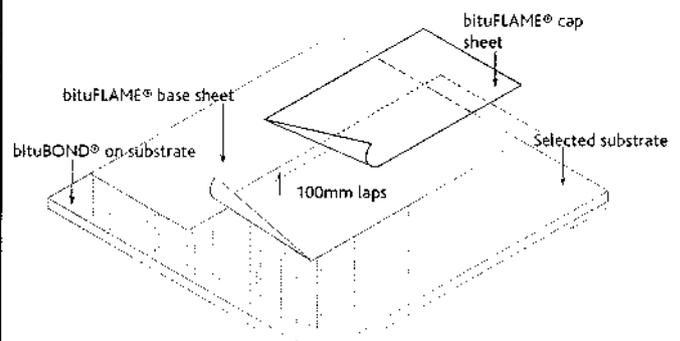
FULLY TORCHED

This is the most common installation method and is used under normal circumstances. The bituFLAME® BS base sheet is fully torched to the preferred substrate.



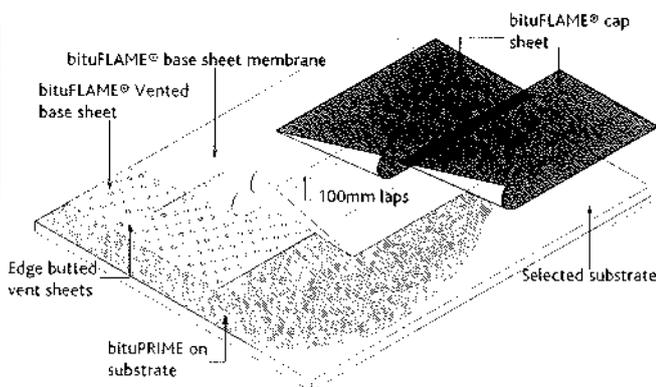
COLD APPLIED SYSTEM

In this system, the bituFLAME® BS MAT, fleece-backed base sheet is glue fixed to the substrate using the bituBOND® adhesive. This system is used where it would be inappropriate to use a gas torch.



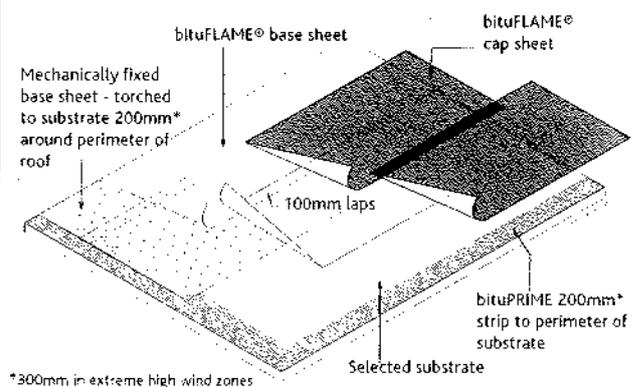
VENTED SYSTEM

The vented system uses the bituFLAME® VBS vented base sheet and is normally used where moisture may be present in the substrate. This moisture is able to move under the bituFLAME® system to a roof vent. Since the vented base sheet, with its perforations, has no waterproofing function, it is not counted as a membrane layer in two-layer applications.



MECHANICALLY FIXED SYSTEM

A mechanically-fixed system is usually used in repair applications, where an existing membrane system is present. The bituFLAME® BS base sheet is mechanically fixed using annular groove nails and washers at specified spacings. Because the base-sheet is mechanically fixed it has no waterproofing function, so does not count as a waterproofing layer in two-layer applications.



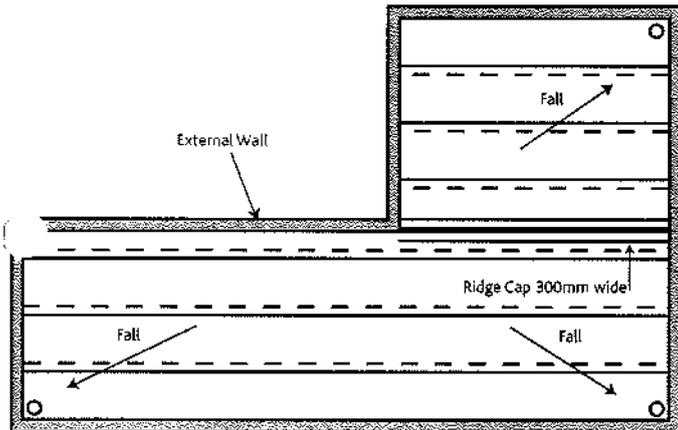
*300mm in extreme high wind zones

Introduction

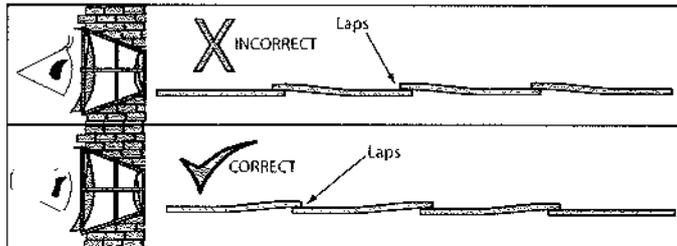
PLANNING THE INSTALLATION

Before commencing the installation it is important to plan the lay out of the membrane to ensure it meets this specification, while at the same time being visually appealing and minimising wastage. This is particularly important where the visual appearance of the roof is paramount.

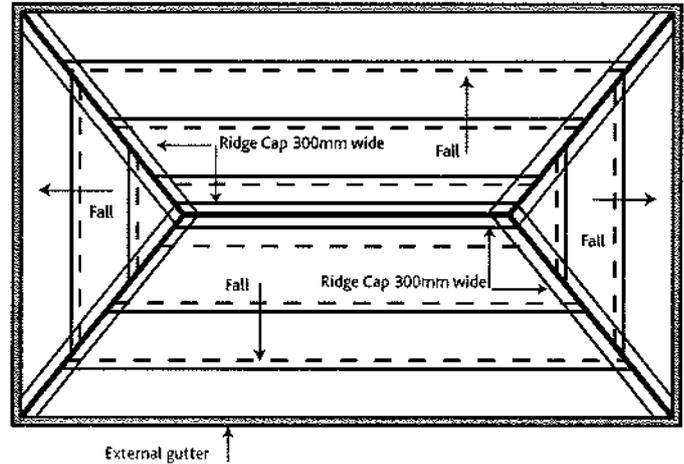
The laps must lay perpendicular to the roof slope to ensure water sheds over the laps to the outlet.



Where possible the laps must face away from any view from within the building (eg in a split level home where occupants look out onto another roof area). This gives a much neater and seamless impression to the roof.



In hip roof designs, once the membrane system has been installed, membrane "ridge caps" are used to enhance the visual look of the roof.



Ridge caps are installed when roof membrane work is complete. Centre the ridge cap 150mm either side of the apex of the roof from the lower ridges to the highest point. This ensures water sheds over the laps.



It is important to plan the roof layout before commencing. Failure to do so could result in a job that fails to meet this specification (eg laps running the wrong way) and looks visually poor.

Installation

SUBSTRATE REQUIREMENTS

CONCRETE SUBSTRATE SHOULD BE:

- Smooth, clean, thoroughly dry and fully cured.
- Firm with all soft areas ground off and all cracks or imperfections fixed using repair mortar.
- Fitted with mortar fillets to all roof-to-wall edges. Fillets should be a minimum of 20mm.
- All external edges chamfered to 5mm to remove sharp edges.
- Smooth-surface finish to be either U2 wood float or U3 steel trowel to NZS 3114. Steel floated finishes may require captive blasting, etching or grinding to permit penetration of bituPRIME.
- Free of any curing agents. Any curing agents used must be removed by an abrasion method. Failure to adequately remove them can result in adhesion failure.

PLYWOOD SUBSTRATE SHOULD BE:

- Construction grade plywood (minimum C plugged face).
- CCA treated H3.2 grade plywood and complying with AS/NZS2269 (Do not use LOSP treated.) A minimum of 17mm thick for roofs and 20mm for decks.
- Laid tight-butted in a staggered pattern (offset all plywood sheets) with all edges supported with solid timber battens.
- Laid with the face grain at right angles to supports or cross members.
- Set to minimum falls of 1.5° slope (1:40) for roofs.
- Set to minimum falls of 1.0° slope (1:60) for decks.
- Set to minimum falls of 0.5° slope (1:100) for gutters.
- Fixed at 150mm centres at sheet edges and 200mm in the girth.
- Fixed with grade 316 corrosion-resistant stainless steel countersunk screws, 10 gauge with a length three times the plywood thickness.
- Smooth, clean and dry (maximum moisture content 20%), and all lip edges sanded if necessary.
- Fitted with timber fillets to all roof-to-wall edges, with external corners chamfered to a rounded edge (5mm radius). Fillets should be a minimum of 20mm x 20mm.
- Fixed using galvanised steel tek-type fasteners on steel purlins, where H1 treated plywood is used.

LAYING OVER OLD BITUMINOUS ROOFS:

The Plura R bitumen membrane gives a single application repair system to bituminous roofs needing repair.

Contact the office for specifications covering preparation of old bitumen roofs, before installing the Plura R membrane.

PRIMING

Prime the substrate with bituPRIME at a rate of 0.2-0.3 ltr/m², ensuring good even coverage.

Allow reasonable time for the primer to dry (4-5 hours), otherwise adhesion problems may occur.

You may have to re-prime substrates if there is a delay in installing the membrane. These delays increase the likelihood of adhesion problems due to contamination.

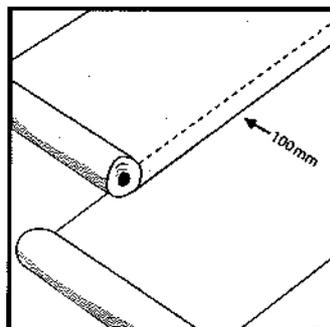


bituPRIME is flammable and must be stored, transported and used with care. Refer to the Material Safety Data Sheet for further information.

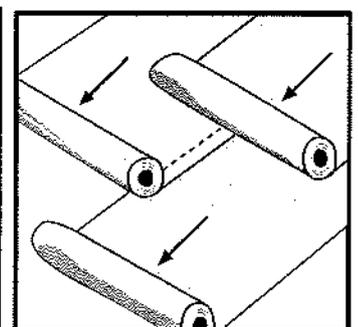
LAYING PATTERN

Start from the lowest point on the roof (i.e. at valleys, water outlets or gutters) and lay the membrane across the roof fall, working up to the highest point. This will ensure that water runs over the laps rather than down or into the lap edge.

Strike a chalk line, along the sheet to be overlapped, to mark the 100mm side lap. Set out subsequent rolls to that mark and continue, ensuring 150mm end laps are allowed for. Ensure that the bituFLAME® cap sheets are fully offset to the base-sheet.



All side laps to be 100mm



Cap sheet offset from the base sheet



DO NOT commence laying membrane until you are totally satisfied that the substrate is up to standard. Once you commence installation, **YOU** accept responsibility for the substrate you are working on!



Check from time to time, that the membrane is running parallel by striking a chalk line from fixed points.

Installation

UNDER-FLASHING

Detail Drawings: Page 22

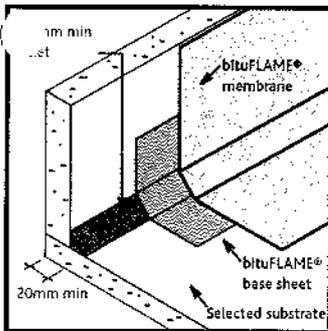
Use standard timber or sand cement mortar fillets (as described on the previous page) at all upstands.

In single-layer systems, underflash all internal and external corners, penetrations and all upstands (for the full length of the fillet).

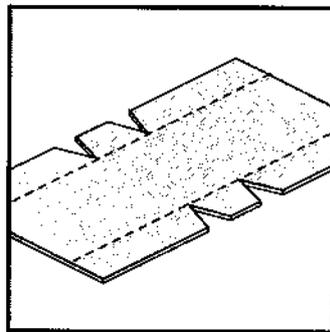
In two-layer systems install a bituFLAME® BS underflashing membrane at all corners and penetrations.

Fully torch the flashing membrane 100mm on the horizontal onto the fillet and 100mm up the vertical.

Use the cutting pattern below to form the corner gussets.



Single-layer underflashing



Internal Corner Cutting pattern



Use timber fillets on plywood substrates, and sand cement fillets on concrete substrates.



Once the gutter width exceeds 700mm, there is no alternative but to install the membrane across the gutter rather than down its length.

INSTALLING GUTTERS

Detail Drawings: Page 24

Ensure that the gutter is swept clean and is dry. Apply bituPRIME primer (if torching gutters) or bituBOND® (if glue-fixing gutters) to the substrate. Underflash all changes of direction with bituFLAME® BS (refer to previous section).

Calculate the length of the gutter (including the two end upstands), and the girth (including the two side upstands). Use a relaxed roll and cut to this size.

Mark out the end and side upstands and fold along the dotted lines shown in the diagram (1) below. Form creases along these lines in the material.

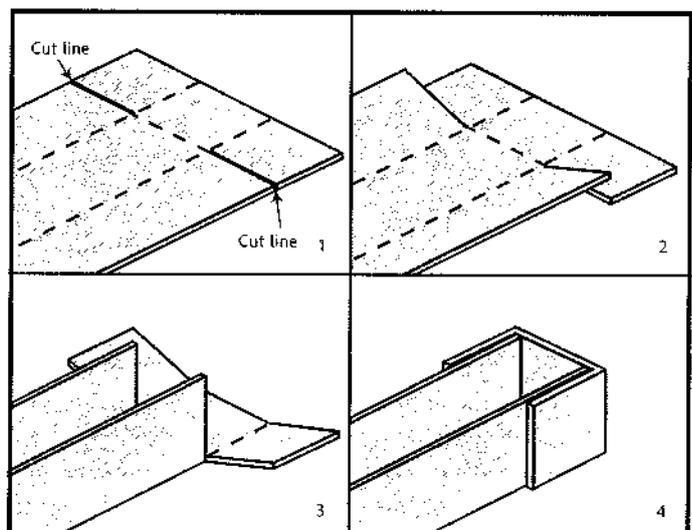
Open out and cut the membrane at the cut lines shown (1). Fold up the side upstand material (2). Fold up the end upstand material (3) and fold the cut flap material outside the side upstands (4).

Place the folded membrane into the gutter. If torching, roll up the membrane to half way. Slowly unroll and using the small torch head, torch to the primed base of the gutter ensuring you do not overheat the membrane.

Unfold the end upstands and torch to substrate. Then unfold the cut flaps and torch to the substrate. Once the end upstand is in place, unfold the side upstands and torch to the substrate.

Alternatively, if glue-fixing, apply bituBOND® to the gutter base (refer page 15). Turn the folded membrane upside down and burn the polyethylene film off the membrane. Place the folded membrane into the adhesive.

Apply bituBOND® to the sides and ends of the gutter. Burn the polyethylene film off the back of the membrane and place into the adhesive.



Installing gutters

TORCHING DOWN MEMBRANE

Prepare and install the underflashing membrane as described on page 14.

After relaxing the rolls, position the membrane to be installed and roll back up half way. Roll out this portion of the roll and as you do so, slowly move the torch across the back of the roll.

Burn off the polyethylene film and create a small bead of molten bitumen that rolls along with the roll. Once this half is installed, repeat with the opposite half. Once the roll is installed, go back over and seamweld all laps.

Ensure rolls run straight and that the 100mm side lap is maintained.

When torching the granule chip finish, take care not to burn the chip coating and minimise the amount of bitumen that oozes out the side lap. This will ensure a good visual finish.



Use soapy water to wet the chip along the selvedge to stop the chip from burning.

MECHANICALLY-FIXED SYSTEMS

Prepare and install the underflashing membrane as described on page 14. Prime and fully torch the base-sheet 200mm around the roof perimeter. Fix the remaining base-sheet by nailing to an unprimed substrate at 300mm centres.

When nailing to construction plywood, use 25mm x 2.8mm annular groove nails and a minimum of 25mm washers. Ensure good coverage of the nail head over the washers, and take care not to 'cup' the washer which may damage the cap-sheet.

When nailing onto lightweight foam concrete screed, use only split-shank fasteners or equivalent, with electro zinc galvanised shanks for spreading out when driven, to provide back-out resistance.

Install a further bituFLAME® base-sheet layer and cap-sheet in the normal manner.

HIGH WIND LOAD AREAS

Fully torch the base sheet 200mm around the roof perimeter. Increase the fixings to one every 200 centres. Contact WPS for more specific fixing instructions for very high wind loads, especially where the wind speed calculations are considered extreme.



DO NOT install the cap sheet onto the base sheet using the cold applied process as the adhesive will not cure.

VENTED SYSTEMS

Lay out the bituFLAME® VBS vented base sheet without any allowance for side laps or end laps. Fully torch the bituFLAME® BS base-sheet over the vented base-sheet in the normal way. Install the cap-sheet.

ADHESIVE-FIXING MEMBRANES

Installing the torch-on membrane using a cold-applied bitumen adhesive is an alternative to fully torching the membrane.

Adhesive-fixing the tricky details is quicker, easier and gives a much neater finish. We recommend that parapets and gutters be adhesive-fixed. Have the membrane to be installed turned upside down and handy. Apply bituBOND® to the substrate at a rate of 3m²/l, ensuring a good, even coverage. On the membrane to be glued, lightly torch the back to remove the polyethylene foil and make the bitumen soft and tacky. Do not heat too much. Without delay place the membrane onto the adhesive and dress into place. Torch and seam-weld any laps. Refer also to the section on installing gutters (Page 14).

We also recommend that single-layer roofing systems be adhesive-fixed rather than torch-applied. When glue-fixing the roof membrane, apply bituBOND® to the substrate and allow to dry. Place the roll of membrane to be installed into position and slowly roll out. While doing so, burn the polyethylene film off the back of the membrane and activate the bitumen. Do not over heat.

ADHESIVE-FIXING DO'S AND DON'TS

While bituBOND® adhesive-fixing is quick, neat and time saving, there are a number of situations to be aware of;

- On metal and other non porous substrates, allow the adhesive to fully cure before installing the membrane. Reactivate the adhesive by lightly torching it just prior to placing membrane on top.
- With colour steel finishing trims, clean the surface to be coated with bituBOND® with methylated spirits prior to the application. If this is not done, delamination of the membrane could take place.
- bituBOND® will generally skin within five hours and at this point may stand a shower of rain. However if bituBOND® is caught in rainfall while in wet form, it will wash out and it is possible a rusty coloured water stain may contaminate other surfaces.
- When using bituBOND® on substrates other than concrete or plywood, please contact WPS for advice.



DO NOT apply the adhesive too thickly, or when too hot, as skinning of the surface will effect its performance.

Installation

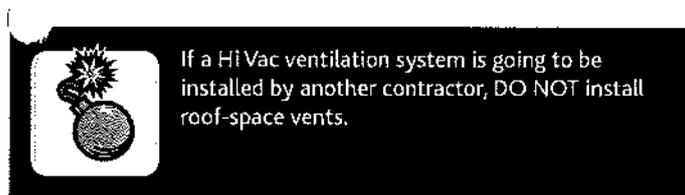
ROOF SPACE & MOISTURE VENTING

Detail Drawings: Page 29, 34

WHY VENT?

When working on substrates where moisture is present, it is vital to vent under the membrane. Failure to do so will allow the entrapped moisture to expand under the membrane causing bubbling. When moisture venting, the bituFLAME® vented base sheet must be used, prior to installing the base-sheet and cap-sheet.

Roof-space venting of confined skillion type roofs creates air flow and equalises roof-space pressure. Roof space venting minimises temperature variations across the roof and so reduces substrate movement due to thermal expansion and contraction.



INSTALLING VENTS

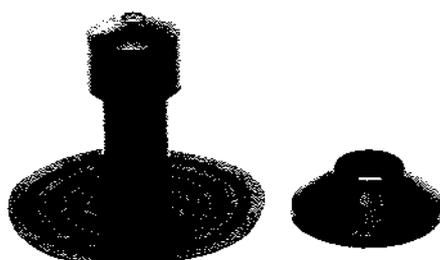
A minimum of two vents are required in each roof area to be vented. Vents should be installed for every 50m² of roof area.

When moisture venting, layout the bituFLAME® VBS vented base sheet. Locate the roof vent and fix into place with stainless steel screws. When fixing to concrete, fix using a nail gun.

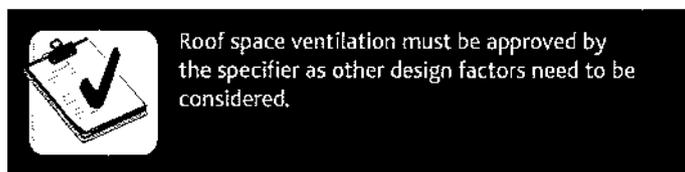
When roof-space venting the vented base sheet may not be required. Cut a 20mm hole through the substrate before fixing the vent.

Fix the vent by installing the bituFLAME® base-sheet up the vent flange and neatly around the shaft of the vent.

Install the cap-sheet in a similar manner. Overflash around the upstand using the bituFLAME® cap-sheet.



Roof Vent & Collar



ROOF DRAINS, SUMPS AND OVERFLOWS

Detail Drawings: Page 27-29, 33-34

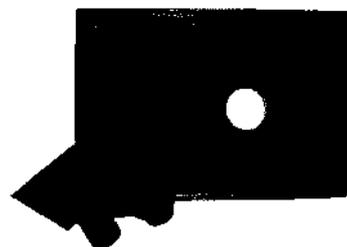
Ensure that there is a 6mm recess formed to fit the diameter of the Eterno rainwater outlet flange and also ensure that the drain outlet has been formed. Make sure this is primed.

Cut out a flashing membrane to fit the recess and torch or glue-fix into place. Carefully cut out the membrane over the outlet hole and seam around the edge. Heat the surface of the flashing membrane to create molten bitumen. Fit outlet into place by pushing it into molten bitumen.

Install the membrane in the normal way. Cut out the exit hole and seam-weld around outlet edge using a pointing trowel.



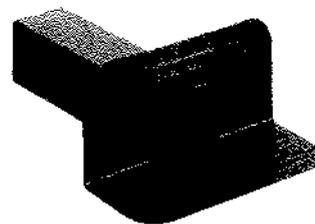
Roof Drain



Rainwater Sump



Ring Clamp



Scupper Overflow

TERMINATION

Detail Drawings: Page 25-26, 32

It is important that the membrane terminations are detailed correctly so water cannot track behind the membrane.

The bituFLAME® membrane can be terminated into a chase, behind a wall cladding system, under a cap flashing or with a compression flashing.

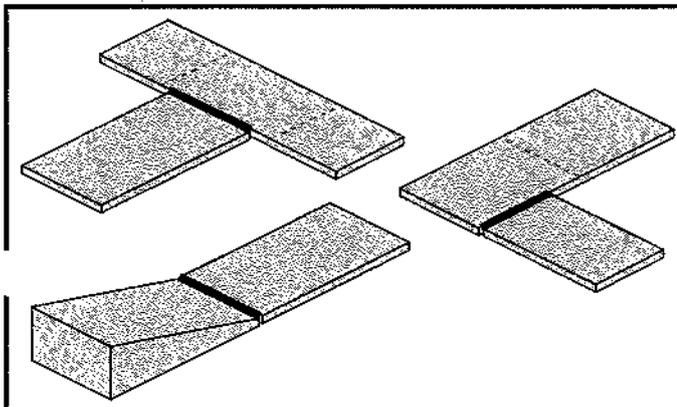
MOVEMENT JOINTS

Detail Drawings: Page 31

Purpose-made expansion joints and flashings must be installed to meet the specific stresses expected and be compatible with APP modified bitumen membranes.

Movement joints should be allowed for in the following situations:

- Around the perimeter of the roof or deck, allowing a 5mm gap at all abutments.
- Around the perimeter of columns and post penetrations through roof or deck.
- Where a new roof area meets and joins an existing roof or deck.
- At changes of direction or at changes of heights in a roof or deck surface. This means movement joints should be allowed for at all "T" or "L" type junctions or wings (see bold line in drawings below).
- Where construction plywood abuts a concrete slab or wall.
- In large plywood roof or deck areas where flex or dimensional movement will be present - a suitable movement detail and location will need to be developed (see dotted lines in drawings below).



Movement Joints



All movement joint details and their selected locations should be approved by the architect/engineer.

UV COATING (MATT-FINISHED MEMBRANES ONLY)

Once the membrane is fully installed, sweep clean removing all dust and debris. Repair any imperfections and check all laps are fully sealed.

The following coating options exist:

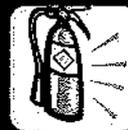
WHEN COATING WITH ALUGARD/SUNGARD

- Mix the aluminium flakes fully into the bitumen liquid, to an even consistency, using an electric drill and spindle stirrer. Ensure that it is well mixed.
- Apply with brush or roller ensuring a good even coverage.

WHEN DUROTUF® IS BEING USED

- Apply two or more coats of duroTUF® to give a good even coverage.
- When tinting the duroTUF® follow the requirements outlined on page 10, and box the pails to ensure colour consistency.
- Ensure the specified coat weight is applied - at least 0.5ltr/m² per coat to a minimum of 0.8-1.0mm dry film thickness.

Alugard	One or two layer systems at 0.4-0.5 kg/m ²
Sungard	Two layer systems at 0.15 kg/m ²
duroTUF®	Non-reflective effect. Residential applications



Alugard and Sungard flammable items and must be stored transported and used with care. Refer to Material Safety Data sheets for further information.

Installation

ECOROOF™ APPLICATIONS

Drawings: Page 35-37

The bituFLAME® torch-on system can also be used in environmentally friendly green roof systems. The green roof system incorporates the bituFLAME® torch-on system, drainage cell, filler fabric, soil and planting.

As an alternative to planting, a decorative pebble ballast may be used.

WPS is able to provide project specific specifications, however the following general guidelines apply;

PRODUCT OVERVIEW

BITUFLAME® ANTI-ROOT MEMBRANE

An APP-modified bitumen membrane with a 180gm/m² spundbond composite polyester reinforcement. bituFLAME® AR has a thin torch-off polyethylene foil permanently fixed to the under side, and polypropylene or mineral chip finish on the top surface.

bituFLAME AR anti-root membrane has the prevental B2 antiroot additive incorporated into the bitumen giving high resistance to both root penetration and aggressive chemical attack from fertilisers and herbicides. This anti-root additive does not in any way affect the plant.

The bituFLAME® AR membrane is used in the ecoROOF® green roof system and in planter box applications.

ECOROOF™ DRAINAGE CELL

In green roof systems, it is important that while excess water is effectively drained away, some moisture must be retained. The ecoROOF™ G plastic drainage cell has water retention cusps and drainage holes that retain sufficient water to support plant growth; while draining excess water. The ecoROOF™ B drainage cell is used in pebble ballast roofs and will drain all water from the roof.



Both drainage cell sheets are manufactured from recycled plastic.

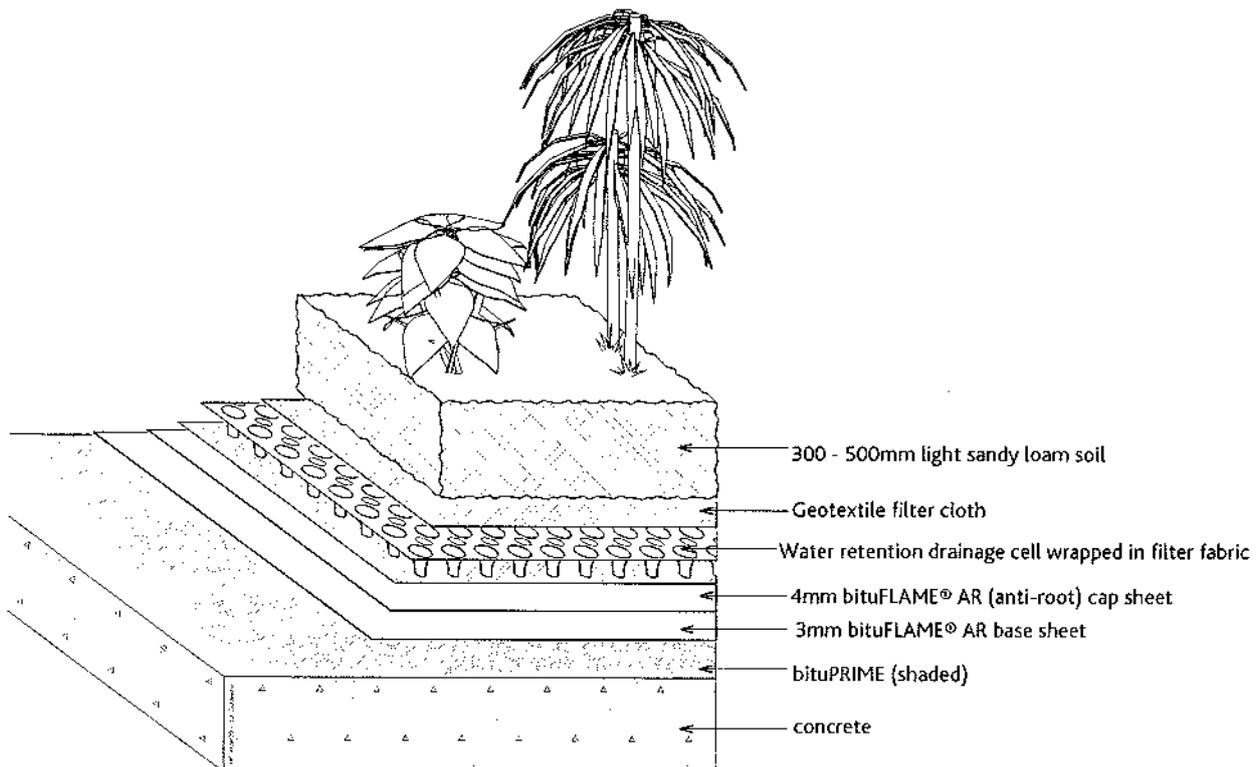
FILTER FABRIC

It is important that the filter fabric stops fines getting into the drainage cell, preventing the flow of water. The bidim® A14 geotextile cloth should be used, as this is manufactured from recycled polymer.

SUBSTRATE

It is important to ensure the substrate and roof structure has been designed taking account of the loadings presented by the ecoROOF™ system.

In particular, it is important that adequate movement joints have been designed to account for anticipated movement, particularly with timber substrates.



ECOROOF™ APPLICATIONS (CONT)

BITUFLAME® AR MEMBRANE INSTALLATION

The two-layer fully torched bituFLAME® system is installed as outlined on pages 13-17. Ensure the two layers are fully torched and that all laps and penetration details are neatly formed and watertight.

GREENROOF SYSTEMS

ROOF DRAINS.

Detail drawings: page 36

Eterno roof drains must be recessed into the substrate and flush. This is important as the drainage cell will be installed over the membrane system including the outlets.

The rainwater outlets will need risers manufactured from a perforated stainless steel. Ensure the riser extends to at least 60mm higher than the soil depth and ensure a neat fit into the outlet. Have a 30mm stainless steel flange fitted 80mm up from the bottom of the riser to stop the riser sliding into the drainage system. When installing the riser, wrap a geotextile filter cloth around the riser to ensure no fines are washed down the roof drain.

SCUPPER AND OVERFLOW OUTLETS

Detail drawings: page 37

The scupper and overflow outlets will need a mesh placed over the outlet point where it discharges into a rainwater head or similar, to prevent birds nesting in the scupper/ outlet and blocking the system.

TERMINATION

Detail drawings: page 35

It is important that the membrane terminations are detailed correctly so water cannot track behind the membrane. The bituFLAME® membrane can be terminated into a chase, behind a wall cladding system, under a cap flashing or with a compression flashing.

SOIL COVER

Cover the ecoROOF™ system with light sandy loam soil depending on the planting requirements.

Extensive green roof systems require approximately 25-100mm of soil planted with low growing stress-tolerant grasses, mosses and similar plants.

Intensive green roofs require 150mm or more of soil planted with a variety of shrubs, vegetables and small trees.

PLANTING

A wide variety of planting options are available for ecoROOF™ applications. Normally stress tolerant plantings will perform best. A planting list can be obtained from WPS

PEBBLE BALLAST SYSTEMS

Detail drawings: page 35, 36

The Ballast Pebble systems will generally have 20mm smooth stone overlaid at approximately 40mm to 50mm thick. No stainless steel riser will be required as the whole roof will be a drainage system. However, a special edge flashing is required where an internal gutter is specified, so the stones can be contained. It is important that leaf guards are in place at all times where an internal gutter is part of the design, to prevent stones getting into the drainage system.



It is critical that all laps and penetrations are checked to ensure watertight integrity. Where possible a 24-hour flood test should be carried out after the membrane has been installed.

Installation

DECK APPLICATIONS

Refer to page 13 for substrate requirements. On timber decks, the supporting joists are to be installed at 400mm centres in each direction with 20mm CCA treated H3.2 grade plywood, glue and screw fixed.

The membrane is installed in the same way as outlined on pages 13 - 17, with the following additional requirements or adjustments.

1. TILED DECK APPLICATIONS

- Install bituFLAME® BS base sheet and the bituFLAME® T membrane, including all underflashings, as outlined in this manual.
- When installing the cement screed over the membrane, place a separation layer over the bituFLAME® membrane (a heavy weight polythene or a non-woven fabric or similar suitable separation layer material). The cement screed must be thick enough to bind together and be reinforced to avoid cracking. Recommended falls are 1.5 degrees to the water outlet with no ponding.
- Prime the cement screed with duroPRIME™, and waterproof with the duroQIK® waterproofing membrane, as outlined on pages 9-10 in the duro™ Product Manual.
- Install tiles with duroFIX® tile adhesive as per specification.

ETERNO PAVER SUPPORTS

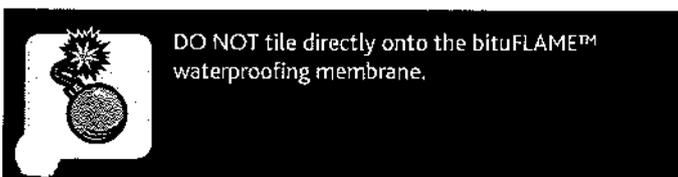
Paver stands form part of the acceptable solution E2/AS1 (paragraph 7.3) and allow maintenance access to the membrane. Paver stands also allow services to be run underneath the paver stand system. Unlike standard tile applications, paver stands can have a variety of surface finishes installed on them.

Eterno paver supports can be installed directly onto the bituFLAME™ membrane. They are available in a 20mm fixed height support, or in a range of adjustable supports. The adjustable supports are available in the WM range or the WE self-levelling range.

On substrates with a significant slope, the self-levelling supports make it much easier to keep a level surface while following the contour of the substrate.

WE2	Self-levelling Adjustable paver support - 50 to 75mm
WE3	Self-levelling Adjustable paver support - 75 to 120mm
WE4	Self-levelling Adjustable paver support - 120 to 170mm
WE6	Self-levelling Adjustable paver support - 140 to 230mm
WE9	Self-levelling Adjustable paver support - 205 to 345mm
WE10	Self-levelling Adjustable paver support - 250 to 385mm
WE12	Self-levelling Adjustable paver support - 270 to 455mm
WE14	Self-levelling Adjustable paver support - 365 to 550mm

WM1	Adjustable paver support - 35mm to 50mm high
WM2	Adjustable paver support - 50mm to 80mm high
WM3	Adjustable paver support - 70mm to 120mm high
WM4	Adjustable paver support - 120mm to 170mm high
WM5	Adjustable paver support - 170mm to 220mm high



2. LOOSE-LAID DUCKBOARD / PAVED APPLICATIONS

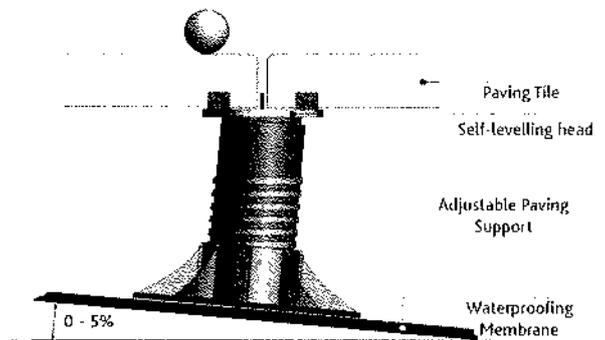
- Where a duckboard decking system is installed over the torch-on membrane, strips of bituFLAME® CS must be torched onto the membrane at the centres of the timber bearers. These strips are 20mm wider than the timber bearer width.
- Lay the timber bearers so that water will be able to flow freely to the water outlet. Rub the bearer surface that will sit on the bituFLAME® strips with candle wax, to ensure freedom of movement and prevent adhesion. Ensure that no screw or nail fixings penetrate through the bearer into the membrane.
- For a permanent duckboard system fully bonded to the membrane, please contact WPS for design specifications.

DECK APPLICATIONS (CONT)

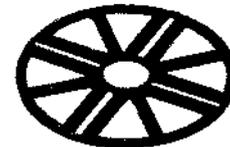
INSTALLATION GUIDELINES

1. Ensure the substrate is clean and watertight.
2. Calculate the number and size of the paver stands required.

Paver size	Number of supports
300mm x 300mm	11.11/m ²
400mm x 400mm	6.25/m ²
500mm x 500mm	4/m ²
600mm x 600mm	3/m ²



Example of a Self Levelling Paver Support



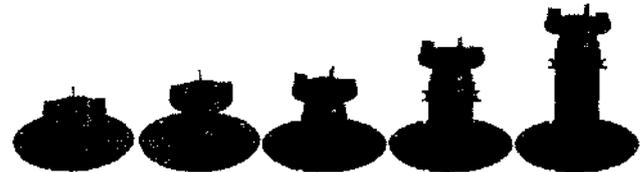
Leveller



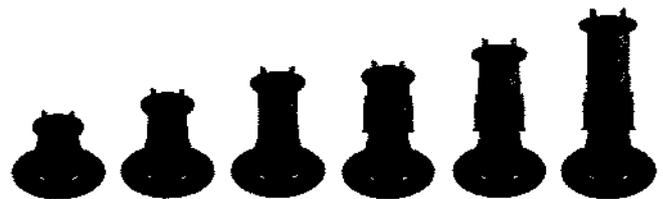
Fixed Height Paver Supports



Balancers



Adjustable Height Paver Supports

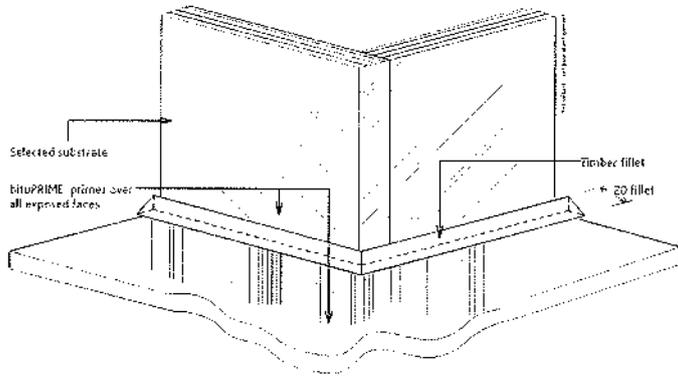


Adjustable Height (Self Levelling) Paver Supports

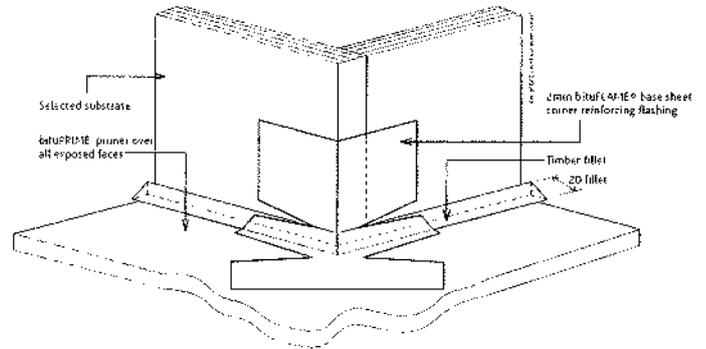
3. Establish the centre lines to the area being paved, to ensure the pavers will be positioned geometrically around these centre lines.
4. To achieve a level paver finish when installing on a sloped substrate, use a theodolite or dumpy level to strike the perimeter levels and check the levels across the area being installed.
5. Note also that when installing 20mm fixed-height supports, they are designed to be broken into half for installing into a wall, into quarters when installing into an internal corner and into three quarters when installing onto external corners.
6. Remove two of the spreader fins on the paver support head when installing adjustable paver supports into walls. Remove all of the spreader fins when installing into corners.
7. Do not penetrate the membrane when installing. If paver supports need to be fixed to the surface, contact the WPS office for specification details.
8. Where required, use the LH-3 levelling disk or balancers to ensure the pavers are perfectly stable/level. This is important when installing over bituFLAME® laps.
9. Do not damage the membrane when installing the pavers onto the stands. Protect the membrane if stacking the pavers on the membrane surface.

Flashing Drawings

EXTERNAL CORNERS

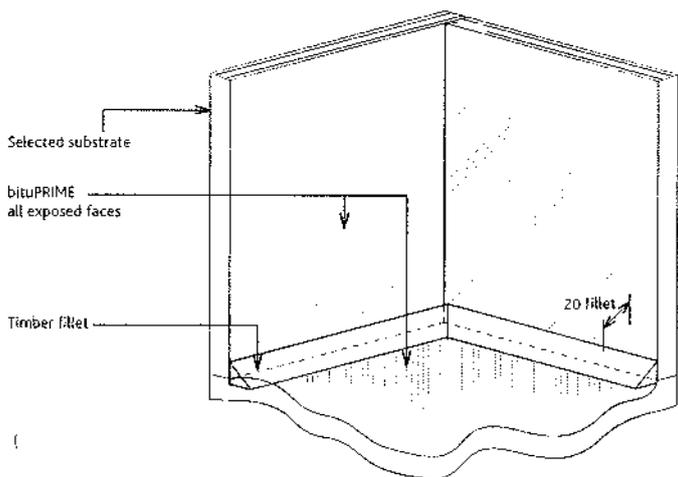


Step 1

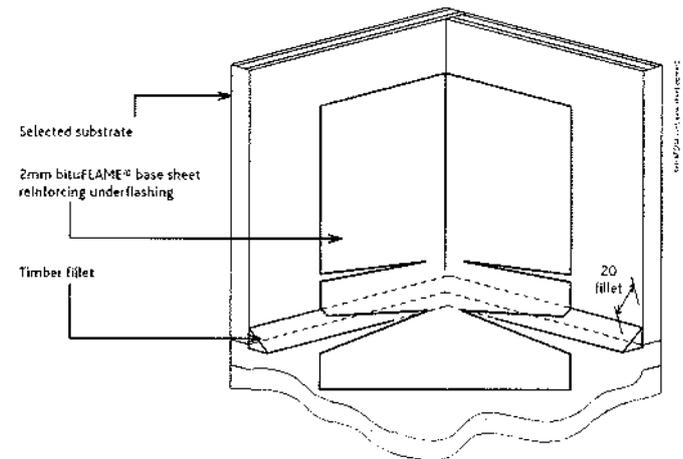


Step 2

INTERNAL CORNERS

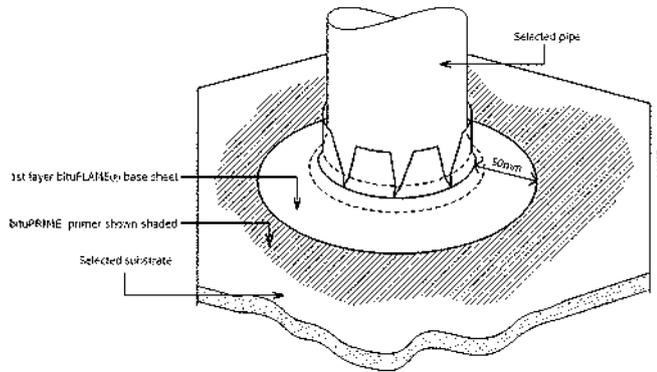


Step 1

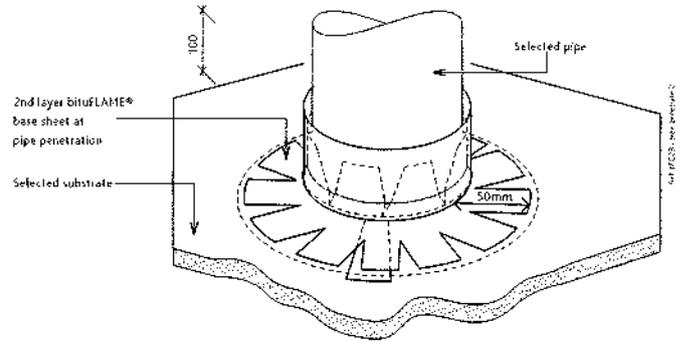


Step 2

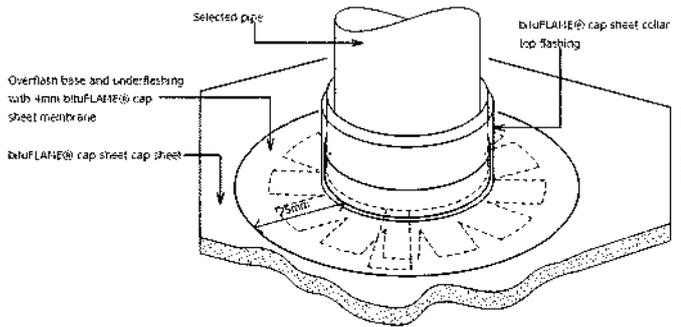
PIPE PENETRATIONS



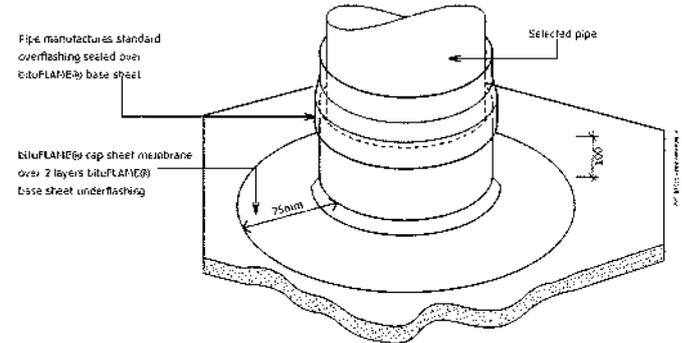
Step 1



Step 2



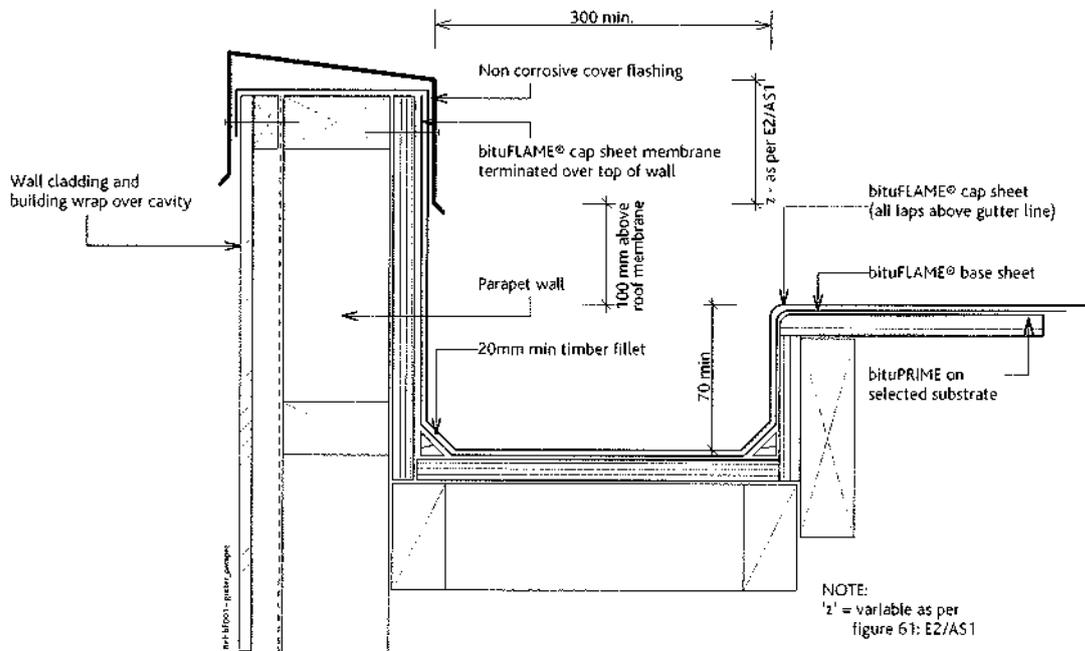
Step 3



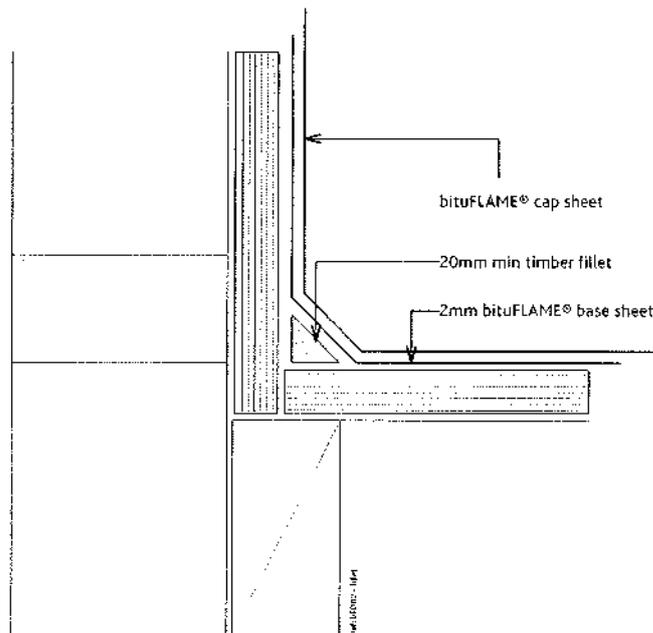
Step 4

Detail Drawings

DOUBLE LAYER DETAILING

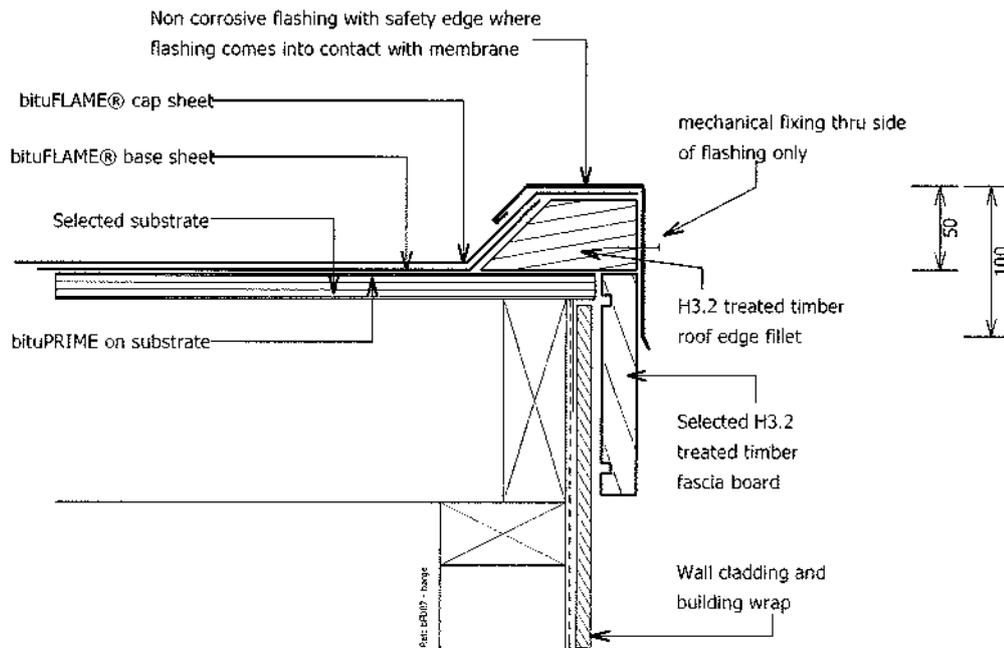
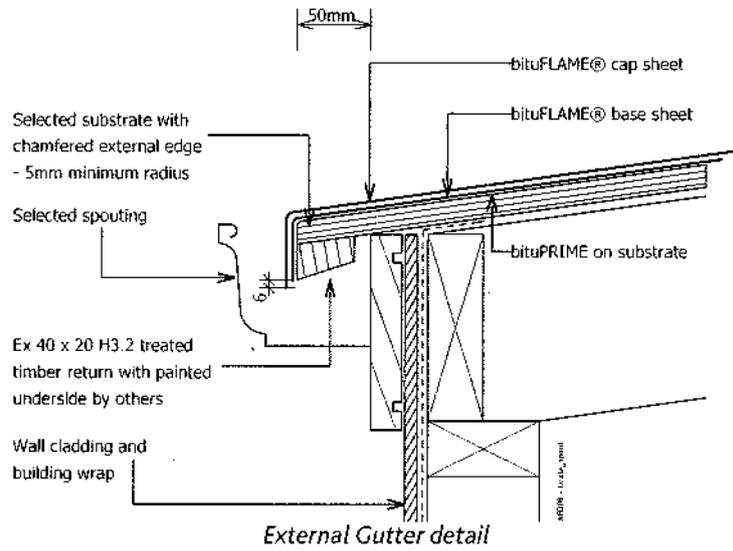


Gutter - Parapet detail



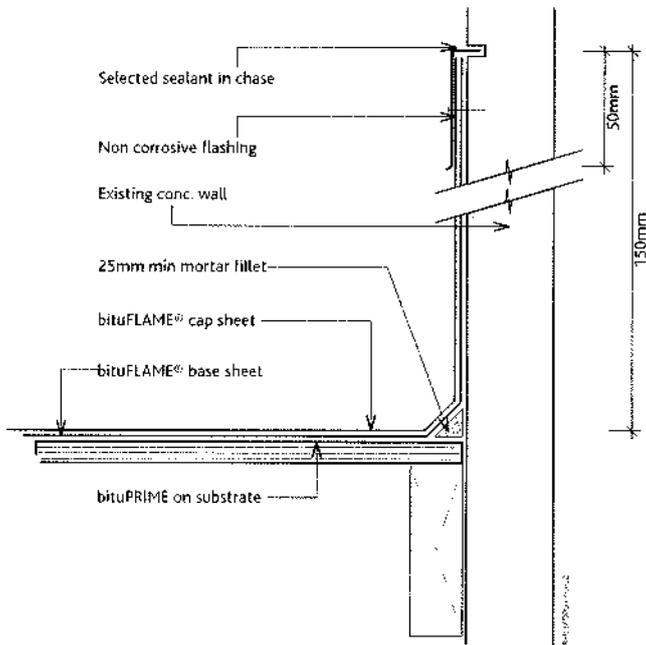
Internal Corner

DOUBLE LAYER DETAILING

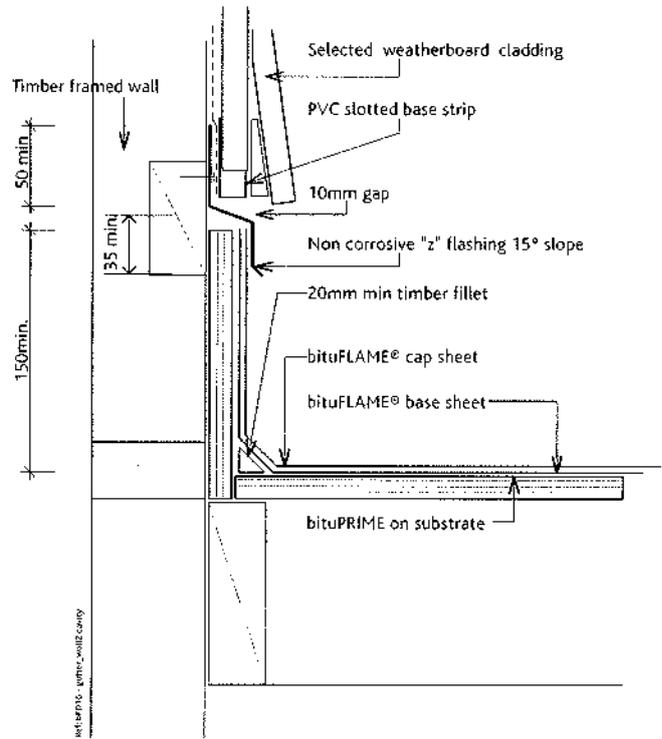


Detail Drawings

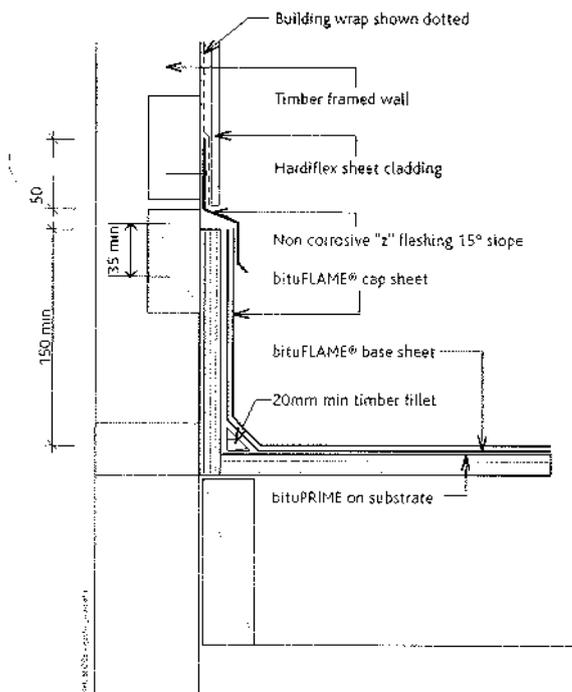
DOUBLE LAYER DETAILING



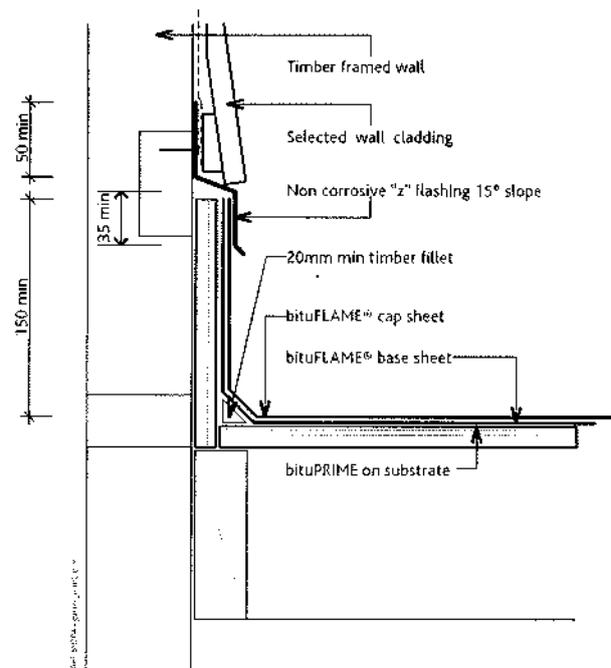
Chase termination detail



Gutter Wall Cavity

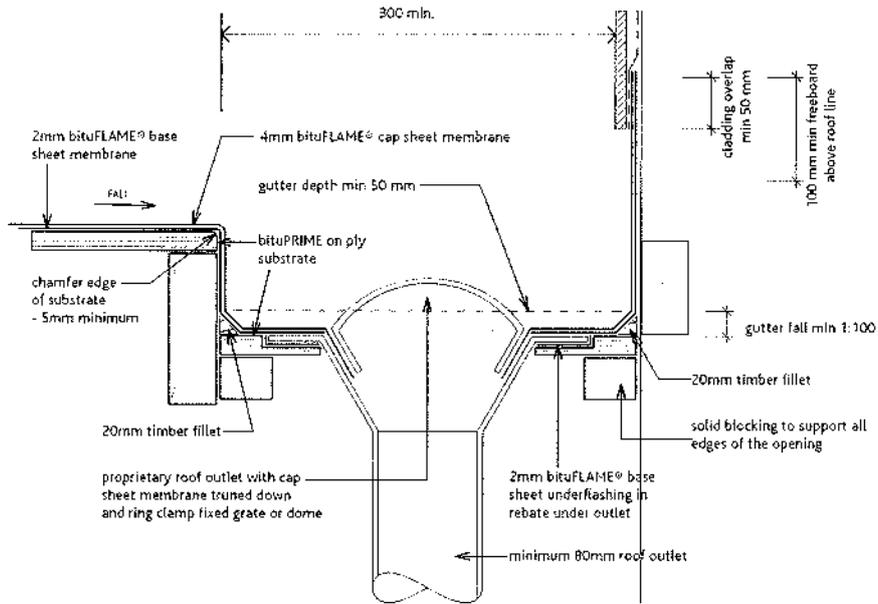


"Z" Flashing termination 1

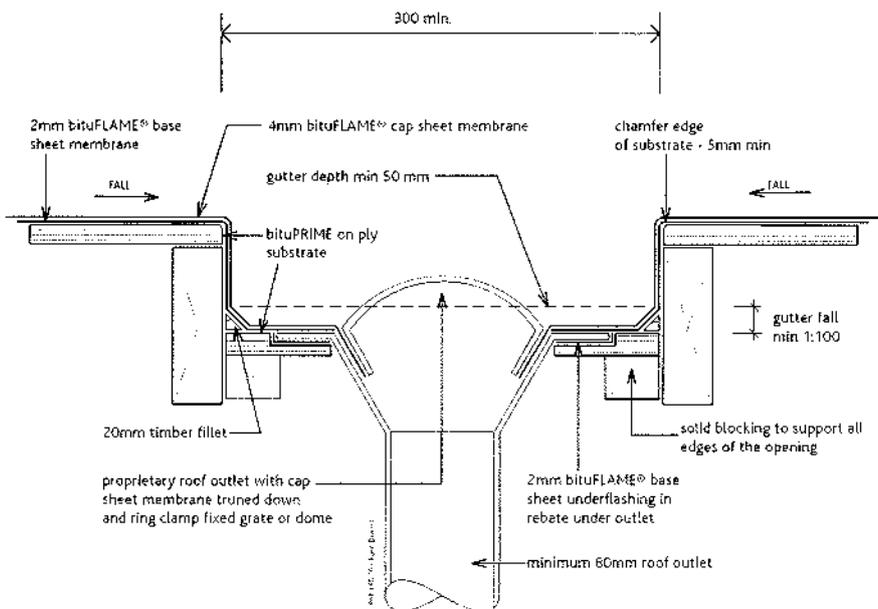


"Z" Flashing termination 2

DOUBLE LAYER DETAILING



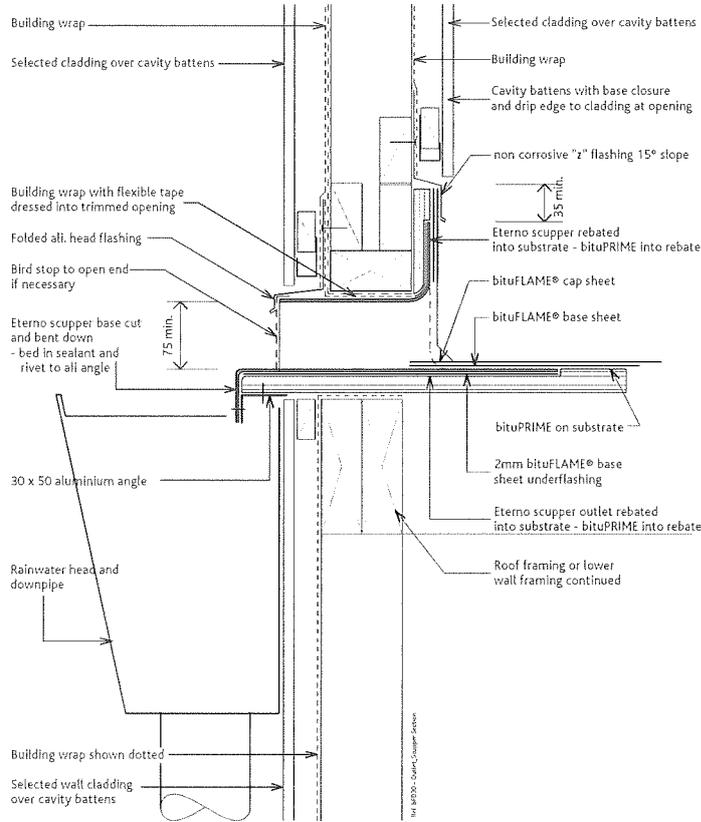
Sunk Roof Drain Detail 1



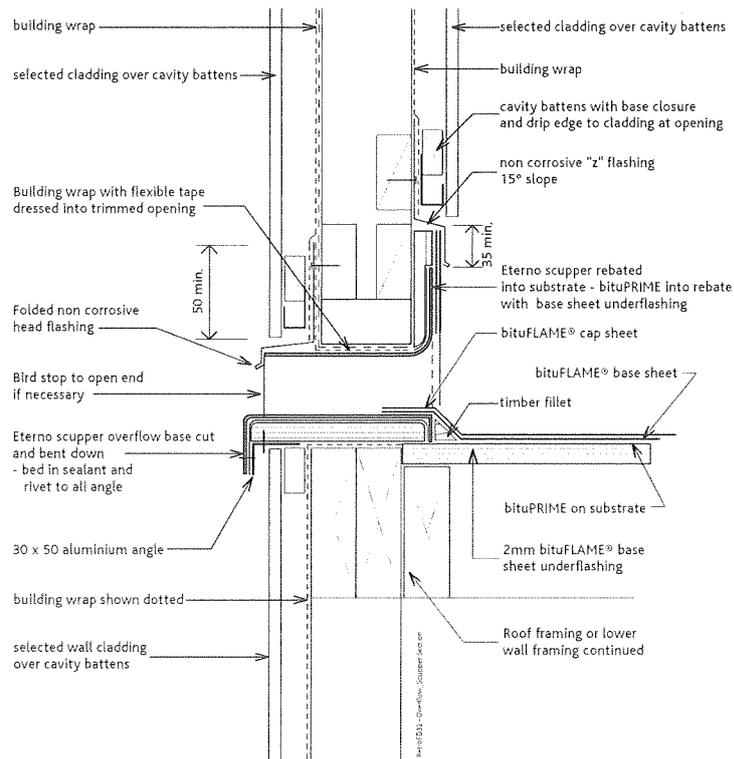
Sunk Roof Drain Detail 2

Detail Drawings

DOUBLE LAYER DETAILING

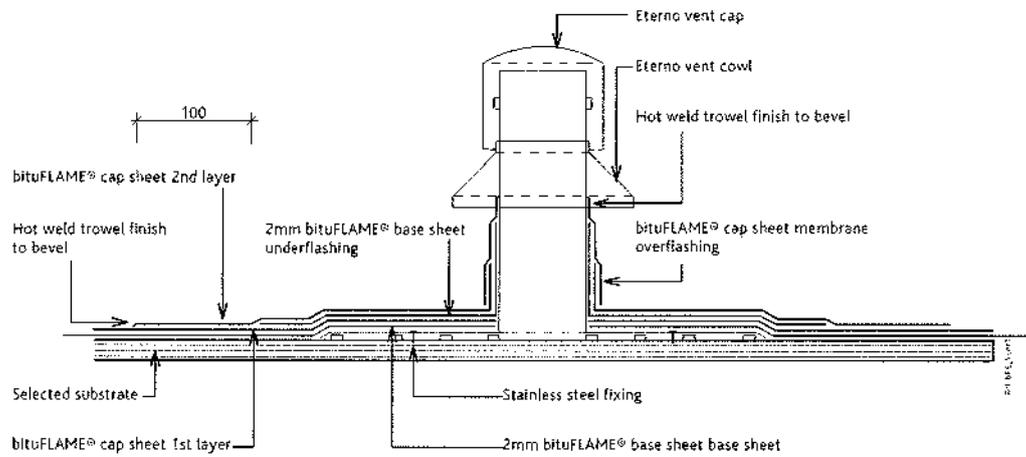


Outlet Scupper Section Detail

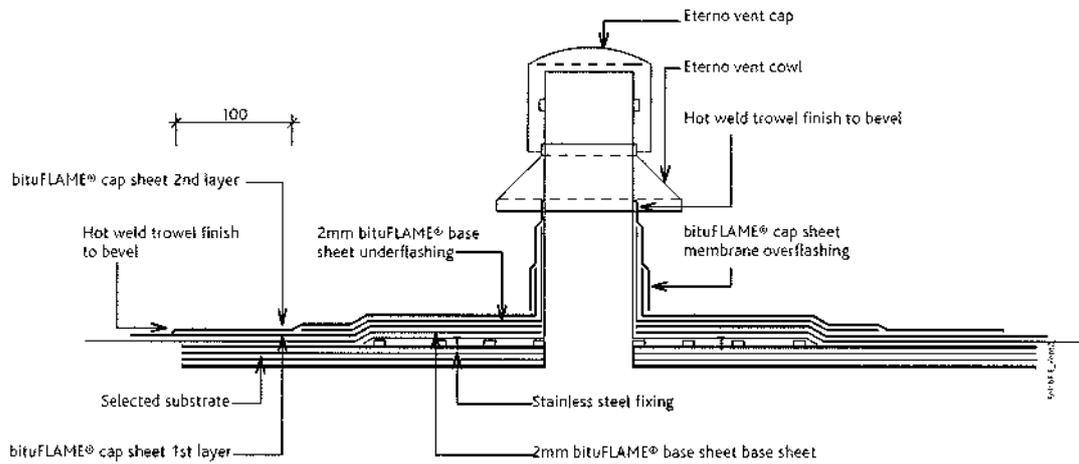


Overflow Scupper Section Detail

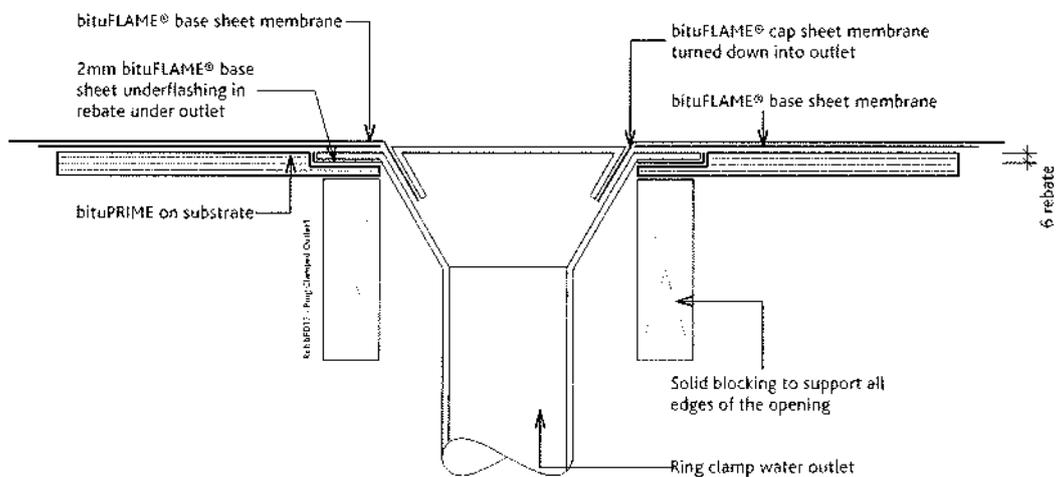
DOUBLE LAYER DETAILING



Moisture Vent Detail



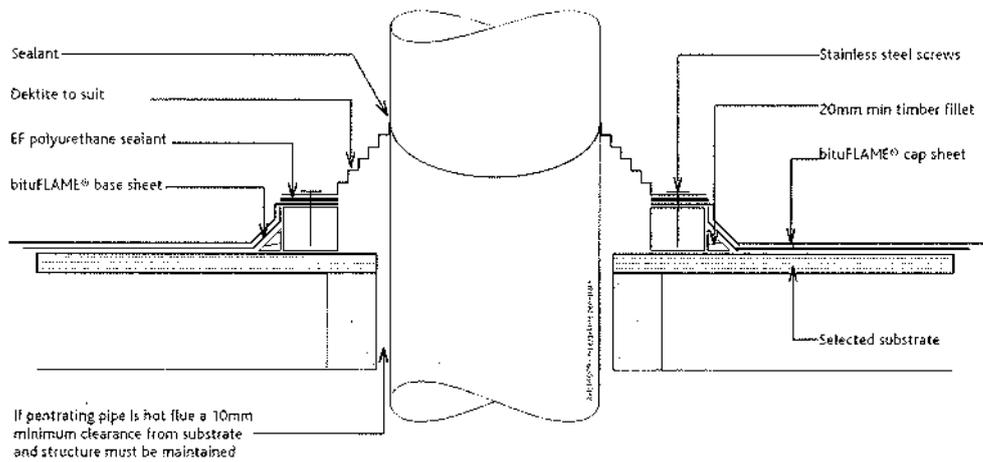
Roof Space Vent Detail



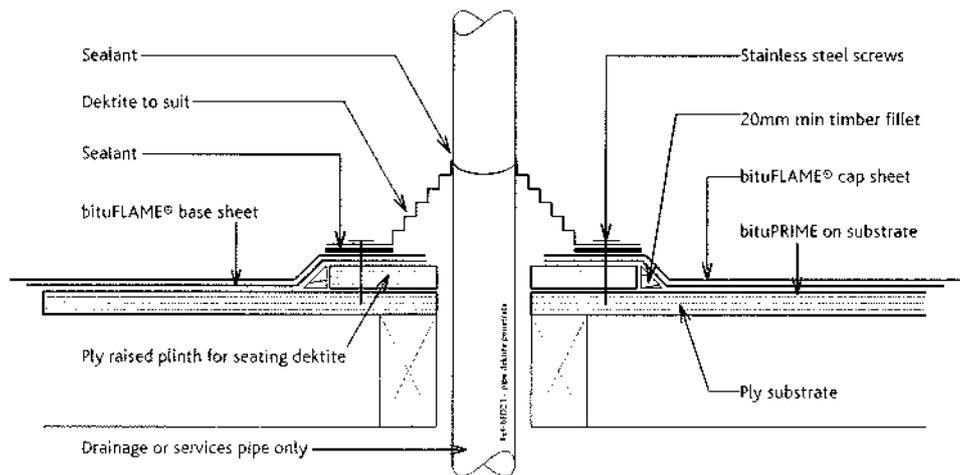
Flush Ring Clamp Outlet Detail

Detail Drawings

DOUBLE LAYER DETAILING

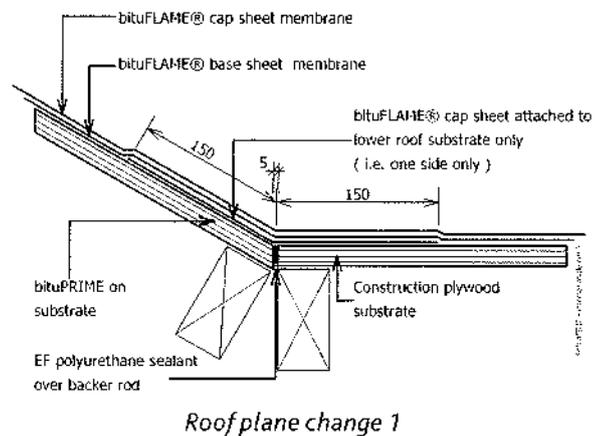
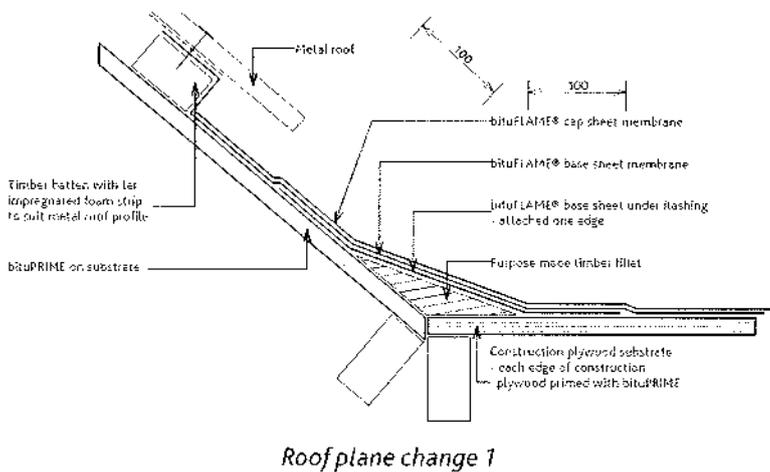
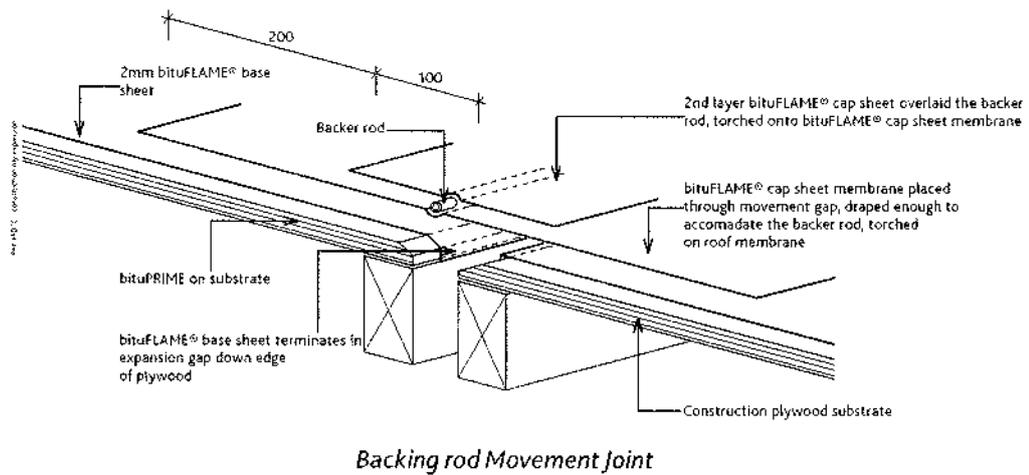
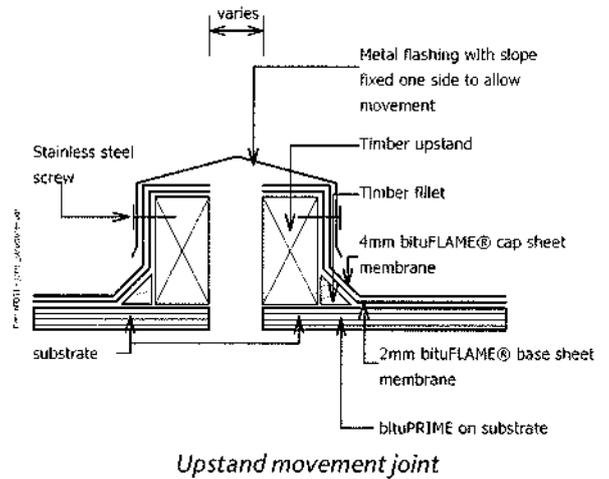
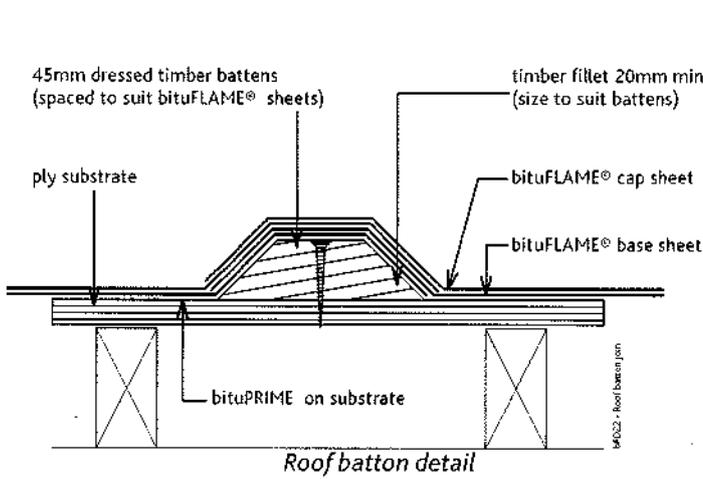


Hot Flue Penetration



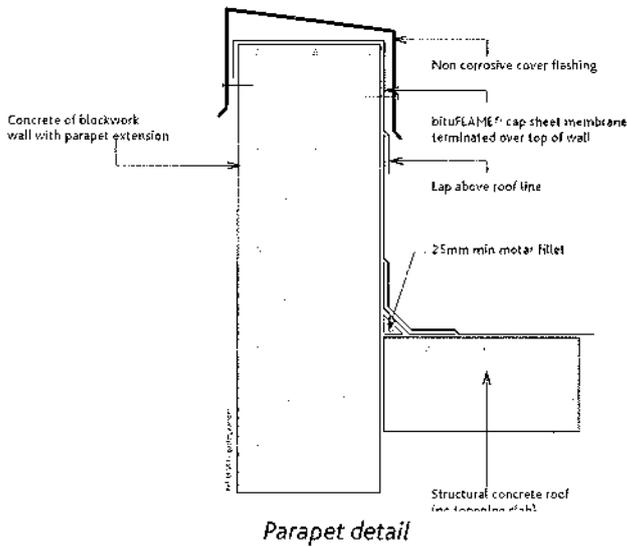
Service/Vent Pipe Penetration

DOUBLE LAYER DETAILING

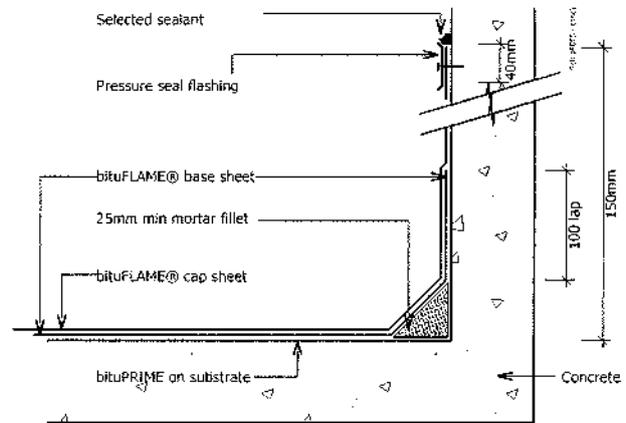


Detail Drawings

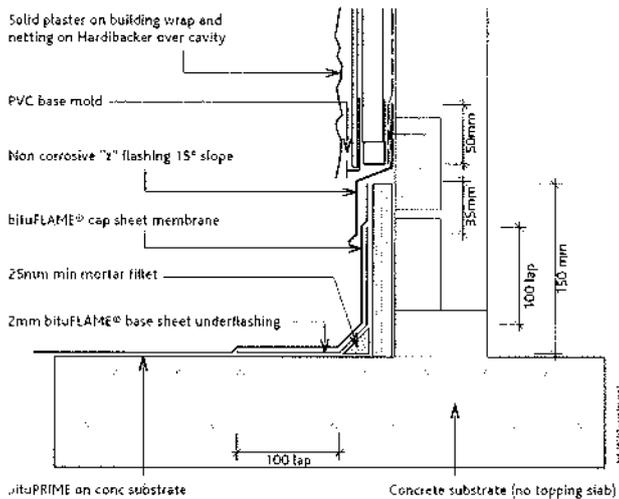
SINGLE LAYER DETAILING



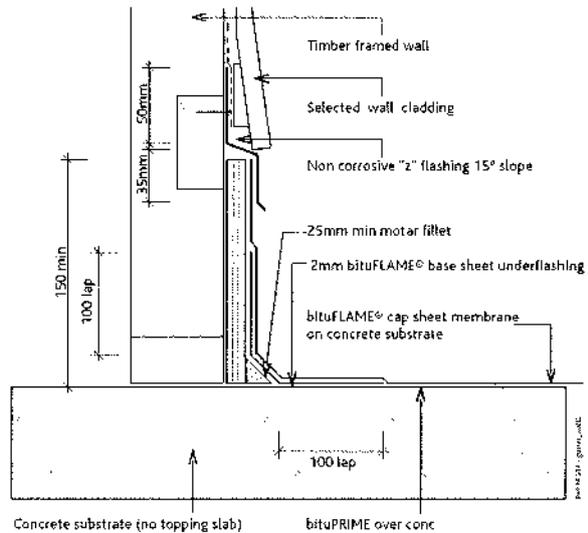
Parapet detail



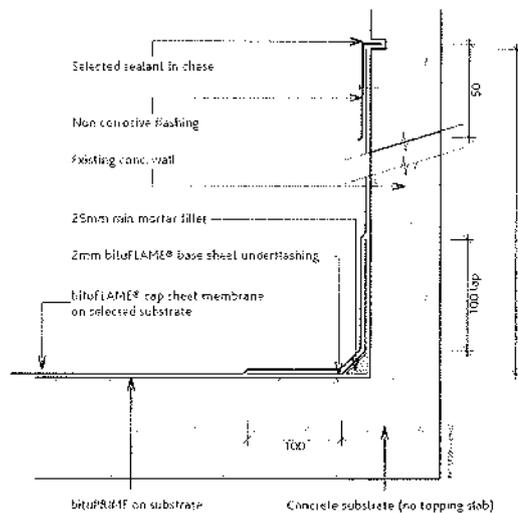
Compression flashing termination detail



Cavity Termination

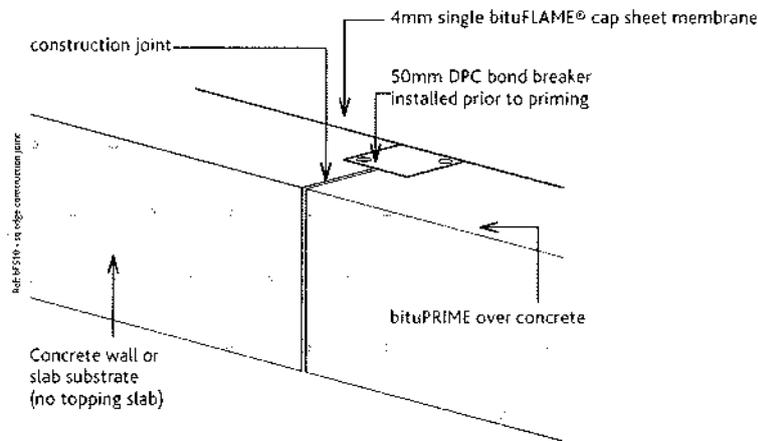


Z Flashing Termination

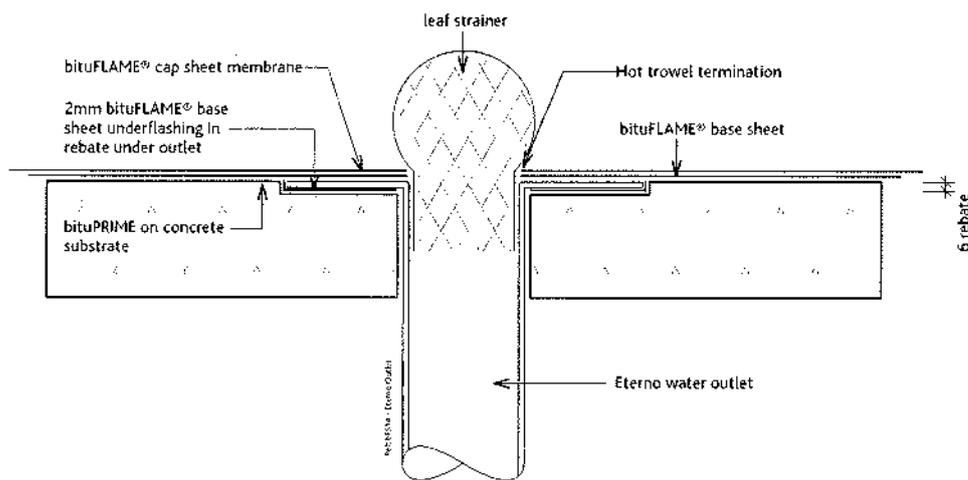


Chase Termination

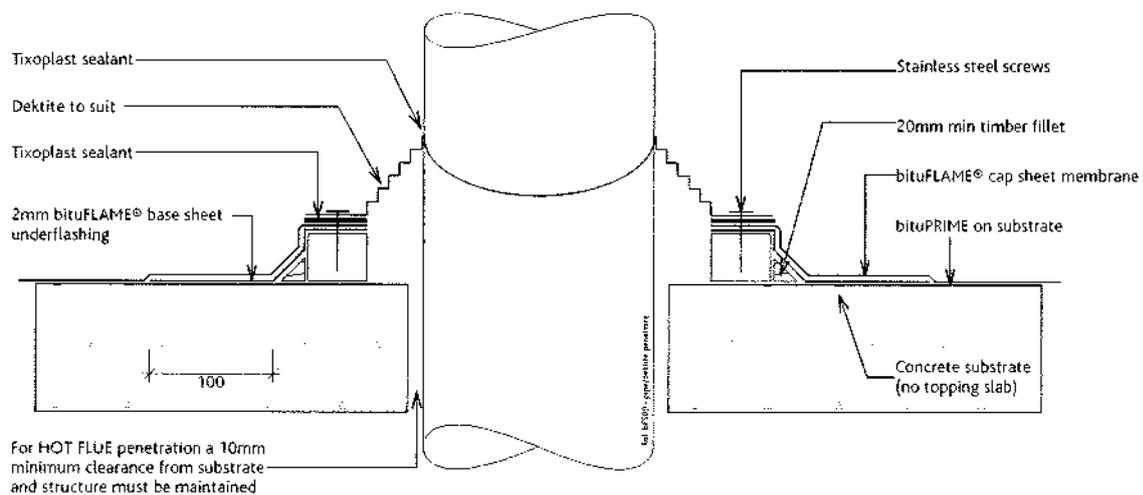
SINGLE LAYER DETAILING



Single Layer Slip Joint



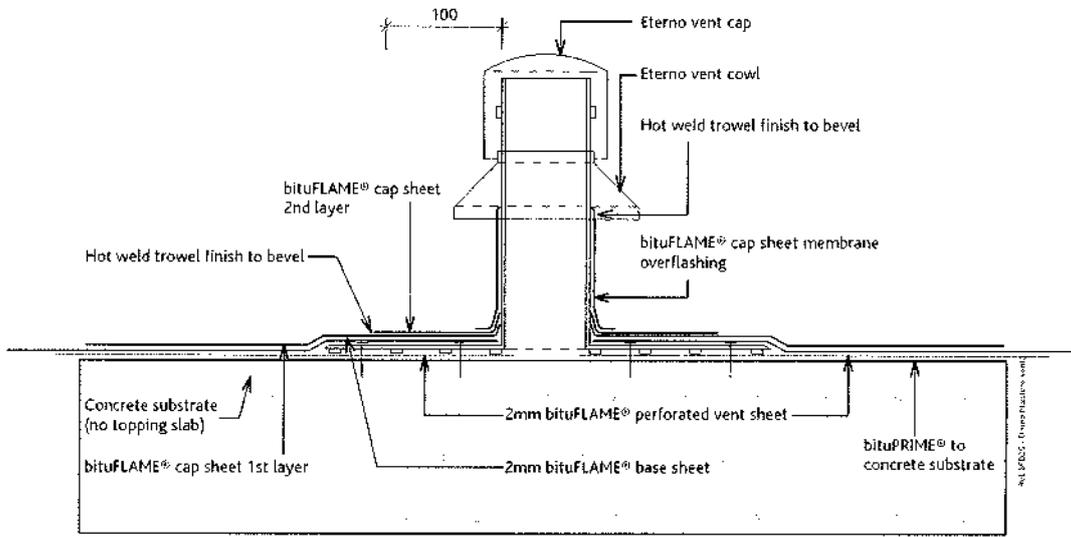
Eterno Outlet with Leaf Strainer



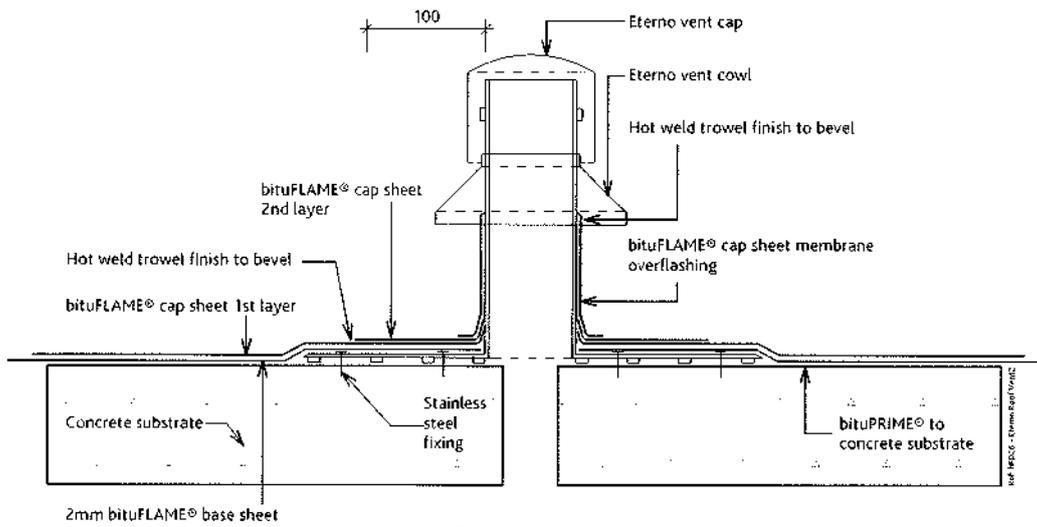
Hot Flue Penetration Detail

Detail Drawings

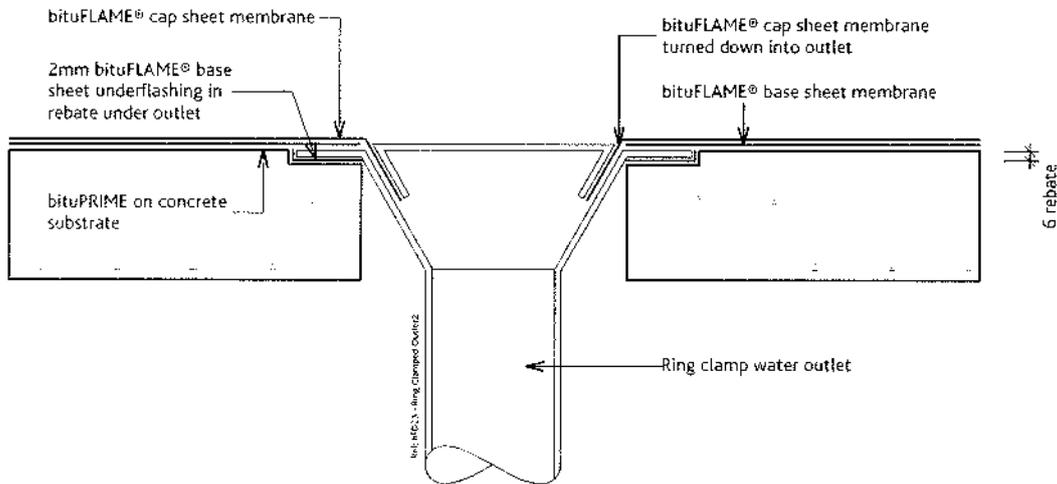
SINGLE LAYER DETAILING



Moisture Vent Detail

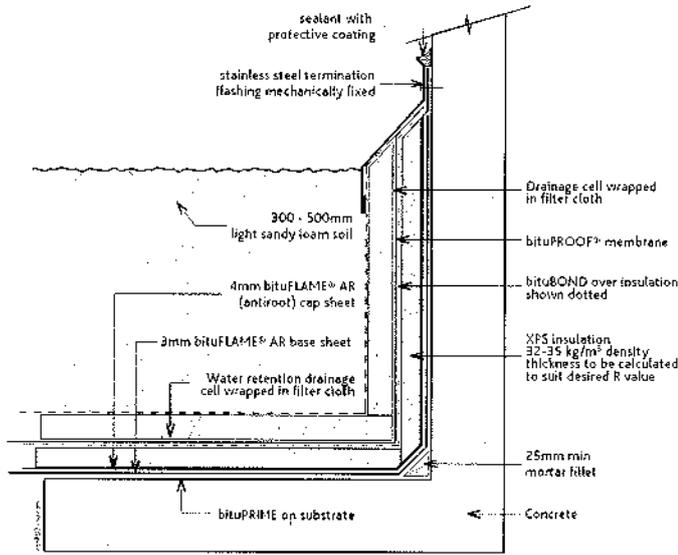


Roof Space Vent Detail

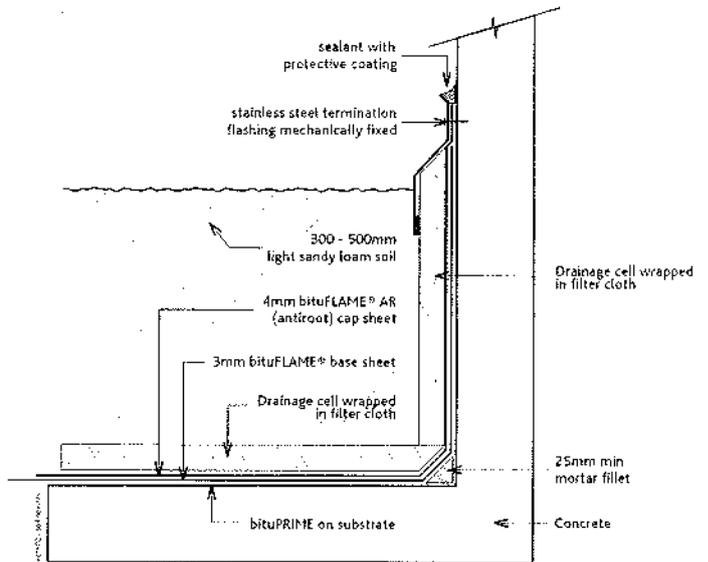


Flush Ring Clamp Outlet Detail

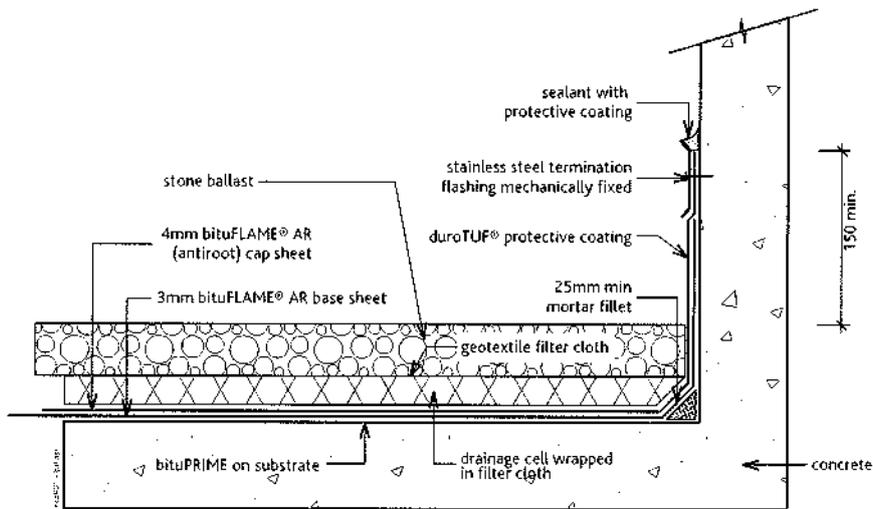
ecoroOF™ DETAILED DRAWINGS



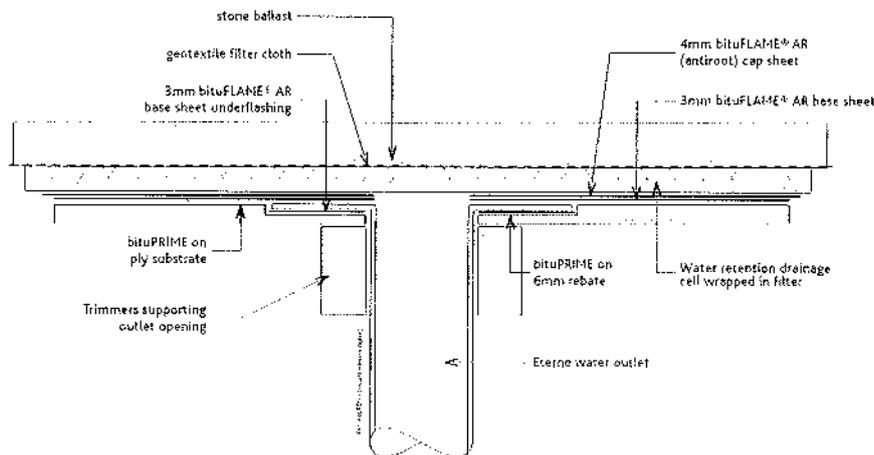
ecoroOF™ insulated termination



ecoroOF™ non-insulated termination



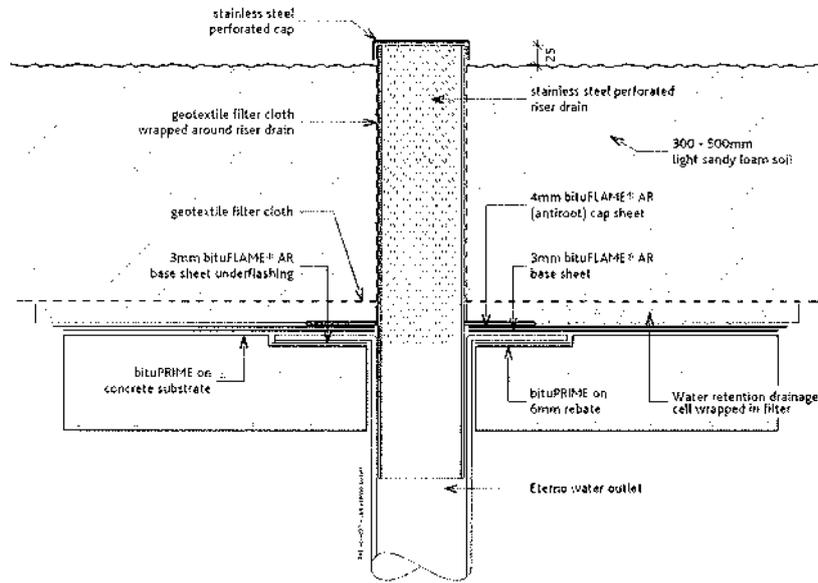
ecoroOF™ ballast termination



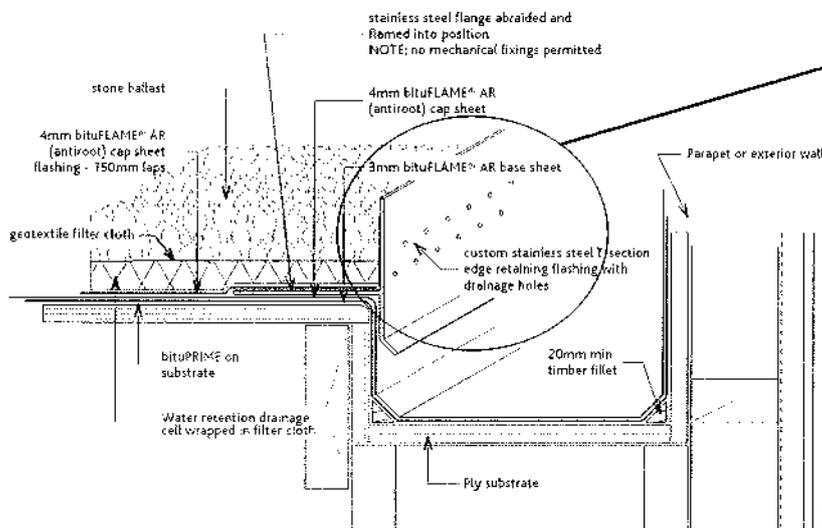
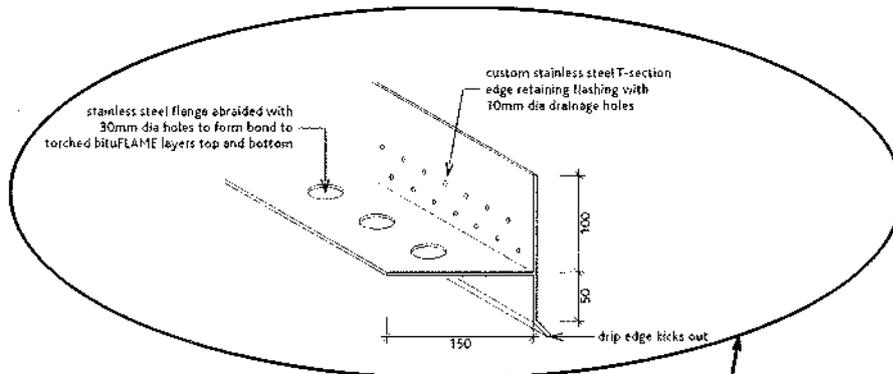
ecoroOF™ ballast eterno outlet

Detail Drawings

ECOROOF™ DETAILED DRAWINGS

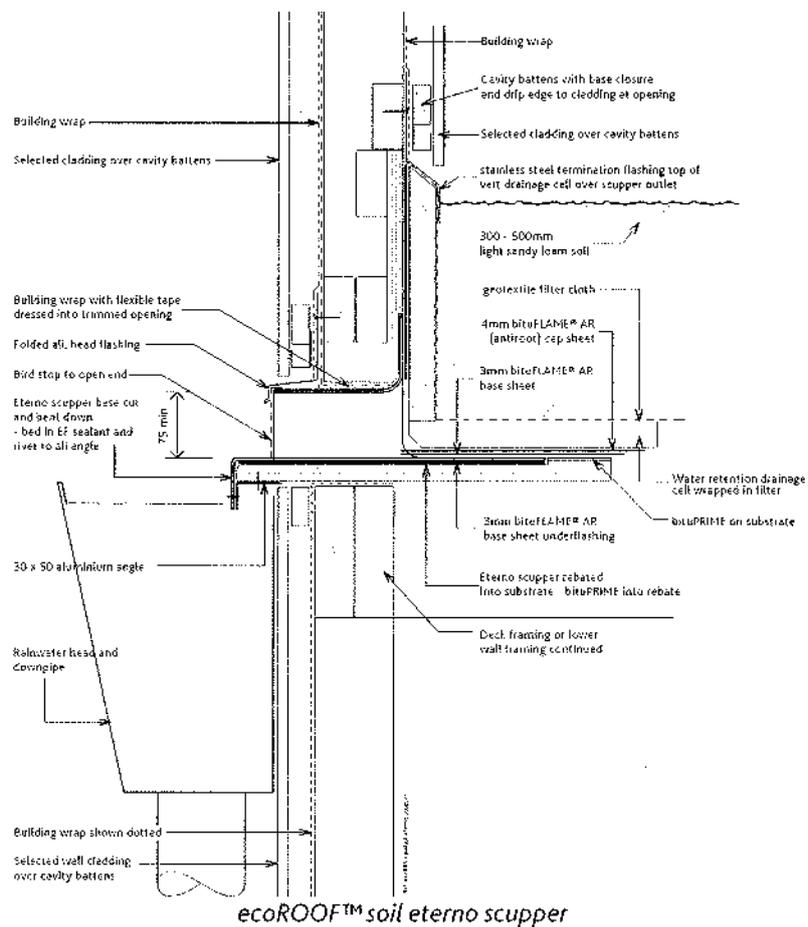
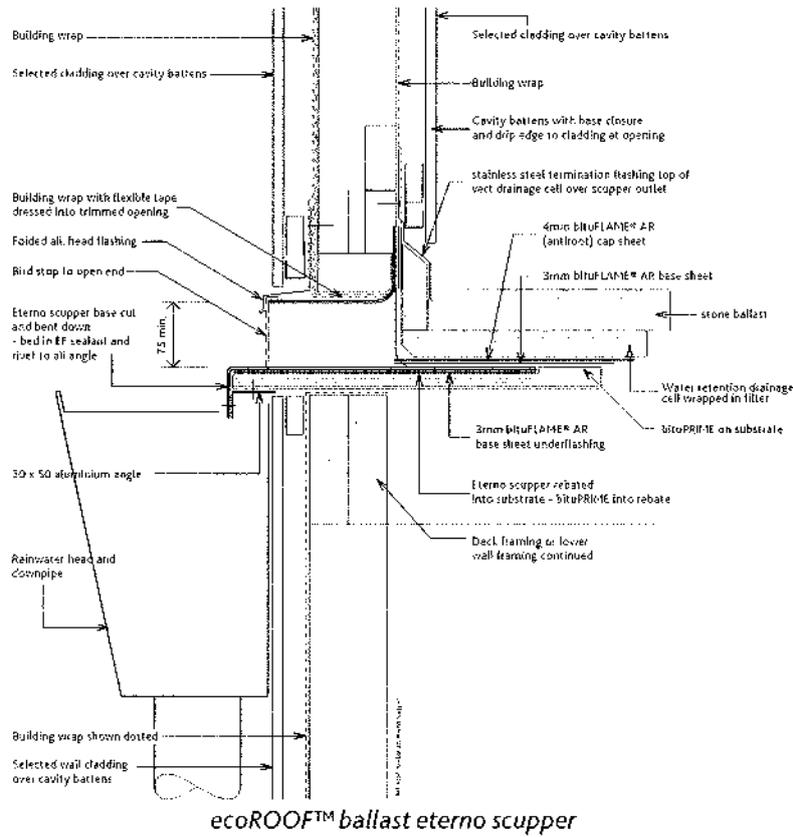


ecoROOF™ Soil eterno outlet



ecoROOF™ Ballast Gutter

ECOROOF™ DETAILED DRAWINGS



Maintenance

MAINTENANCE

As with all roofs, regular and adequate maintenance must be undertaken. All debris should be removed from all roof/gutter areas, and water should not pond. The UV protection coat (Sungard/Alugard/duroTUF®) used to coat the matt-finished membranes may require some occasional maintenance, and after 5-10 years may require a full recoat.



When possible, a roof maintenance service contract should be arranged to ensure the longevity of the system. Use the maintenance grid below as a guide.

	Action	Frequency	Comments
1. General use guidelines			Work by other trades should not be carried out on the unprotected membrane. Rigid protection boards should be used to protect the membrane where the roof is used for storage of items.
2. Routine maintenance	Roof inspections	6 monthly	Remove all debris from drains, gutters etc. Check for any other maintenance required such as membrane damage, surface scuffing and lap degradation. Ensure all water outlets are clear and any overhanging vegetation is cut back.
	Roof cleaning	Annually or as required	Lightly broom surface with soft bristled brush and/or wash using a light detergent.
	Recoating	As required	Where the aluminium UV protection or chip finish shows signs of wearing or scuffing recoat as required. When using an aluminium coat, simply clean area and repaint ensuring good suspension of aluminium flakes. Where recoating of the chip is required, heat the membrane and sprinkle the loose chips over the molten bitumen ensuring good even coverage.
3. Specified maintenance	Warranty inspections	Year 10 Year 15	Full roof inspection required by an approved applicator. Surface coating and laps must be sound. Recoating with aluminium protection coat may be required. Any damage to the membrane must be repaired. Evidence of regular cleaning/maintenance should be apparent. Provide WPS with an inspection report to file.
4. Problem solving (to be completed by approved applicator)	Tears, holes, splits	As required	Remove the protective coating to suit the repair patch size. Torch-apply the patch ensuring a good seam-weld around the perimeter. Reapply the protective coating as required. If the tear is due to movement, consider installing a movement joint.
	Ridges/Buckles	As required	Ridges/buckles are a sign of substrate movement and should not be cut out. Unless obvious strain is being exerted on the membrane, or ridges/buckles are located in a trafficable area, they should be left and inspected every 6 months.
	Lap failure	As required	Open up the lap with pointing trowel, clean out dirt and ensure no moisture is evident. Re-heat together and hot trowel-weld the seam. Patch if necessary.
	Blisters	As required	As for ridges/buckles, the decision to cut out should only be made where the integrity of the membrane is in question. Regular inspection should help decide if the blister should be left or cut out and patched. As required, cut out the blister, prime the substrate and insert a patch flush with the existing membrane. Install an overlay patch 150mm wider around all sides. Torch into place and seam-weld all edges.
	Crazy cracking of aluminium coat	As required	Check to confirm the extent of the cracking (coating only?). Generally cracking is caused by ponding water. Ponding should be eliminated and the surface repainted with the aluminium coating. Depending on the ponding depth, a fall may be created by additional layers of membrane glue-fixed using bituBOND. Heat-weld all edges and recoat with protective coating if needed.
	Mould growth	As required	Clean using light detergent or mould inhibitor as recommended by the supplier of cleaning agents.

Quality Control

Project Name: _____

Subcontractor: _____

Area ready: _____

Fax Number: _____

PLYWOOD SUBSTRATE READINESS CHECKSHEET



Plywood treated (CCA) H3.2 grade sheets to AS/NZS 2269:2004 and NZ building code requirements minimum of 17mm thick for roofs and 20mm for decks.

Sheet edges fully supported with batons, screw-fixed 150mm on edges and 200mm through girth.

Stainless steel countersunk screw-fixing (Grade 316, 10 gauge of length 3 times plywood thickness)

Sheets stagger-laid (fully offset) with correct falls, with no ponding.

5mm clearances from all abutments.

Timber fillets installed to all internal junctions and neatly fitted (minimum size 20x20).

Mitres neatly formed, no sharp edges

5mm radius to all external corners.

Recesses formed to fit proprietary roof drains, outlets and overflows, flush with substrate.

Plywood dry (maximum 20% moisture).

Sharp edges and tips removed and cavities filled. All sheet joints flush.

Substrate clean, firm and suitable condition for laying.

WHEN THE SUBSTRATE IS READY, COMPLETE THIS FORM AND FAX TO THE WATERPROOFING SUBCONTRACTOR

Notes

Quality Control

CONCRETE SUBSTRATE READINESS CHECKSHEET

Project Name: _____

Subcontractor: _____

Area ready: _____

Fax Number: _____



Surface smooth and clean with recommended falls, curing compounds removed.

Cavities and cracks filled with repair mortar and flushed off.

Concrete surface firm with any soft concrete or curing compounds removed.

Mortar fillets to all upstands and smooth - 5mm radius to all external edges.

Recesses formed to fit proprietary roof drains, outlets and overflows, flush with substrate.

5mm radius to all external corners.

Ponding areas removed.

If terminating into a chase, pre-form the chase and ensure that it is straight and 20mm deep.

Concrete cured and thoroughly dry (RH 75%)

Substrate clean, firm and suitable condition for finishing. Vacuum off all concrete dust.

Plinths formed for any exterior ventilation, fixtures or similar.

WHEN THE SUBSTRATE IS READY, COMPLETE THIS FORM AND FAX TO THE WATERPROOFING SUBCONTRACTOR

Notes

BTUF LAME® ROOFING QC SHEET

Project Name: _____ Sign-off below by: _____

Area covered by QC sheet: _____ Date: _____

Roofing membrane installation item	Comply Y/N	Sign-off (initials)	Comments
Plywood substrate s/s screw-fixed to specification, no loose/drummy sheets or delamination (refer substrate readiness sheet).			
Concrete substrate installed to specification (refer substrate readiness sheet).			
Substrate clean, dry and free from foreign matter and sharp edges, and within maximum moisture limits.			
Substrate installed to specified falls to outlets.			
Substrate primed - good even coverage/penetration. All soft areas in concrete removed/repared.			
Movement joints identified and installed to approved specification/detail (attach detail drawings).			
Underflashings installed to all corners and upstands (pay attention to parapets, gutters, junctions).			
Gutters correctly and neatly installed, particularly the internal corners - ensure laps above roof line.			
Eterno roof drains installed to specification and watertight.			
Eterno overflows installed to specification/local body requirements and watertight.			
Vented Base sheet set out with no allowance for laps (vented system only).			
Base sheet fully torched as per spec 200mm around roof perimeter. (mechanically-fixed or spot-bonded system).			
Base sheet fixed as per spec 300mm centres through the body of the roof. (mechanically-fixed or spot-bonded system).			
High wind zones 200mm centres or less (mechanically-fixed system only).			
Base sheet to be fully torched / glue-fixed to specification (fully torched / cold applied system).			
Base sheets side laps 100mm and end laps 150mm fully torched.			
Cap sheet side laps 100mm and end laps 150mm fully torched and seamed off.			
Cap sheet and base sheet laps offset satisfactorily. No three-layer lap build-ups.			
Cap sheet laid across roof slope. Cap sheet and basesheet fully bonded together, no areas of delamination.			
Cap sheet overlaps running down roof slope or away from field of view.			
Membrane termination completed to approved detail.			

Quality Control

Roofing membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Eterno roof vents installed to specification (min. two vents/roof area, with one every 50m ²).			
All penetration details completed to specification including under/overflashing and plinths.			
All non-standard details installed as per pre-approved specifications (attach approved drawing).			
Any mechanical damage to cap sheet repaired to specification.			
Sand-finished cap sheets UV coated to specification, Sand removed by broom before coating.			
Overall installation free of wrinkles, creases and splits.			
No sign of overheating/excessive bitumen bleed from laps (over 2-3mm).			
Job sheets completed recording area installed, date of installation, membrane batch numbers used etc.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Priming System used (Tick one)

bituPRIME

bituBOND®

Installation Method (Tick one)

Fully Torched

Mechanically Fixed

Cold Applied

Primer Coverage Calculation

m²

@

ltr/m²

=

litrs required

installation area

coverage rate

=

pails required

pails actually used

Issues to note or raised during installation:

Remedial action required:

Note of damaged areas repaired:

Attach any photographs taken during application.

ECOROOFTM QC SHEET

Project Name: _____ Sign-off below by: _____

Area covered by QC sheet: _____ Date: _____

ecoROOFTM membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Concrete substrate clean, dry and sound. Free from foreign matter.			
Movement joints identified and installed to approved specification/detail (attach approved detail drawing).			
Mortar/concrete fillets fitted to all internal junctions and corners chamfered at a 5mm radius.			
All rainwater outlets and overflows recessed to be flush with substrate.			
Substrate primed with good, even coverage and penetration, only prime what you could cover per day.			
Underflashings to all corners and upstands.			
Anti-root base sheet fully adhered to substrate with no bridging, bubbling, or delaminating.			
Anti-root cap sheet fully adhered to substrate with no bridging, bubbling, or delaminating.			
Side laps 100mm and end laps 150mm fully torched and seamed.			
All penetrations installed to specification including under/over flashings (plumbing, vents etc).			
Rainwater outlets installed correctly with stainless steel riser fitted, scupper outlets to have drainage cell installed across outlet.			
Junction of the floor and wall membranes installed to specification, fully bonded and watertight.			
All non-standard details installed as per pre-approved specification (attach approved drawings).			
Any mechanical damage to membrane repaired to specification.			
Membrane termination completed to approved detail. Termination flashings installed correctly and watertight.			
Eco drainage system installed to specification with Geotech filter cloth installed to full coverage.			
Filter cloth wrapped around riser, birdstop mesh installed to scupper outlets.			

Quality Control

ecoROOF™ membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Overall installation free of wrinkles, bubbles, creases and splits.			
No sign of overheating or excessive bitumen bleed from laps (over 2-3mm).			
Any damage patched with fully torched patch extending 150mm beyond damaged area - trowel seamed.			
Job sheet completed recording area installed, date of installation and material batch numbers.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Material Coverage Calculation

	m ²	@		ltr/m ²	=		ltrs required		
installation area			coverage rate		=	area	pails required		pails actually used

Issues to note or raised during installation:

Remedial action required:

Note of damaged areas repaired:

Attach any photographs taken during application.

bituFLAME® DECK QC SHEET

Project Name: _____ Sign-off below by: _____

Area covered by QC sheet: _____ Date: _____

Deck membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
20mm Plywood substrate glued and s/s screw-fixed to specification, no loose/drummy sheets or delamination (refer substrate readiness sheet).			
Concrete Substrate installed to specification (refer concrete readiness sheet).			
Substrate clean, dry and free from foreign matter and sharp edges and within maximum moisture limits			
Substrate primed - good even coverage/penetration. All soft areas of concrete removed/repaired.			
Movement joints identified and installed to approved specification/ detail (detail drawings attached).			
Underflashings installed to all corners and upstands (attention paid to parapets, gutters and junctions).			
bituFLAME® torched to substrate allowing for 100mm side laps and 150mm end laps.			
All bituFLAME® seam-welded with complete lap integrity.			
Gutters correctly and neatly installed, particularly the internal corners - laps above roof line.			
No 3-ply lap areas formed.			
Eterno roof drains recessed and installed to specification and watertight.			
Eterno overflows recessed and installed to specification, flush with substrate surface and watertight.			
Membrane termination completed to approved detail.			
All penetration details completed to specification including under/overflashing.			
No sign of overheating/excessive bitumen bleed from laps (2-3mm).			
Overall installation free of wrinkles, creases and splits.			

Quality Control

Deck membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Separation layer installed over the membrane before the concrete screed is installed. (Tiled decks only).			
Concrete screed installed ensuring a minimum slope of 1:60 is allowed for - no ponding. (Tiled decks only).			
duroSET® or duroQIK® installed on concrete screed to specification. (Tiled decks only).			
Extra strip of bituFLAME™ located under bearer - 20mm wider than timber bearers. (Timber deck system only).			
Bearers set out so water can run to rain water outlet. (Timber deck system only).			
Candle wax applied under bearer surface. (Timber deck system only).			
Job sheets completed recording area installed, date of installation and batch numbers used.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Primer Coverage Calculation

	m ²	@		ltr/m ²	=		ltrs required		
installation area			coverage rate		=	pails required			pails actually used

Issues to note or raised during installation:

Remedial action required:

Note of damaged areas repaired:

Attach any photographs taken during application.

Tanking applications

Installation

PRODUCT OVERVIEW

BITUPRIME PRIMER

A solvent-based, bituminous primer designed to penetrate concrete or ply surfaces and provide a bondable surface. Supplied in 20ltr metal pails.

BITUFLAME® TANKING MEMBRANE

bituFLAME® T is an APP modified bitumen with a 180gm/m² spunbound composite polyester reinforcement, with a thin polyethylene film on both sides.

RAWSEAL WATERSTOPS

- CJ1015
A 10 x 15mm high density bentonite waterstop. Supplied in boxes of 10m coils (6/box) and installed into preformed rebates within the concrete joint, or nailed/glued into place.
- CJ2025
A 20 x 25mm high density bentonite waterstop. Supplied in boxes of 5m coils (5/box) and installed into preformed rebates within the concrete joint, or nailed/glued into position.

SEPARATION LAYER

Polyethylene foil at least 150 microns thick.

PROTECTION BOARD

Protection boards must be 20mm polystyrene sheets, core flute or heavy duty protection board; as recommended for such use by board manufacturer.

BACKFILLING MATERIAL

Includes sand or natural soil, free from stones larger than 30mm in size.



WPS recommend that rawMAT pre-hydrated bentonite is used in high level tanking applications such as below the water table or when waterproofing habitable spaces.

SUBSTRATES

SUBSTRATE SHOULD BE:

- Clean, dry and cured. Water must be removed from the area being installed.
- Smooth on the surface so as not to allow water to track behind the membrane.
- Free of gaps, cracks and voids. All gaps between panels or blocks must be filled and flush-pointed, with no bridging points or gaps.
- Free from sharp edges, boxing lines, and nail spikes.
- Fitted with mortar fillets to all internal junctions, and external corners chamfered to 5mm radius. Mortar fillets should be a minimum of 20mm.

MANAGING THE INSTALLATION

It is important to adequately drain the area where the membrane is being installed.

To drain, dig a hole next to the installation area to position the pump. The hole should be deeper than the area to be drained. Use the pump to remove water from the installation area.

In large construction situations a full site dewatering system may be required.

Co-ordination between the membrane installers, steel-fixers and concrete contractor is important to minimise the likelihood of damage to the membrane. A pre-installation meeting should be held to clarify expectations and confirm installation requirements.

PRIMING

Prime the substrate with bituPRIME™ at a rate of 0.2-0.3 ltr/m², ensuring good even coverage.

Allow reasonable time for the primer to dry (4-5 hours), or adhesion problems may occur.

You may have to re-prime substrates if there is a delay in installing the membrane. These delays increase the likelihood of adhesion problems due to contamination.

TORCHING DOWN MEMBRANE

Prepare and install the underflashing membrane to external and internal corners and upstands as described on page 14.

After relaxing the rolls, position the membrane to be installed and roll back up half way. Roll out this portion of the roll and as you do so, slowly move the torch across the back of the roll.

Burn off the polyethylene and create a small bead of molten bitumen that rolls along with the roll. Once this half is installed, repeat with the opposite half. Once the roll is installed, go back over and seamweld all laps.

Ensure rolls are installed straight and that the 100mm side lap is maintained, and that 150mm end laps are formed.

It is critical to ensure all laps are fully formed and that the system is fully watertight. Once it is covered, it is often impossible to get back to the membrane to undertake repairs.

WATERSTOPS

Detail Drawings: Page 50, 52

All construction joints should have a rawSEAL CJ1015 or CJ2025 waterstop installed. The waterstop should be installed into a pre-formed rebate. Where no rebate has been formed, the waterstop should be nailed into position so that it cannot dislodge.

The waterstop/rebate must be located at least 50mm from the rebar to ensure that there will be at least 50mm cover of concrete over the waterstop.

Lengths of waterstop should be butt-joined and kneaded together to form a continuous length.

FOUNDATIONS

Ensure the under slab membrane extends 150mm beyond the building perimeter.

Protect this portion until the walls have been struck and the wall-to-floor junction can be formed.

Install a separation layer onto the bituFLAME® for protection prior to pouring the floor.

WALLS

Ensure there is no bridging of the wall membrane. It is important that it is fully torched to the substrate.

Bring the under-slab membrane up, torching it to the base of the walls. Install the wall membrane over this portion forming the floor-to-wall junction. Ensure a good seal.

If the underslab membrane is polythene, torch the vertical membrane down across the floor-to-wall junction and bring the polythene up over the vertical torch-on membrane.

or terminate to a chase.

PILE CAPS

Detail Drawings: Page 51

Clean the top of the pile cap thoroughly and flush smooth with a high strength mortar. Install a 20mm mortar fillet around the pile cap. Prime the area with bituPRIME ensuring good even coverage. Install a bituFLAME® BS under-flashing by cutting and dressing the under-flashing around the pile cap perimeter and up over the mortar fillet onto the top of the pile cap. Terminate the under-flashing clear of the rebar. In the same way, install the bituFLAME® CS cap-sheet ensuring all laps are well bonded, and that the base-sheet and cap-sheet membrane cuts are off-set. Ensure all work is fully bonded and a watertight seal is formed.

PENETRATIONS

Detail Drawings: Page 52

Clean the top of the pile cap thoroughly and flush smooth with a high strength mortar. Install a 20mm mortar fillet around the pile cap. Prime the area with bituPRIME ensuring good even coverage. Install a bituFLAME® BS under-flashing by cutting and dressing the under-flashing around the pile cap perimeter and up over the mortar fillet onto the top of the pile cap. Terminate the under-flashing clear of the rebar. In the same way, install the bituFLAME® CS cap-sheet ensuring all laps are well bonded, and that the base-sheet and cap-sheet membrane cuts are off-set. Ensure all work is fully bonded and a watertight seal is formed.

MEMBRANE TERMINATION

Detail Drawings: Page 52

Terminate the membrane using a compression flashing and sealant, or terminate to a chase.

PROTECTION AND DRAINAGE

Detail Drawings: Page 50

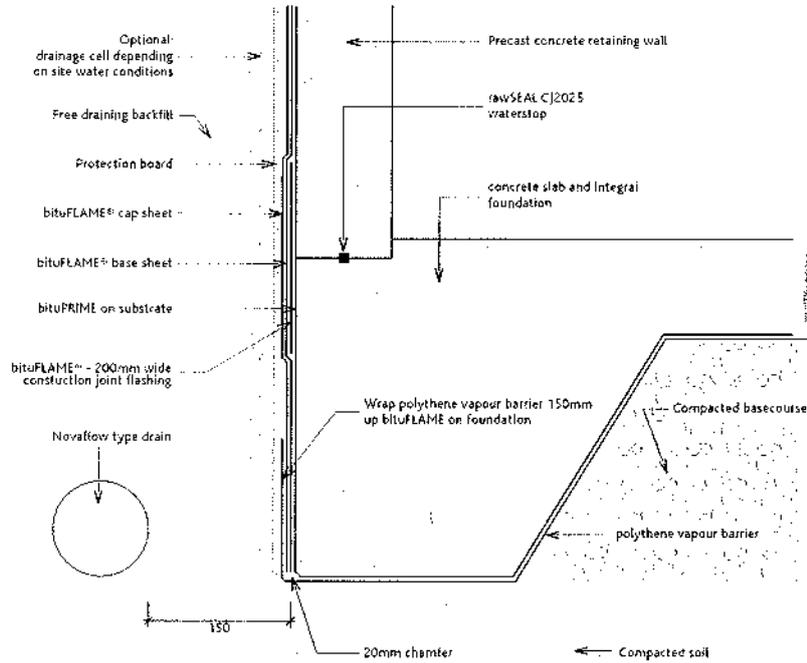
Install 20mm polystyrene sheets, core flute or heavy duty protection boards, next to the tanking system.

A certified drainage system should be installed to remove water from the building perimeter. The drainage should be able to cope with the anticipated volumes of water likely on site. Drainage should be placed 150mm from the membrane.

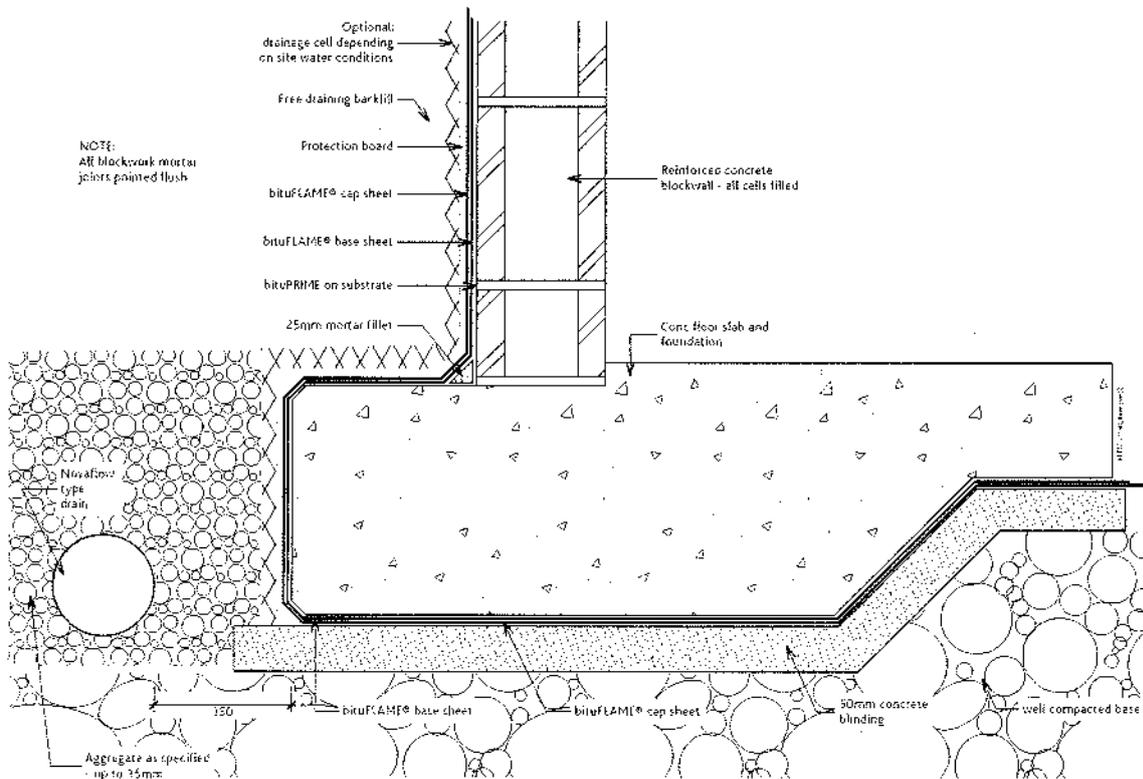


When connecting onto another membrane system, contact WPS for a specific detail.

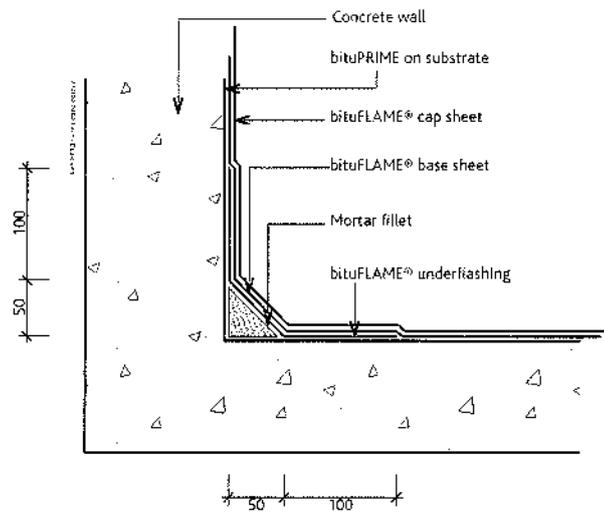
Detail Drawings



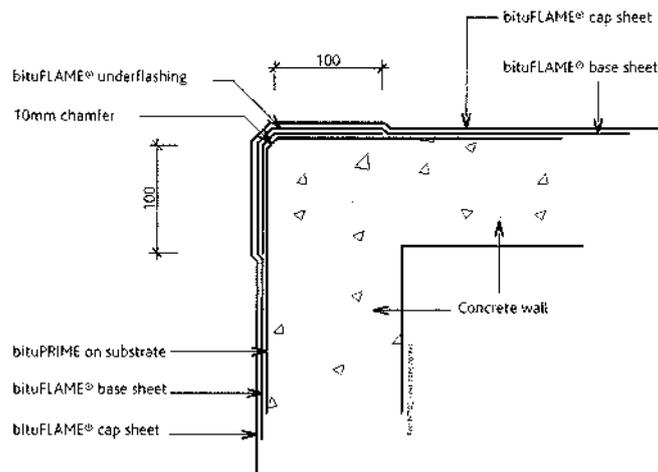
Floor : wall junction : no kicker



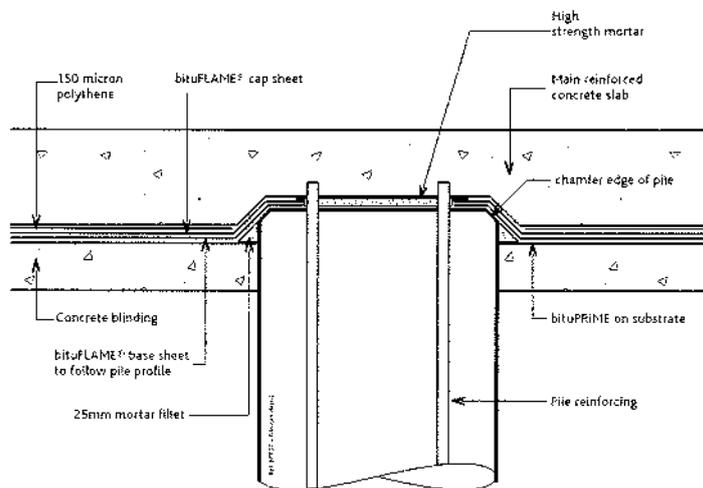
Blockwall floor joint



Internal Corner

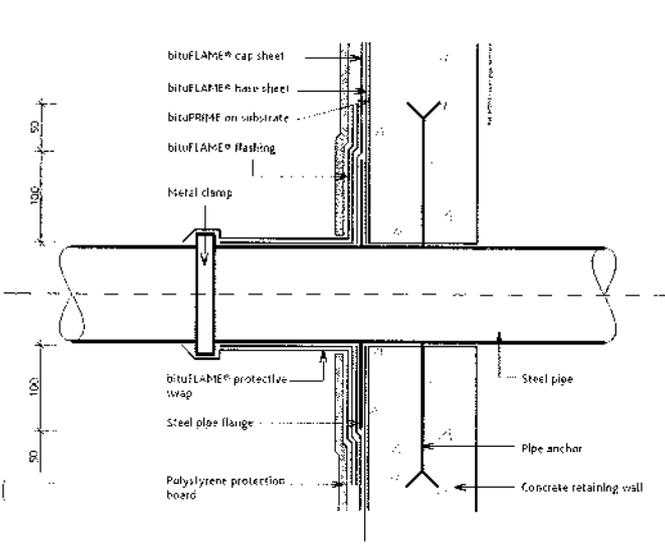


External Corner

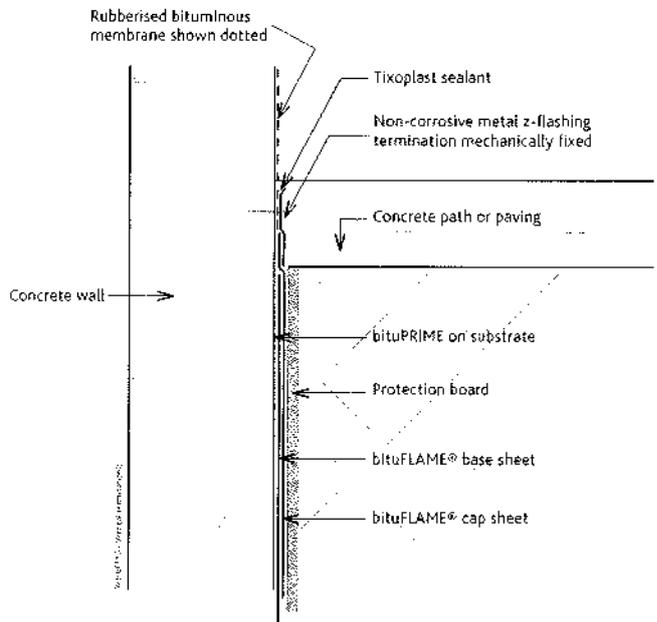


Pile Cap detail

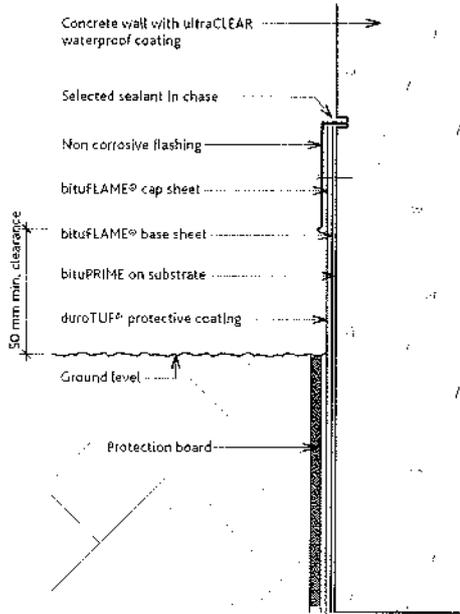
Detail Drawings



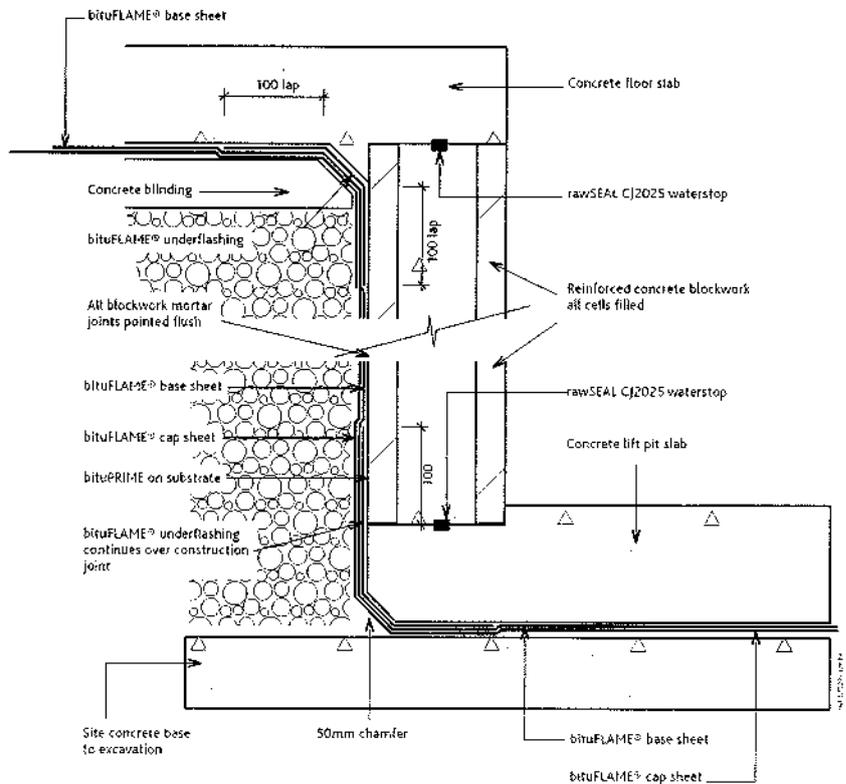
Pipe Penetration detail



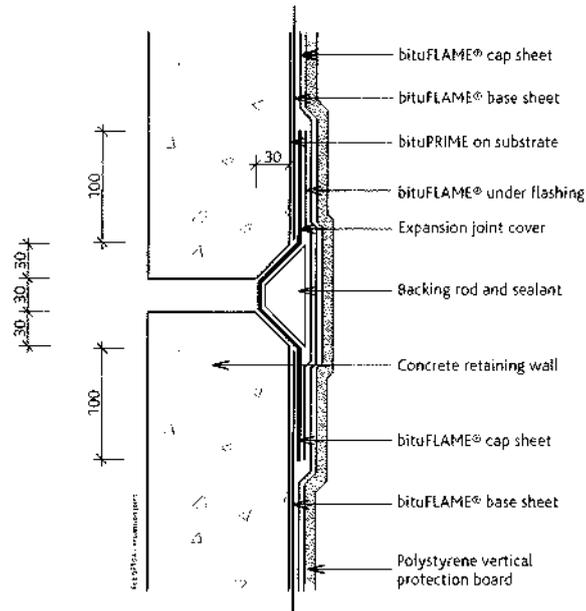
Vertical Termination detail



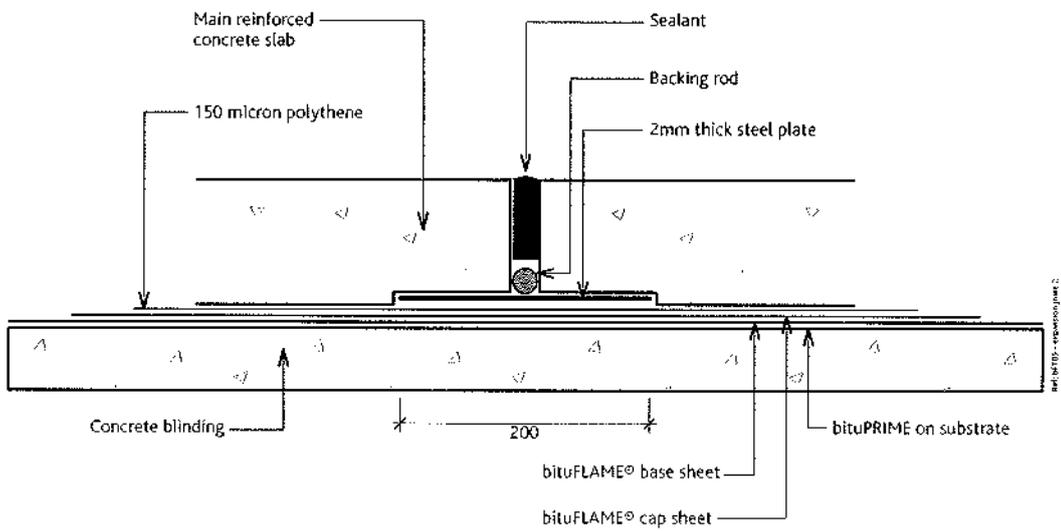
Chase termination detail



Lift Pit detail



Movement joint detail 1



Movement joint detail 2

Quality Control

BITUFLAME® TANKING QC SHEET

Project Name: _____ Sign-off below by: _____

Area covered by QC sheet: _____ Date: _____

Tanking membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Concrete substrate clean, dry and sound. Free from foreign matter.			
Concrete blocks and panels pointed flush and cracks repaired.			
Waterstops installed to construction joints as per specification - located 50mm from rebar.			
Movement joints identified and installed to approved specification/detail (attach approved detail drawing).			
Mortar/concrete fillets fitted to all internal junctions and corners chamfered at a 5mm radius.			
Substrate primed with good, even coverage and penetration, only prime what you could cover per day.			
Underflashings to all corners and upstands.			
Under-slab membrane extends beyond footing by 150mm and protected until vertical membrane installed.			
Membrane fully adhered to substrate with no bridging, bubbling, or delaminating.			
Side laps 100mm and end laps 150mm fully torched and seamed.			
Penetrations installed to specification including Ker/over flashings.			
150mm floor perimeter membrane in sound condition (smooth and clean) ready for bonding to wall.			
Junction of the floor and wall membranes installed to specification; fully bonded and watertight.			
All non-standard details installed as per pre-approved specification (attach approved drawings).			
Any mechanical damage to membrane repaired to specification.			
Membrane termination completed to approved detail.			
Suitable drainage system installed below footing as per specification. Place 150mm from membrane.			
Membrane protection boards installed correctly.			

Quality Control

Tanking membrane installation item	Comply Y/N	Sign-off (Initials)	Comments
Overall installation free of wrinkles, bubbles, creases and splits.			
No sign of overheating or excessive bitumen bleed from laps (over 2-3mm). [Ⓞ]			
Any damaged patched with fully torched patch extending 150mm beyond damaged area - trowel seamed.			
job sheet completed recording area installed, date of installation and material batch numbers.			

Note: Where an element identified in the above checklist is not applicable, please record N/A in the comply column

Primer Coverage Calculation

	m ²	@		ltr/m ²	=		ltrs required		
installation area			coverage rate		=		pails required		pails actually used

Issues to note or raised during installation:

Remedial action required:

Note of damaged areas repaired:

Attach any photographs taken during application.

Bradford™

BRADFORD WHITE

Installation Guide For New and Existing Homes



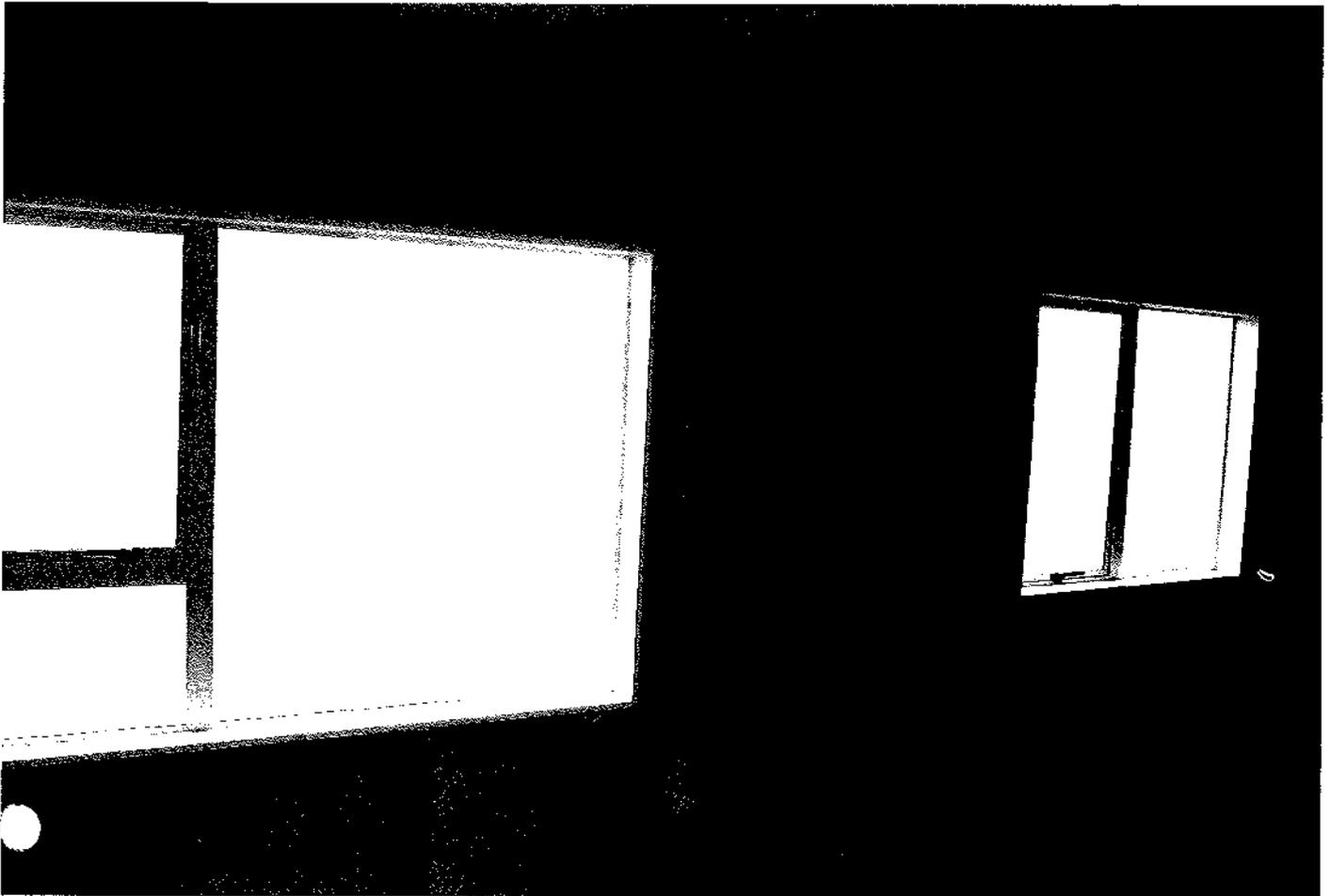
CSR

ENERGY STANDARDS

As a result of the increasing energy efficiency performance standards, well-insulated ceilings and walls are vital for energy efficiency.

New homes have to meet increasing energy efficiency performance standards. Well-insulated ceilings and walls are vital for energy efficiency.

Even the best built homes suffer from heat loss transfer unless they are adequately insulated. In winter, 42% of a home's heat is lost through the ceiling and 24% through the walls. In summer heat flows in at the same rates. To compensate, heating and cooling appliances need to run at elevated power levels and for longer periods to be effective. This costs money.



Benefits of insulating with Bradford Gold™

- ☛ Highest insulation values in New Zealand
- ☛ Noise is significantly reduced
- ☛ Fire resistant
- ☛ Saves up to 70% of heating and cooling costs
- ☛ Range of widths and R-Values to suit all homes
- ☛ Bradford lifetime warranty



SIMPLE TO INSTALL

Bradford Gold™ wall and ceiling insulation products have been developed to make installation easy. The fine fibres make them soft and easy to handle while having minimal irritation compared to other glasswool products on the market. Bradford products come in a range to suit the standard frame sizes used in New Zealand. These instructions are a guide only. For more comprehensive instructions please refer to NZS 4246: 2006 Amendment One (Installing Insulation in Residential Buildings).

Bradford Gold™ wall and ceiling insulation products have been developed to make installation easy. The fine fibres make them soft and easy to handle while having minimal irritation compared to other glasswool products on the market. Bradford products come in a range to suit the standard frame sizes used in New Zealand. These instructions are a guide only. For more comprehensive instructions please refer to NZS 4246: 2006 Amendment One (Installing Insulation in Residential Buildings).

Tools required to install your wall or ceiling insulation:

- 1. Sharp Knife
- 2. Cutting Board
- 3. If working in a dusty area – cap, goggles and dust/ respirator mask
- 4. Measuring Tape or Stick

HELPFUL HINTS:

- 1. Use a sharp knife to cut pieces to fit around obstructions and between smaller spaces.
- 2. Cut on a flat wooden surface, using a straight edge to guide the knife.

Ceiling applications also require:

- 1. Insulation Poker
- 2. Torch or Lamp
- 3. Stepladder and knee board

Step 1: Plan your work

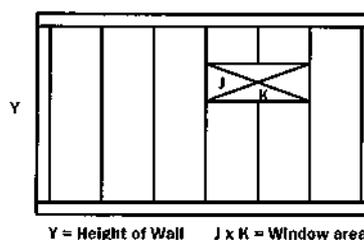
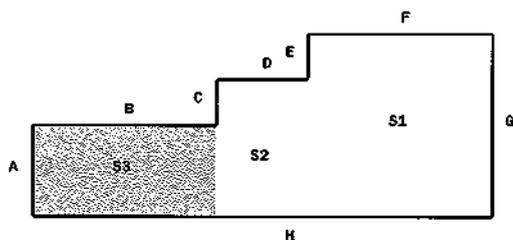
First things first - the best thing is to plan out what you are doing - make sure you have all the tools you need and that you are going to buy the right amount of Bradford Gold.

Step 2: Choosing the right level of Insulation

You have a choice of R value. R value stands for thermal resistance and is shown on the pack label. The R value measures the ability of the insulation to resist heat flow. The higher the value, the greater the effectiveness of the insulation. For a new home the R value that is stated on the plan, for an existing home there is no minimum requirement, however if your winters are cold or your summers are hot and humid select the highest value your budget will allow for maximum benefit.

Step 3: How much Insulation will you need?

To work out how much insulation you need, calculate the M^2 area you intend to insulate. Use the total M^2 area to select the right number of packs required (refer to the table on the last page to see the coverage of a bale). To calculate the M^2 simply measure the perimeter of your house then draw a plan of your house from a birds eye view (examples shown below).



Y = Height of Wall J x K = Window area

Not all homes are perfectly square, however in most cases you can break down your home into sections. To measure your total ceiling area (m^2) $F \times G =$ the M^2 of the larger section of the house S1. $(C+A) \times D =$ the M^2 of S2 and $A \times B =$ the M^2 of S3. $S1 + S2 + S3 =$ total M^2 for ceiling.

To measure your total wall area (m^2) measure height (Y) x perimeter $(A+B+C+D+E+F+G+H)$ then deduct any windows/doors $(J \times K)$.

SIMPLE TO INSTALL

THE BRADFORD GOLD™ INSULATION SYSTEM IS THE EASIEST AND MOST EFFECTIVE WAY TO INSULATE YOUR HOME'S CEILING AND WALLS.

Step 4:

Using the table at the back of this brochure, divide your total M2 by the coverage M2 for a) ceilings and b) walls to obtain the number of packs you require.

Step 4 (A): Ceilings

Place the packs/rolls into the roof area. Start from the farthest point from the manhole and work from one pack before opening the next (Image 1). For new homes you can install from the underside if the ceiling has not been lined (Image 2). You may need to strap the segments to hold them in place until the lining takes place.

When installing from above for existing homes, stand on joists only and fit the knee board over at least two joists. Fit the segments snugly between the joists, using your insulation poker to slide the segments to the outside edge of the wall plate. Ensure segments are fitted with no gaps.

Step 4 (B): Walls

Put the segments into place so that the insulation fits flush with the inside face of the frame. This will avoid the segments touching the external wall.

Segments can be cut to fit odd size spaces. Segments should be cut 5 to 10mm oversize for a tight friction fit. Segments can be cut around power point plates and over wiring, as long as it does not push the insulation out past the stud. If the wire runs directly through the middle of the stud, it is often required to cut the insulation around the wiring as neatly as possible to avoid thermal bridging (Images 3 and 4).



Image 1



Image 2



Image 3



Image 4

New Clearance Standards:

Refer to Standard 4246.1

HELPFUL HINTS:

- 1. Wherever possible, Bradford Gold should be laid beneath electrical wiring or pipes.
- 2. That being said if the insulation is likely to be compressed it should be placed over the pipes or wiring.

BRADFORD™ GOLD CEILING INSULATION

Introduction

Bradford™ Gold ceiling insulation is a resilient and compressible insulation manufactured from the controlled felting of glasswool bonded with a thermosetting resin.

Product Description

Bradford Gold ceiling insulation has been designed to reduce energy costs by keeping heat out in summer and heat in during winter.

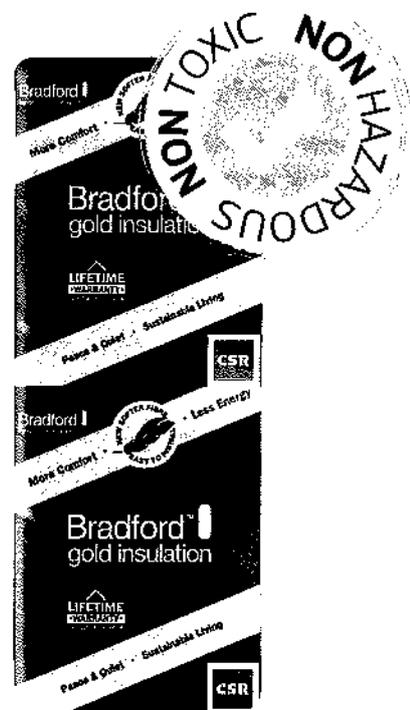
Applications

Bradford Gold ceiling insulation has been designed to reduce unwanted noise:

- Entering the building to give a quieter more relaxing environment
- Between floors when installed into mid-floor and underfloor applications
- To be used for ceiling and underfloor applications, not designed for wall applications

Technical Leadership

Bradford Gold is manufactured using the latest Arlanda fibre technology, making Bradford Gold products nicer to handle, cut and install, while providing superior performance.



Features & Benefits

- Pieces are supplied in 430mm widths for joists spaced at 450mm centres and can be cut in half for joists at 600mm centres
- Softer feel for easy handling
- High recycled content
- 100% Bio-soluble, posing no risk to health
- Low irritant and low allergen
- Lifetime Warranty
- Will not settle over time
- Bradford Gold achieves the best possible fire ratings. Bradford Gold will not ignite or burn and can hinder the spread of flame

Standard Sizes & Packaging

R-Value	BRANZ Appraised	Nominal Thickness (mm)	Standard Size (mm)	Density (kg/m³)	Pieces per pack	Area per pack (m²)	NRC Values
R1.8	✓	95	1160 x 430	7.1	24	12	-
R2.2	✓	115	1160 x 430	7.8	24	12	-
R2.7	✓	145	1160 x 430	7.3	20	10	1.00
R3.2	✓	165	1160 x 430	7.8	16	8	1.05
R3.6	✓ ✓	185	1160 x 430	8	14	7	-
R4.0	✓ ✓	215	1160 x 430	7.3	12	6	-
R5.0	✓ ✓	210	1160 x 430	13.2	8	4	-
R6.0	✓ ✓	260	1160 x 430	12.6	6	3	-

- ✓ Bradford have Environmental Choice ticks against all products that fall within category EC-25-04. All products that can be tested have the green tick. The minimum criteria is R2.5 for walls, R3.4 for ceilings and R1.4 for underfloor products.

BRADFORD™ GOLD CEILING INSULATION

Formulation

Bradford's advanced manufacturing processes provides products that are safe for allergy sufferers, allowing you and your family to breathe easy with added piece of mind.



Bradford products are manufactured using the latest FBS-1 bio-soluble formulation which has been assessed as nonhazardous under the National Occupational Health and Safety Commission's guidelines and can be installed with absolute confidence.

Bradford glasswool products do not contain harmful VOC's - Volatile Organic Compounds nor do they contain any harmful amounts of formaldehyde or other organic chemicals.

Designing for Sustainability

Bradford Gold is manufactured from up to 65% recycled glass. Much of the recycled content used is not suitable for recycling in other applications.

Zero Ozone Depleting Potential

Bradford Insulation has undertaken an audit of its Glasswool, Rockwool and reflective foil laminate insulation manufacturing processes referencing the US EPA List of Ozone Depleting Substances (Class 1 and Class 2).

This audit found that no ozone depleting substances are involved in either the manufacture or composition of these products.

Physical Properties

Property	Performance	Test Criteria
Maximum Service Temperature	350°C	Bradford recommends where high temperature use is required seek advice from your Bradford office.
Flow Resistivity	0.5 x 10 ⁴ mks Rays/m	
Fire Resistance	Ignitability 0 Heat Evolved 0 Spread of Flame 0 Smoke Developed 0	When tested in accordance with AS/NZS1530.3:1999
Corrosion Resistance	pH 7.5 - 8.0	When tested in accordance with BS 3958 Part 5 - 1986
Moisture Absorbance	<0.2% by volume	Exposure to an atmosphere of 50°C and 95% relative humidity for four days. Note: IF the insulation becomes wet, full thermal efficiency will be restored on drying out.



Bradford™

gold insulation

BRADFORD™ GOLD WALL INSULATION

Introduction

Bradford™ Gold wall insulation is a resilient and compressible insulation manufactured from the controlled felting of glasswool bonded with a thermosetting resin.

Product Description

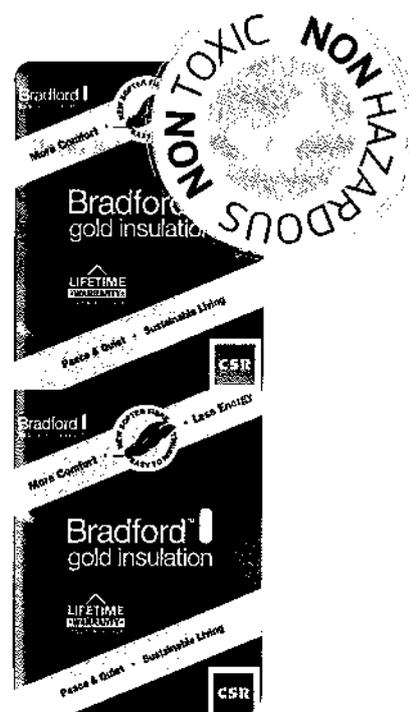
Bradford Gold wall insulation has been designed to reduce energy costs by keeping heat out in summer and heat in during winter.

Specially treated with a water repellent to increase the ability to repel water, a second line of defence in external walls is achieved and gives added protection to internal walls from water damage.

Applications

Bradford Gold wall insulation has been designed to reduce unwanted noise:

- Entering through external walls
- Between rooms within the house when installed into internal walls



Features & Benefits

- Specifically stiffened for use in wall applications
- Pieces are supplied in 580mm widths for 600mm stud centres and can readily be cut to fit other stud spacings
- Softer feel for easy handling
- High recycled content
- 100% Bio-soluble, posing no risk to health
- Low irritant and low allergen
- Lifetime Warranty
- Will not settle over time
- Bradford Gold achieves the best possible fire ratings. Bradford Gold will not ignite or burn and can hinder the spread of flame

Standard Sizes & Packaging

R-Value	BRANZ Appraised	Nominal Thickness (mm)	Standard Size (mm)	Density (kg/m³)	Pieces per pack	Area per pack (m²)	NRC Values
R1.8	✓	90	1160 x 580	8.4	22	14.8	0.85
R2.2	✓	90	1160 x 580	12.6	16	10.8	1.05
R2.4	✓	90	1160 x 580	18.9	10	6.7	-
R2.6	✓ ✓	90	1160 x 580	22	8	5.4	1.10
R2.8	✓ ✓	90	1160 x 580	34	5	3.4	1.10

Acoustic Performance

Product	Frequency (Hz)							NRC
	125	250	500	1000	2000	4000	5000	
R1.8	0.51	0.75	0.90	0.91	1.04	1.01	0.85	0.85
R2.2	0.56	1.00	1.04	1.02	1.05	1.10	1.05	1.05
R2.6	0.35	1.00	1.00	1.00	1.00	1.00	1.00	1.10
R2.8	0.55	1.00	1.00	1.00	1.00	1.00	1.00	1.10

- ✓ Bradford have Environmental Choice ticks against all products that fall within category EC-25-04. All products that can be tested have the green tick. The minimum criteria is R2.5 for walls, R3.4 for ceilings and R1.4 for underfloor products.



BRADFORD™ GOLD WALL INSULATION

Formulation

Bradford's advanced manufacturing processes provides products that are safe for allergy sufferers, allowing you and your family to breathe easy with added piece of mind.

Bradford products are manufactured using the latest FBS-1 bio-soluble formulation which has been assessed as nonhazardous under the National Occupational Health and Safety Commission's guidelines and can be installed with absolute confidence.



Bradford glasswool products do not contain harmful VOC's – Volatile Organic Compounds nor do they contain any harmful amounts of formaldehyde or other organic chemicals.

Technical Leadership

Bradford Gold is manufactured using the latest Arlanda fibre technology, making Bradford Gold products nicer to handle, cut and install, while providing superior performance.

Designing for Sustainability

Bradford Gold is manufactured from up to 65% recycled glass. Much of the recycled content used is not suitable for recycling in other applications.

Zero Ozone Depleting Potential

Bradford Insulation has undertaken an audit of its Glasswool, Rockwool and reflective foil laminate insulation manufacturing processes referencing the US EPA List of Ozone Depleting Substances (Class 1 and Class 2).

This audit found that no ozone depleting substances are involved in either the manufacture or composition of these products.

Physical Properties

Property	Performance	Test Criteria
Maximum Service Temperature	350°C	Bradford recommends where high temperature use is required seek advice from your Bradford office.
Flow Resistivity	0.5 x 10 ⁴ mks Rayls/m	
Fire Resistance	Ignitability 0 Heat Evolved 0 Spread of Flame 0 Smoke Developed 0	When tested in accordance with AS/NZS1530.3:1999
Corrosion Resistance	pH 7.5 - 8.0	When tested in accordance with BS 3958 Part 5 - 1986
Moisture Absorbance	<0.2% by volume	Exposure to an atmosphere of 50°C and 95% relative humidity for four days. Note: IF the insulation becomes wet, full thermal efficiency will be restored on drying out.

Bradford™
for smarter environments

CSR Bradford Insulation
111b Kerwyn Ave, PO Box 204115, Highbrook, Manukau 2161, Auckland
Telephone (+64) 9 968 2160 Facsimile (+64) 9 968 2199 Freephone 0800 277 123

www.bradfordinsulation.co.nz

CSR Bradford Insulation is a business division of CSR Building Products Limited ABN 55 008 631 356

The contents of this brochure are copyright protected and may not be reproduced in any form without prior written consent of CSR Bradford Insulation. Recommendations and advice regarding the use of the products described in this brochure are to be taken as a guide only, and are given without liability on the part of the company or its employees. We reserve the right to change product specifications without prior notification, please refer to the Bradford website for the latest version of this document. The purchaser should independently determine the suitability of the product for the intended use and application.



BRADFORD™ OPTIMO™ UNDERFLOOR

Introduction

Even where homes are well insulated in the ceilings and walls, households could still be losing as much as 15 - 20% of their heating and cooling energy use through the floor.

Product Description

Bradford™ Optimo™ underfloor insulation is a rigid, high density insulation with excellent thermal and acoustic properties, specifically developed to increase the comfort, energy efficiency and safety of homes with timber floors.

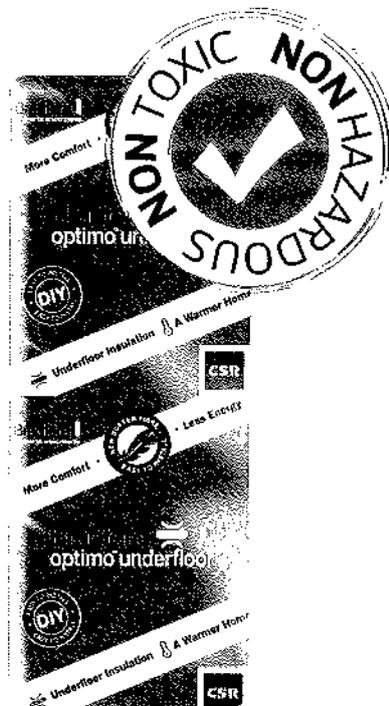
Technical Leadership

Bradford's new softer Arlanda glasswool fibre manufactured to reduce irritation during handling and provides installers, DIY enthusiasts and renovators alike with the softest feeling glasswool the market can offer. The new soft fibre can be identified on the pack with the soft fibre logo.

Arlanda is a globally recognised technology. With a long standing track record in providing high quality glasswool, it is also the chosen technology of Saint-Gobain, the largest insulation company in the world.

Installation

Bradford Optimo is simple to install beneath existing or new timber floors.



The segments are friction fitted and then tightly secured by fixing aluminium straps to the underside of the floor joists. See Optimo underfloor brochure for more detail.

Features & Benefits

- Easy to install
- With an R-Value of 2.6, Optimo is the ultimate in comfort
- R-Value that exceeds the building code
- Available in 2 sizes to accommodate 450mm & 600mm joist centres
- Water repellent
- Softer feel for easy handling
- High recycled content
- 100% Bio-soluble, posing no risk to health
- Low irritant and low allergen
- Lifetime Warranty
- Will not settle over time
- Bradford Gold achieves the best possible fire ratings. Bradford Gold will not ignite or burn and can hinder the spread of flame

Standard Sizes & Packaging

R-Value	Environmental Choice	Nominal Thickness (mm)	Standard Size (mm)	Density (kg/m³)	Pieces per pack	Area per pack (m²)	NRC Values
R2.6	✓	90	1160 x 415	22	8	3.8	1.10
R2.6	✓	90	1160 x 565	22	8	5.2	1.10

Acoustic Performance

Product	Frequency (Hz)							NRC
	125	250	500	1000	2000	4000	5000	
R2.6	0.35	1.00	1.00	1.00	1.00	1.00	1.00	1.10

- ✓ Bradford have Environmental Choice ticks against all products that fall within category EC-25-04. All products that can be tested have the green tick. The minimum criteria is R2.5 for walls, R3.4 for ceilings and R1.4 for underfloor products.



BRADFORD™ OPTIMO™ UNDERFLOOR - DATA SHEET



BRADFORD™ OPTIMO™ UNDERFLOOR

Formulation

Bradford's advanced manufacturing processes provides products that are safe for allergy sufferers, allowing you and your family to breathe easy with added piece of mind.

Bradford products are manufactured using the latest FBS-1 bio-soluble formulation which has been assessed as nonhazardous under the National Occupational Health and Safety Commission's guidelines and can be installed with absolute confidence.



Bradford glasswool products do not contain harmful VOC's - Volatile Organic Compounds nor do they contain any harmful amounts of formaldehyde or other organic chemicals.

Designing for Sustainability

Bradford Gold is manufactured from up to 65% recycled glass. Much of the recycled content used is not suitable for recycling in other applications.

Zero Ozone Depleting Potential

Bradford Insulation has undertaken an audit of its Glasswool, Rockwool and reflective foil laminate insulation manufacturing processes referencing the US EPA List of Ozone Depleting Substances (Class 1 and Class 2).

This audit found that no ozone depleting substances are involved in either the manufacture or composition of these products.

Physical Properties

Property	Performance	Test Criteria
Maximum Service Temperature	350°C	Bradford recommends where high temperature use is required seek advice from your Bradford office.
Flow Resistivity	0.5 x 10 ⁴ mks Rayls/m	
Fire Resistance	Ignitability 0 Heat Evolved 0 Spread of Flame 0 Smoke Developed 0	When tested in accordance with AS/NZS1530.3:1999
Corrosion Resistance	pH 7.5 - 8.0	When tested in accordance with BS 3958 Part 5 - 1986
Moisture Absorbance	<0.2% by volume	Exposure to an atmosphere of 50°C and 95% relative humidity for four days. Note: IF the insulation becomes wet, full thermal efficiency will be restored on drying out.

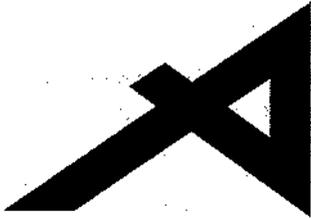
Bradford™
for smarter environments

CSR Bradford Insulation
111b Kerwyn Ave, PO Box 204115, Highbrook, Mairangi 2161, Auckland
Telephone (+64) 9 968 2160 Facsimile (+64) 9 968 2199 Freephone 0800 277 123

www.bradfordinsulation.co.nz

CSR Bradford Insulation is a business division of CSR Building Products Limited ABN 55 008 631 356

The contents of this brochure are copyright protected and may not be reproduced in any form without prior written consent of CSR Bradford Insulation. Recommendations and advice regarding the use of the products described in this brochure are to be taken as a guide only, and are given without liability on the part of the company or its employees. We reserve the right to change product specifications without prior notification, please refer to the Bradford website for the latest version of this document. The purchaser should independently determine the suitability of the product for the intended use and application.



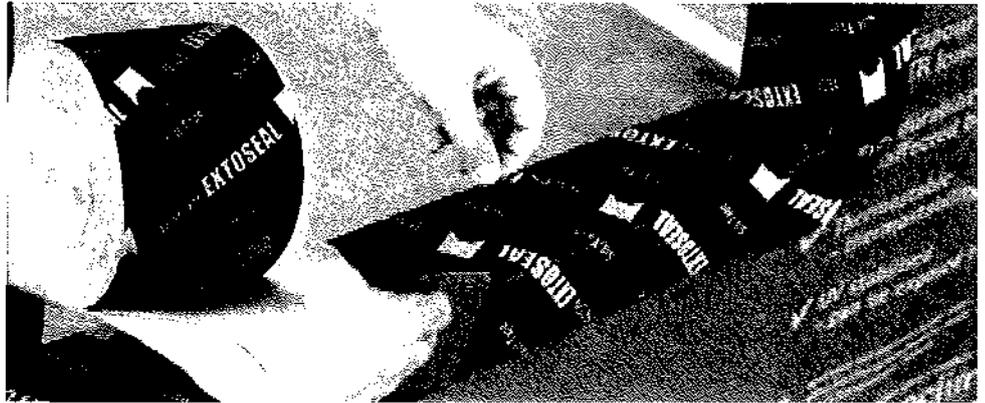
BRANZ Appraised
Appraisal No.815 [2013]

BRANZ Appraisals

Technical Assessments of products
for building and construction

BRANZ
APPRAISAL
No. 815 (2013)

- 1.1 TESCON EXTONSEAL Sill Tape is a flexible flashing tape for use around framed joinery openings as a secondary weather resistant barrier.
- 1.2 The system is installed into and around the framed joinery opening over the building underlay and exposed frame to cover both the face and edge of the opening framing.



TESCON EXTONSEAL SILL TAPE

Pro Clima (NZ) Ltd
PO Box 925
Wellington 6140

Tel: 04 589 8460
Fax: 04 589 8461

Web: www.proclima.co.nz
Email: welcome@proclima.co.nz



BRANZ
BRANZ Limited
Private Bag 50 908
Porirua City
New Zealand
Tel: +64 4 237 1170
Fax: +64 4 237 1171
www.branz.co.nz



2.1 TESCON EXTONSEAL Sill Tape has been appraised as a flexible flashing system for use around window and door joinery openings for buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, Paragraph 1.1; and,
- with a risk score of 0-20, calculated in accordance with NZBC Acceptable Solution E2/AS1, Table 2; and,
- with wall cladding systems complying with NZBC Acceptable Solution E2/AS1 or a valid BRANZ Appraisal that specifies a flexible flashing system; and,
- with flexible wall underlays compatible with the flashing tape; and,
- situated in NZS 3604 Wind Zones up to, and including, 'Extra High'.

2.2 TESCON EXTONSEAL Sill Tape has also been appraised as a flexible flashing system for use around window and door joinery openings for steel framed buildings within the following scope:

- the scope limitations of NZBC Acceptable Solution E2/AS1, with regards to building height and floor plan area; and,
- constructed with steel framing complying with the NZBC; and,
- with a risk score of 0-20, calculated in accordance with NZBC Acceptable Solution E2/AS1, Table 2; and,
- with wall cladding systems covered by a valid BRANZ Appraisal that specifies a flexible flashing system; and,
- with flexible wall underlays compatible with the flashing tape and steel frame; and,
- situated in NZS 3604 Wind Zones up to, and including, 'Extra High'.

New Zealand Building Code (NZBC)

3.1 In the opinion of BRANZ, TESCON EXTONSEAL Sill Tape, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet or contribute to meeting the following provisions of the NZBC:

Clause B2 DURABILITY: Performance B2.3.1(b), 15 years and B2.3.2. TESCON EXTONSEAL Sill Tape meets these requirements. See Paragraphs 8.1 and 8.2.

Clause E2 EXTERNAL MOISTURE: Performance E2.3.2. TESCON EXTONSEAL Sill Tape contributes to meeting this requirement. See Paragraphs 7.1 - 7.4 and 11.1.

Clause F2 HAZARDOUS BUILDING MATERIALS: Performance F2.3.1. TESCON EXTONSEAL Sill Tape meets this requirement and will not present a health hazard to people.

3.2 This is an Appraisal of an **Alternative Solution** in terms of New Zealand Building Code compliance. See Paragraph 7.1.

4.1 System components and accessories supplied by Pro Clima (NZ) Ltd are:

- TESCON EXTONSEAL Sill Tape is a pressure-sensitive, self-adhering, one piece stretchable butyl rubber based sill tape with a release backing paper. The core of the tape is coloured grey with a black polyethylene upper layer which bears the product and manufacturer's name. The tape is supplied in rolls of 150 mm and 200 mm width and a length of 20 m. The rolls are wrapped in clear plastic.
- Pro Clima PRESSFIX application tool to aid installation of the tape.

Handling and Storage

5.1 Handling and storage of all materials supplied by Pro Clima (NZ) Ltd, whether on or off site, is under the control of the installer. TESCON EXTONSEAL Sill Tape must be protected from damage and weather. Rolls must be stored under cover, in clean, dry conditions away from direct exposure to sunlight.

Technical Literature

6.1 Refer to the Appraisals listing on the BRANZ website for details of the current Technical Literature for the TESCON EXTONSEAL Sill Tape. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance contained in the Technical Literature and within the scope of this Appraisal must be followed.

General

General

7.1 TESCON EXTONSEAL Sill Tape has been assessed against BRANZ criteria which is an alternative solution to the test method referenced by NZBC Acceptable Solution E2/AS1 Paragraph 9.1.5(b). The installation method for TESCON EXTONSEAL Sill Tape follows the installation guidelines shown within NZBC Acceptable Solution E2/AS1, Figures 72A and 72B.

7.2 The use of flexible flashing systems around window and door joinery openings is critical to assist the overall weathertightness performance of window and door joinery installations.

7.3 TESCON EXTONSEAL Sill Tape is designed to prevent air leakage and water penetration around window and door openings at framing junctions (e.g. at the sill trimmer and opening stud junction), and to keep any water that gets past the cladding, or through the joinery, from direct contact with the framing timber.

7.4 TESCON EXTONSEAL Sill Tape is not designed to overcome poor detailing and workmanship of the window or door joinery installation. The system must not be considered in isolation, but be considered as part of the wall cladding system. TESCON EXTONSEAL Sill Tape is designed to be used in conjunction with air seals and joinery flashing systems, not as a substitute.

7.5 When the TESCON EXTONSEAL Sill Tape is used in conjunction with LOSP (light organic solvent preservative) treated timber, the solvent from the timber treatment must be allowed to evaporate (generally at least one week) prior to the installation of the system.

Durability

8.1 Assessment of durability to meet the NZBC is based on difficulty of access and replacement, and the ability to detect failure of the TESCON EXTONSEAL Sill Tape both during normal use and maintenance of the building.

Serviceable Life

8.2 Provided it is not exposed to the weather or ultra-violet light for a total of more than 30 days, and provided the exterior cladding is maintained in accordance with the cladding manufacturer's instructions and the cladding remains weather resistant, TESCON EXTONSEAL Sill Tape is expected to have a serviceable life equal to that of the cladding.

Maintenance

9.1 No maintenance is required for TESCON EXTONSEAL Sill Tape. Regular checks, at least annually, must be made of the junctions between the joinery and wall cladding to ensure that they are maintained weathertight and that the primary means of weather resistance for the junction e.g. flashing, sealant, etc continues to perform its function, to ensure that water will not penetrate the cladding.

Prevention of Fire Occurring

10.1 TESCON EXTONSEAL Sill Tape must be separated from fireplaces, heating appliances, flues and chimneys in accordance with the requirements of NZBC Acceptable Solutions C/AS1 to C/AS6, Paragraph 7.5.9 for the protection of combustible materials.

External Moisture

11.1 Where a cladding manufacturer specifies the use of generic flashing tape around window and door joinery openings at framing junctions as part of their system, or they specify the use of flexible flashing tapes that comply with NZBC E2/AS1, Paragraph 9.1.5(b), TESCON EXTONSEAL Sill Tape may be used.

Installation Skill Level Requirements

Installation Skill Level Requirements

12.1 Installation of the TESCON EXTONSEAL Sill Tape must be completed by tradespersons with an understanding of flexible flashing tape systems, in accordance with instructions given within the TESCON EXTONSEAL Sill Tape Technical Literature and this Appraisal.

General

13.1 The selected wall underlay must be installed in accordance with the manufacturer's instructions, and must completely cover the joinery opening. The underlay is then cut on a 45° angle away from each corner of the opening so the flaps can be folded into the opening and secured to the interior face of the timber framing.

13.2 Before the TESCON EXTONSEAL Sill Tape is applied, the substrate surfaces must be clean, dry and free from any surface contaminants such as dust and grease that may cause loss of adhesion.

13.3 A length of TESCON EXTONSEAL Sill Tape must then be cut to the length of the sill plus 200 mm. The tape is installed flush with the interior face of the opening and is applied along the entire length of the sill and minimum 100 mm up each jamb. The overhanging tape is folded onto the face of the wall underlay.

13.4 A 200 mm length of TESCON EXTONSEAL Sill Tape must be installed minimum 100 mm down the jamb and minimum 100 mm along the lintel at each of the top corners of the window or door joinery opening.

13.5 At the corners, the TESCON EXTONSEAL Sill Tape is fanned out over the face of the wall and pressed firmly onto the wall underlay, taking care not to overstretch the tape.

13.6 Ensure that adequate adhesion of the tape to the wall underlay is achieved by using the Pro Clima PRESSFIX tool and that the tape is installed tight into the sill/jamb junction.

13.7 TESCON EXTONSEAL Sill Tape must not be over stretched. To avoid wastage, the tape can be lapped 100 mm minimum onto itself without reducing the performance of the TESCON EXTONSEAL Sill Tape.

13.8 If the TESCON EXTONSEAL Sill Tape is exposed to the weather or UV light for more than 30 days, then it must be replaced with new material.

Installation Temperature

13.9 The TESCON EXTONSEAL Sill Tape must not be installed where the ambient air and substrate temperatures are less than -5°C. Care is required to ensure adhesion is still able to be achieved when the temperature is less than 0°C.

(Note: Pro Clima (NZ) Ltd claims an installation temperature of -20°C. This claim has not been assessed by BRANZ and is therefore outside the scope of this Appraisal.)

Inspections

13.10 The Technical Literature must be referred to during the inspection of TESCON EXTONSEAL Sill Tape installations.

Quality

16.1 The manufacture of the TESCON EXTONSEAL Sill Tape has been examined on behalf of BRANZ, including methods adopted for quality control. Details of the quality and composition of the materials used were obtained and found to be satisfactory.

16.2 The quality of supply to the market is the responsibility of Pro Clima (NZ) Ltd.

16.3 Designers are responsible for the building design, and building contractors are responsible for the quality of installation of framing systems and wall underlays in accordance with the instructions of the designer.

16.4 The quality of installation, handling and storage on site is the responsibility of the installer in accordance with the instructions of Pro Clima (NZ) Ltd.

Sources of Information

- ICC Evaluation Service, Inc, AC148 Acceptable Criteria for Flexible Flashing Materials, July 2001.
- NZS 3604: 2011 Timber-framed buildings.
- Compliance Document for New Zealand Building Code External Moisture Clause E2, Department of Building and Housing, Third Edition July 2005 (Amendment 5, 1 August 2011).
- Ministry of Business, Innovation and Employment Record of Amendments for Compliance Documents and Handbooks.
- The Building Regulations 1992.

Technical Literature

The following is a summary of the technical investigations carried out:

Tests

14.1 The TESCON EXTONSEAL Sill Tape has been tested to BRANZ criteria to assess the tensile strength of control and UV aged material, nail sealability, water resistance of control and UV accelerated aged material and pliability. BRANZ has determined that the tape is fit for purpose for the intended use. The adhesion of TESCON EXTONSEAL Sill Tape to black bituminous Kraft paper complying with the requirements of NZBC Acceptable Solution E2/AS1, Table 23 and other selected synthetic wall underlays has also been tested and found to be satisfactory.

Other Investigations

15.1 An assessment was made of the durability of the TESCON EXTONSEAL Sill Tape by BRANZ technical experts.

15.2 Site inspections were carried out by BRANZ to examine the practicability of installation.

15.3 The Technical Literature has been reviewed by BRANZ and found to be satisfactory.



BRANZ

In the opinion of BRANZ, TESCO
EXTOSEAL Sill Tape is fit for
purpose and will comply with
the Building Code to the extent
specified in this Appraisal provided
it is used, designed, installed
and maintained as set out in this
Appraisal.

The Appraisal is issued only to
Pro Clima (NZ) Ltd, and is valid
until further notice, subject to the
Conditions of Appraisal.

Conditions of Appraisal

1. This Appraisal:
 - a) relates only to the product as described herein;
 - b) must be read, considered and used in full together with the technical literature;
 - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
 - d) is copyright of BRANZ.
2. Pro Clima (NZ) Ltd:
 - a) continues to have the product reviewed by BRANZ;
 - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
 - c) abides by the BRANZ Appraisals Services Terms and Conditions.
 - d) Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
 - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
 - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
 - c) any guarantee or warranty offered by Pro Clima (NZ) Ltd.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to Pro Clima (NZ) Ltd or any third party.

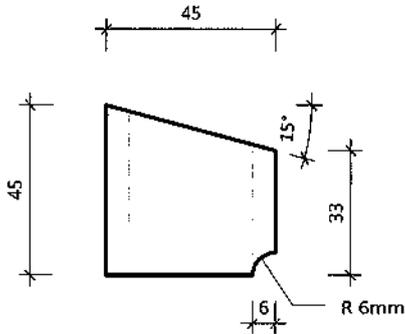
For BRANZ

P Burghout
Chief Executive

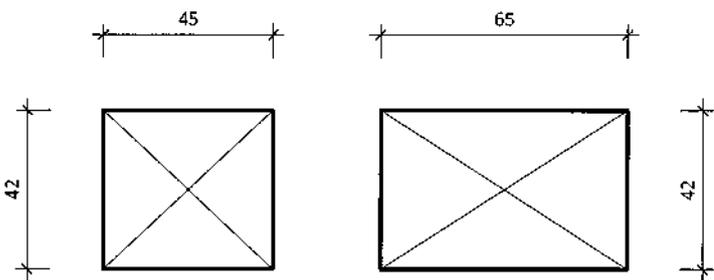
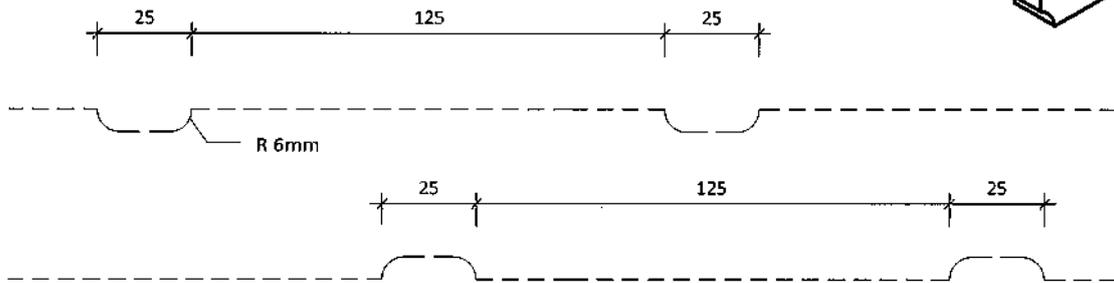
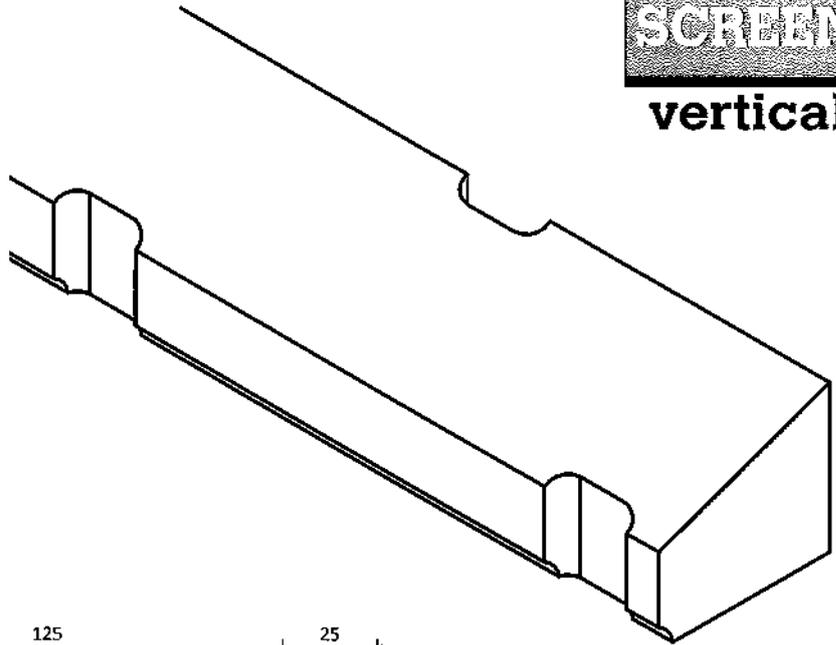
Date of issue: 17 June 2013



vertical



CS-H 45



CS-V 45

CS-V 45

	<h1>Rosenfeld Kidson</h1>	<p>Auckland Branch: 513 Mt Wellington Highway Mt Wellington, Auckland 1060 T. +64 9 573 0503 F. +64 9 573 0504</p>	<p>Christchurch Branch: 15 Edmonton Road, Hornby Christchurch 8042 T. +64 3 349 3316 F. +64 3 349 3317</p>	<p>Title RKV 45mm Cavity Batts</p>
		<p>Postal address: PO Box 621, Shortland Street, Auckland 1140</p>	<p>Drawing RKV45-BATT</p>	<p>Scale 1 : 2 @ A4 Date 02.04.2013</p>
<p>www.rosenfeldkidson.co.nz</p>		<p>Copyright 2012 ROSENFELD KIDSON & CO, LTD. all rights reserved. Details may be subjects to change without notification</p>		



cedar
SCREEN

vertical

400mm to 600mm max crs

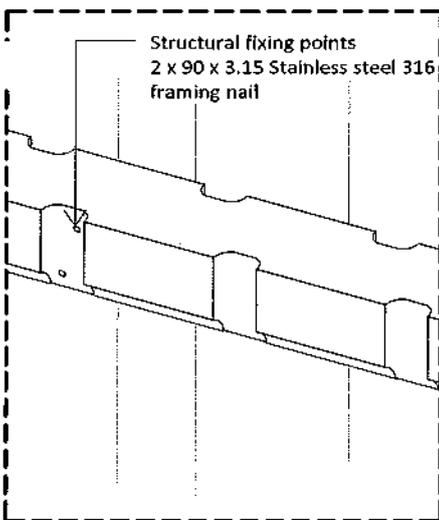
Timber framing

CS-H 45 Structural
cavity batten

Dwang

Dwang

Structural fixing points
2 x 90 x 3.15 Stainless steel 316
framing nail



**Rosenfeld
Kidson**

www.rosenfeldkidson.co.nz

Auckland Branch:
513 Mt Wellington Highway
Mt Wellington, Auckland 1060
T. +64 9 573 0503
F. +64 9 573 0504

Christchurch Branch:
15 Edmonton Road, Hornby
Christchurch 8042
T. +64 3 349 3316
F. +64 3 349 3317

Postal address: PO Box 621, Shortland Street, Auckland 1140

Title **Structural Cavity Batten
Detail**

Drawing

RKV45-RU-48

Scale 1 : 10 @ A4 Date 02.04.2013

Product Information Silicone Sealants

DOW CORNING

Dow Corning® 795 Silicone Building Sealant

FEATURES

- Suitable for most new construction and remedial sealing applications
- Versatile – high performance structural glazing and weather sealing from a single product
- Available in 13 standard colors; custom colors also available

BENEFITS

- Excellent weatherability – virtually unaffected by sunlight, rain, snow, ozone and temperature extremes of -40°F (-40°C) to 300°F (149°C)
- Excellent unprimed adhesion to a wide variety of construction materials and building components, including anodized, alodined, most coated and many Kynar®¹-painted aluminums²
- Ease of application – ready to use as supplied
- Ease of use – all-temperature gunnability, easy tooling and low-odor cure byproduct
- Meets global standards (Americas, Asia and Europe)

COMPOSITION

- One-part, neutral-cure, RTV silicone sealant

Neutral, one-part silicone sealant

APPLICATIONS

- Structural and nonstructural glazing
- Structural attachment of many panel systems
- Panel stiffener applications
- Weather sealing of most common construction materials including glass, aluminum, steel, painted metal, EIFS, granite and other stone, concrete, brick and plastics

TYPICAL PROPERTIES

Specification Writers: These values are not intended for use in preparing specifications. Please contact your local Dow Corning sales office or your Global Dow Corning Connection before writing specifications on this product.

Test	Property	Unit	Result
As Supplied			
ASTM C 679	Tack-Free Time, 50% RH	hours	3
	Curing Time at 25°C (77°F) and 50% RH	days	7-14
	Full Adhesion	days	14-21
ASTM C 639	Flow, Sag or Slump	Inches (mm)	0.1 (2.54)
	Working Time	minutes	20-30
	VOC Content ¹	g/L	28
As Cured-After 21 days at 25°C (77°F) and 50% RH			
ASTM D 2240	Durometer Hardness, Shore A	points	35
ASTM C 794	Peel Strength	lb/in (kg/cm)	32 (5.7)
ASTM C 1135	Tension Adhesion Strength		
	At 25% extension	psi (MPa)	45 (0.310)
	At 50% extension	psi (MPa)	60 (0.414)
ASTM C 719	Joint Movement Capability	percent	±50
ASTM C 1248	Staining (granite, marble, limestone, brick and concrete)		None
As Cured-After 21 days at 25°C (77°F) and 50% RH followed by 10,000 hours in a QUV weatherometer, ASTM G 53			
ASTM C 1135	Tensile Adhesion Strength		
	At 25% extension	psi (MPa)	35 (0.241)
	At 50% extension	psi (MPa)	50 (0.345)

¹Based on South Coast Air Quality Management District of California. Maximum VOC is listed both inclusive and exclusive of water and exempt compounds. For a VOC data sheet for a specific sealant color, please send your request to product.inquiry@dowcorning.com.

DESCRIPTION

Dow Corning® 795 Silicone Building Sealant is a one-part, neutral-cure, architectural-grade sealant that easily extrudes in any weather and cures quickly at room temperature.

This cold-applied, non-sagging silicone material cures to a medium-modulus silicone rubber upon exposure to atmospheric moisture. The cured sealant is durable and flexible enough to accommodate ±50 percent movement of original joint dimension

¹Kynar is a trademark of Atofina Chemicals Inc.

²Contact your local Dow Corning Sales Application Engineer for specifics.

when installed in a properly designed weather seal joint. In a properly designed structurally glazed joint, the sealant is strong enough to support glass and other panel materials under high wind load.

APPROVALS/ SPECIFICATIONS

Dow Corning 795 Silicone Building Sealant meets the requirements of:

- Federal Specification TT-S 001 543A (COM-NBS) Class A for silicone building sealants
- Federal Specification TT-S-00230C (COM-NBS) Class A for one-component building sealants
- ASTM Specification C 920 Type S, Grade NS, Class 50, Use NT, G, A and O
- ASTM Specification C 1184 for structural silicone sealants
- Canadian Specification CAN2-19.13- M82



**SEALANT-WATERPROOFING
& RESTORATION INSTITUTE**

Issued to: Dow Corning Corp.®
Product: 795 Silicone Building Sealant

C719: Pass Ext:+50% Comp:-50%

Substrate: Glass, Aluminum, Kynar
(Glass and Aluminum Substrates were tested unprimed;
Dow Corning 1200 OS Primer used on Kynar substrates)

C661: Rating 41

Validation Date: 9/11/12 - 9/10/17

No. 912-SBS917 Copyright © 2012

SEALANT VALIDATION
www.swrionline.org

COLORS

Dow Corning 795 Silicone Building Sealant is available in 13 colors: white, limestone, champagne, natural stone, gray, black, bronze, sandstone, adobe tan, dusty rose, rustic brick, blue spruce, and charcoal. Custom colors may be ordered to match virtually any substrate.

HOW TO USE

Please consult the *Dow Corning Americas Technical Manual*, Form No. 62-1112, for detailed information on state-of-the-art application methods and joint design. Please

contact your local Dow Corning Sales Application Engineer for specific advice.

Preparation

Clean all joints, removing all foreign matter and contaminants such as grease, oil, dust, water, frost, surface dirt, old sealants or glazing compounds and protective coatings.

Application Method

Install backing material or joint filler, setting blocks, spacer shims and tapes. Mask areas adjacent to joints to ensure neat sealant lines. Primer is generally not required on non-porous surfaces, but may be necessary for optimal sealing of certain porous surfaces. A test placement is always recommended. Apply *Dow Corning 795 Silicone Building Sealant* in a continuous operation using positive pressure. (The sealant can be applied using many types of air-operated guns and most types of bulk dispensing equipment.) Before a skin forms (typically within 15 minutes), tool the sealant with light pressure to spread the sealant against the backing material and joint surfaces. Remove masking tape as soon as the bead is tooled.

HANDLING

PRECAUTIONS

PRODUCT SAFETY

INFORMATION REQUIRED FOR SAFE USE IS NOT INCLUDED IN THIS DOCUMENT. BEFORE HANDLING, READ PRODUCT AND MATERIAL SAFETY DATA SHEETS AND CONTAINER LABELS FOR SAFE USE, PHYSICAL AND HEALTH HAZARD INFORMATION. THE MATERIAL SAFETY DATA SHEET IS AVAILABLE ON THE DOW CORNING WEBSITE AT DOWCORNING.COM, OR FROM YOUR DOW CORNING SALES APPLICATION ENGINEER, OR DISTRIBUTOR, OR BY CALLING DOW CORNING CUSTOMER SERVICE.

USABLE LIFE AND STORAGE

When stored at or below 27°C (80°F), *Dow Corning 795 Silicone Building Sealant* has a shelf life of 12 months from the date of manufacture. Refer to product packaging for "Use By Date."

PACKAGING INFORMATION

Dow Corning 795 Silicone Building Sealant is supplied in 10.3-fl oz (305-mL) disposable plastic cartridges that fit ordinary caulking guns, 20-fl oz (590-mL) sausages and 2- and 4.5-gal (7.5- and 17-L) bulk containers.

LIMITATIONS

Dow Corning 795 Silicone Building Sealant should not be used:

- In structural applications without prior review and approval by your local Dow Corning Sales Application Engineer
- In below-grade applications
- When surface temperatures exceed 50°C (122°F) during installation
- On surfaces that are continuously immersed in water
- On building materials that bleed oils, plasticizers or solvents that may affect adhesion
- On frost-laden or wet surfaces
- In totally confined joints (the sealant requires atmospheric moisture for cure)
- If the sealant is intended to be painted (paints do not typically adhere to most silicone sealants)
- To surfaces in direct contact with food or other food-grade applications

This product is neither tested nor represented as suitable for medical or pharmaceutical uses.

HEALTH AND ENVIRONMENTAL INFORMATION

To support Customers in their product safety needs, Dow Corning has an extensive Product Stewardship organization and a team of Product Safety and Regulatory Compliance (PS&RC) specialists available in each area.

For further information, please see our Web site, dowcorning.com or consult your local Dow Corning representative.

LIMITED WARRANTY INFORMATION – PLEASE READ CAREFULLY

The information contained herein is offered in good faith and is believed to be accurate. However, because conditions and methods of use of our products are beyond our control, this information should not be used in substitution for customer’s tests to ensure that our products are safe, effective, and fully satisfactory for the intended end use. Suggestions of use shall not be taken as inducements to infringe any patent.

Dow Corning’s sole warranty is that our products will meet the sales specifications in effect at the time of shipment.

Your exclusive remedy for breach of such warranty is limited to refund of purchase price or replacement of any product shown to be other than as warranted.

DOW CORNING SPECIFICALLY DISCLAIMS ANY OTHER EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE OR MERCHANTABILITY.

DOW CORNING DISCLAIMS LIABILITY FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.

We help you invent the future.™

dowcorning.com

Dulux[®]

Worth doing, worth Dulux.

Dulux[®]

POWDER & INDUSTRIAL COATINGS

Fluoroset[®] FP

A Super durable warranted Fluoropolymer Powder Coating

Product Code:	964 Line
Specification met:	Meets and/or exceeds requirements of AAMA2605

Description

Fluoroset[®] FP is a range of Fluoropolymer powder coatings designed specifically for architectural applications where colour and gloss retention are critical for prestigious architectural projects. Fluoroset[®] FP is formulated with advanced Fluoropolymer (Lumiflon[®]) resin technology and utilising high performance pigments to conform with the performance requirements of AAMA2605-98 (New AAMA specification released for Superior Performing Organic Coatings) . Fluoroset[®] FP will give increased gloss and colour retention over high durability polyesters and matches Fluoropolymer liquid systems whilst deriving increased mar resistance by virtue of its thermosetting chemistry.

Features**Benefits**

20 year film integrity	Guaranteed performance on correctly pre-treated aluminium
20 Year gloss retention warranty	Long intact life of coating
20 year colour warranty	Very good colour retention
A 1 coat system	Reduced application costs vs equivalent liquid coatings
Registered applicators	Quality assurance systems in place
High transfer efficiency	Increased first pass transfer
Low cure	Cost savings on Energy or increased line speeds
Good flow out	Smooth film appearance
No solvents or emissions	Less waste and pollution to the environment
Tough polyester	Hard wearing/serviceable finish

Uses

Fluoroset[®] FP Powder Coating has been developed for use on extruded architectural aluminium, including window and door frames and panel cladding on commercial and prestigious buildings.

Performance Guide

Weather	AAMA 2605-98. (10 years) Chalking No. 8 for colours, No. 6 for whites Colour Change $\Delta E < 5$ Gloss retention $> 50\%$.	Salt Spray	Excellent salt spray resistance over pretreated aluminium. Pass 4000 hrs
Heat	Excellent resistance to 90°C continuous service conditions.	Humidity	Excellent resistance to 35°C/100% humidity for 4000 hours on pre-treated aluminium.
Acid	Muriatic Acid - unaffected Nitric Acid - Pass $\Delta E < 5$.	Abrasion	Pass abrasion co-efficient > 40
Alkali	Resistant to spills of dilute alkali. Avoid contact.	Pencil Hardness	Min H - 2F
Flexibility	Pass - no tape removal of film	Cross Hatch Adhesion	Dry - Pass, Wet - Pass Boiling Water - Pass

Fluoraset® FP

Chemical Resistance				
Mortar	Resistant	Resistant (24 hr Pat Test)	White Spirits	Resistant
Ethanol	Resistant		Xylene	Slight softening/limit contact
Methyl Ethyl Ketone	Softens/avoid contact		Ethyl Acetate	Softens/avoid contact

Product Guide			
Colour	A limited range of made to order solid and pearl colours	Specific gravity	1.3 - 1.7 @ colour
Gloss Level	25 - 98% at 60° as required	Shelf life	6 months when stored below 25°C @ 50 - 60% r / humidity
Toxicity	Refer CDS (No 14142201)		

Application Data			
Application Method	Electrostatic spray.		
Clean Up	Dust or vacuum loose powder. Avoid use of compressed air.		
Cure Schedule	Metal Temperature (°C)	Time (minutes)	
	210	15	
	200	20	
Cured Film Thickness	Recommended:	40 µm	
	Range:	30 - 80 µm	

Theoretical spreading rate at recommended film thickness
 A coverage rate of 12 - 14m²/kg is commonly experienced. Practical spreading rates will vary due to such factors as method and conditions of application and surface profile and texture..

Application Guide		
Surface Preparation		
Surfaces should be prepared according to AS1627.6-2003 Section 3 to achieve a conversion coating corresponding to Class 1. Chemical supplier recommendations should also be adhered to, as appropriate. Suitable pre-treatment includes:		
Aluminium	Chrome/Chromate	(refer AS1627.6-2003)

Application Procedure and Equipment	
Applied by Dulux Powder Coatings Fluoraset® FP1 Registered Applicators with equipment and control systems to enable correct metal pre-treatment and control of the application and stoving as set out in the Fluoraset® FP Applicators Manual.	
1a)	For fluidised bed, ensure uniform fluidisation of powder. Fluidised powder should resemble "simmering liquid". Aged or compacted powder may require pre-conditioning for several minutes to fluidise evenly.
1b)	For box feeders, ensure probe is fully inserted in powder and operated as per manufacturer's recommendations.
2.	Apply by electrostatic spray.
3.	Cure as per recommendations outlined above.
	Care should be exercised when stoving at 210°C or above as some colours are prone to discolouration.
4.	Test for cure of the coating by contact with a drop of Corsoi PGMA (available from Dulux Powder Coatings) for 30 seconds. Surface should be wiped dry and immediately checked for softening. Only slight surface softening should occur.

Care and Maintenance	
Reference should be made to AAMA610.1:1979 standard for cleaning of surfaces. This is a condition of the warranty.	
In broad terms, cleaning of externally located powder coating surfaces must take place every six months. Where salts/pollutants are more prevalent such as seaside and industrial areas, a cleaning program should be carried out more frequently.	
THREE STEPS TO CLEANING POWDER COATED SURFACES	
1.	Remove loose deposits with a wet sponge (avoid scratching the surface by dry dusting).
2.	Using a soft clean cloth and a mild detergent in warm water, clean the powder coating to remove dust, salt or other deposits.
3.	Always rinse after cleaning with fresh water to remove any remaining detergent.

Fluoraset® FP

WARNING: In some cases, strong solvents recommended for thinning various types of paints and also for cleaning up mastics/sealants are harmful to the extended life of the powder coated surface. These solvents should not be used for cleaning purposes and will render the warranty void if used. If paint splashes or sealants/mastics need to be removed then the following solvents can be used safely: Methylated Spirits, Ethyl Alcohol, Isopropanol.

Health and Safety

The MSDS is an integral part of using this product as it contains information on the potential health effect of exposure, personal protective equipment needed and other relevant SH&E information.

For detailed information, refer to product label and the current Chemical Data Sheet (No. 3969) available through Sales and Customer Service Offices.

Phone: Australia:-	13 24 99	New Zealand:-	09 441 8244.
--------------------	----------	---------------	--------------

Precautions and Limitations

- Strong, bold colours may not necessarily meet these criteria and so should be referred to Dulux Powder Coatings before specifying.
- As a result of possible wide application variations and stoving conditions, some products and colours may show a variance between Dulux Powder Coatings prepared samples and production applied material. Therefore, it is the applicator and/or their customer's responsibility to ensure the product conforms to their requirements.
- For optimum performance ensure recommended dry film thickness is obtained. Not recommended for use in highly corrosive environments such as severe marine or industrial locations.
- Not recommended for components which are exposed to constant temperatures exceeding 90°C.
- Dulux Powder Coatings is under no obligation to replace product or repair damages that may result from the use of this product in any way other than stated on the Product data sheet or Material safety data sheet.

Transport and Storage

Sizes:	20 kg	Flashpoint:	N/A
Weight:	20 kg	UN:	N/A
Dangerous Goods Class:	N/A	Package Group:	N/A
Shipment Name:	Not dangerous goods. No special transport requirements.		

	Dulux Powder & Industrial Coatings	Dulux Powder & Industrial Coatings	
	1-15 Pound Road West	31B Hillside Road	
	Dandenong South, Victoria, 3175	Glenfield, Auckland 0627	
	Australia	New Zealand	
	ACN 004 117 828		
Telephone:	61 3 8787 4500	64 9 441 8244	
Fax:	61 3 8787 4542	64 9 441 8242	

Dulux and Other marks followed by ® are registered trademarks. Marks followed by the symbol ™ are trademarks.

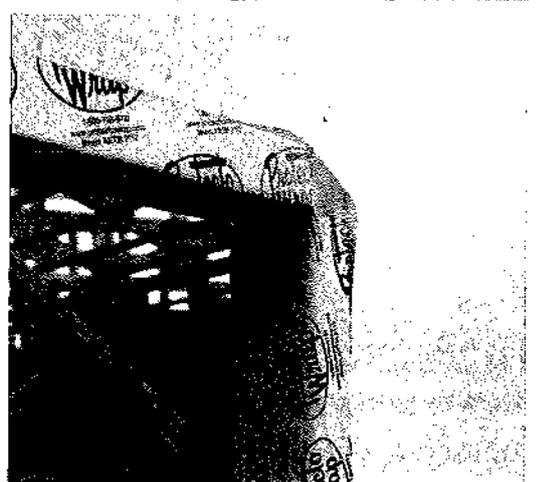
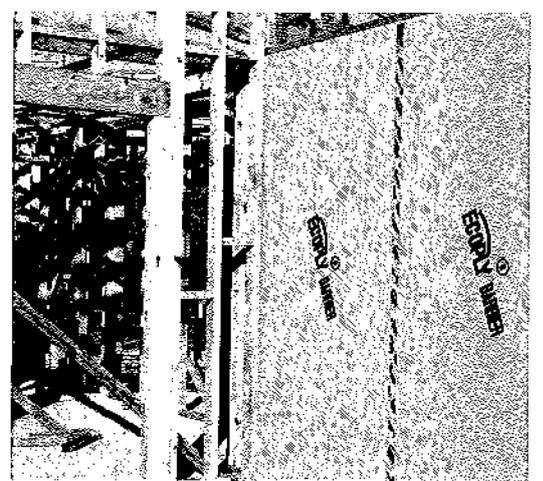
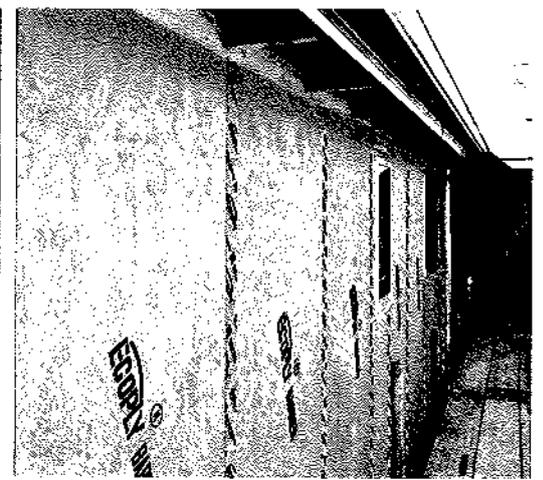
© Copyright 2004

DISCLAIMER: Any advice, recommendation, information, assistance or service provided by Dulux Powder Coatings in relation to goods manufactured by it or their use and application is given in good faith and is believed by Dulux Powder Coatings to be appropriate and reliable. However, any advice, recommendation, information, assistance or service provided by Dulux Powder Coatings provided without liability or responsibility PROVIDED THAT the foregoing shall not exclude, limit, restrict or modify the right entitlements and remedies conferred upon any person or the liabilities imposed upon Dulux Powder Coatings by any condition or warranty implied by applicable legislation, regulation or other Government ordinance voiding or prohibiting such exclusion, limitation or modification

ecoply Barrier

Proven. Durable. Strong.

Specification & Installation Guide
June 2011



Contents

1.0 Ecoply Barrier	2
1.1 Ecoply Barrier Advantages	2
2.0 Ecoply Brand	2
3.0 Technical Information and CAD Details	2
4.0 Ecoply Barrier Products	3
4.1 Building Materials for Use with Ecoply Barrier	3
5.0 Design Considerations	4
6.0 Installation	5
6.1 Framing	5
6.2 Fasteners	6
6.3 Fastener Durability	6
6.4 Sheer Layout	7
6.5 Ground Clearances	7
6.6 Vertical Sheer Joints	8
6.7 Horizontal Sheer Joints	8
6.8 Internal & External Corners	9
6.9 Corner Junctions to Horizontal Joints	9
6.10 Window Penetrations	10
6.11 Service Penetrations	10
6.12 Structural Gaps	11
6.13 Cladding System Installation	11

1.0 ECOPLY® BARRIER

Ecoply® Barrier provides a weather tight rigid air barrier for drained and vented cavity systems outside the building frame effectively replacing traditional building wrap in the cavity while providing superior structural bracing and forming a strong secondary line of defence against moisture penetration into the building envelope.

Ecoply Barrier is suitable for use in both residential and commercial buildings and consists of a 7 mm thick structural plywood panel which is sealed on the face and edges using an advanced polyester powder coating process for increased sheet durability and protection from moisture penetration.

Ecoply Barrier meets the NZ Building Code rigid sheathing performance requirements as outlined in Section 9.1.4 and Table 23 of E2/ AS1 and has been tested to 4.5kPa ultimate limit and 3.3kPa serviceability limit using a 12 mm sheet cladding in accordance with AS/NZS 4284:2008 Testing of Building Facades.

1.1 ECOPLY BARRIER ADVANTAGES

- Fully tested code compliant rigid air barrier system
- Special water repellent face coating
- High structural bracing when installed as per bracing specifications
- Temporary weather protection to the building envelope for up to 6 months prior to cladding installation
- Fast building close in for an earlier interior start and a quicker overall build time
- Low formaldehyde emission level (E₀)
- Manufactured from sustainable plantation pine
- Available FSC certified (SCS-COC-001316) upon request

2.0 ECOPLY® BRAND

Ecoply is New Zealand's leading brand of structural plywood and is manufactured by CHH Woodproducts under a third party audited quality control programme to monitor compliance with AS/NZS 2269 - Plywood Structural.

3.0 TECHNICAL INFORMATION AND CAD DETAILS

Product test reports, technical data sheets and CAD drawings referenced in this guide are downloadable at www.chhwoodproducts.co.nz

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

The information contained in this manual relates to the Ecoply products and is not intended to be used as a substitute for professional advice. The user should consult a qualified professional for advice on the use of Ecoply products in their specific application. Ecoply products are not intended for use in applications where they are not specifically designed for use.

The information contained in this manual is for general information only and does not constitute an offer of any product. The user should consult a qualified professional for advice on the use of Ecoply products in their specific application. Ecoply products are not intended for use in applications where they are not specifically designed for use.

4.0 ECOPLY® BARRIER PRODUCTS

TABLE E: PRODUCT RANGE

Description	Weight (kg/m ²)	Thickness (mm)	Width (mm)	Length (mm)
Ecoply® Barrier Structural Plywood with factory applied proprietary coating to sheet surface and edges	4.0	7 mm	1200	2440 2745

4.1 BUILDING MATERIALS FOR USE WITH ECOPLY® BARRIER

Materials Available from CHH Woodproducts

- Ecoply® Sealing Tape 60 mm x 30 m for vertical, internal and external sheet joints
- Cavity Batten - 47 x 21 mm Merch Grade

Materials Not Available from CHH Woodproducts

- PVC horizontal flashing, Use Ecoply Horizontal Joiner (Product code RDZF7) supplied by E2 Flashing Solutions
- PVC cavity closure flashing or acceptable flashing with Tables 20 and 21 of E2/AS1
- Fasteners - refer to Section 6.2: Fasteners
- Window and penetration flexible flashing tapes

Recommended Window and Penetration flexible flashing tape suppliers

Flexible flashing tapes must comply with Parts 3.2 and 4 of ICBO Acceptable Criteria AC148.

- Protecto Wrap - 0800 776 9727, www.protectowrap.co.nz
- Thermakraft - 0800 806 595, www.thermakraft.co.nz

ECO DESIGN CONSIDERATIONS

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.

Preservative Treatment

Ecoply® Barrier is treated in accordance with AS/NZS 1604.3 with H3.2 CCA (Copper Chrome Arsenate) water borne treatment.

H3.2 CCA treated plywood in accordance with AS/NZS 1604.3 is described as suitable for: "outside, above ground, suitable to periodic moderate wetting and leaching."

Cut Sheets

Ecoply Barrier is envelope preservative treated. If a sheet end is cut place the cut end to the top. Always have a sealed sheet end at the bottom to avoid potential moisture ingress into the panel.

All other cuts and penetrations must be covered by a suitable flexible flashing tape and installed as per Ecoply Barrier literature.

When installed as per the above requirements, cut edges and penetrations are not required to be resealed with a brush on preservative treatment however if desired CHH® Woodproducts recommends the use of Holdfast Metalex End Seal.

Dimensional Sheet Change

Detailing and construction using Ecoply Barrier must allow for natural movement in line with normal cycles of moisture change occurring in the external environment.

The total expansion both along and across a 2440 x 1200 mm panel can be in the order of 1.5 mm to 3 mm dependent upon the natural environment. Detailing and construction practise should take the potential for natural movement into consideration.

Ecoply Barrier sheets may exhibit slight sheet bowing across the sheet resulting from the preservative treatment and surface coating processes. This is to be expected and will not affect the products structural performance or weather tightness when installed as per specifications.

Formaldehyde

Formaldehyde occurs naturally in the environment and is emitted by processes such as combustion, decay and naturally by all timber species. Ecoply Barrier meets the lowest formaldehyde emission classification (E₀ - less than 0.5 mg/ litre).

Wind Loadings

Ecoply Barrier is suitable for use in all wind zones up to and including extra high (up to 55 m/s) in New Zealand as defined by NZS 3604 and has been tested to 4.5kPa ultimate limit and 3.3kPa serviceability limit in accordance with the AS/NZS 4248:2008 Testing of Building Facades in conjunction with a 12 mm sheet cladding (ie: Shadowclad® exterior cladding) on a drained cavity system.

For Ecoply Barrier section properties refer to Section 1.5: Section Properties in the Ecoply Specification and Installation Guide.

Sustainability

Ecoply Barrier is manufactured from radiata pine, a plantation grown medium density softwood. 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.

Ecoply Barrier is available Forestry Stewardship Council (SCS-COC-001316) certified upon request.

Health & Safety

Ecoply Barrier should be handled in accordance with the Material Safety Data Sheet (MSDS) for H3.2 CCA treated Ecoply.

Always wear safety glasses or non fogging goggles when working with Ecoply Barrier.

If wood dust exposure is not controlled when machining (sawing, drilling etc) a 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.

Storage & Handling

Ecoply Barrier requires care in storage and handling. The following suggestions will help keep the plywood in good condition prior to installation:

- The storage area should be protected from sun, rain and wind that would otherwise bring about rapid changes in temperature and humidity
- Support for the sheets should be provided at both ends and middle to avoid distortion. Ensure bearers in packs above are aligned over bearers below (to avoid inducing curves in sheets)
- The stack should be kept dry and clear of ground contact, and placed so that it will not be exposed to mechanical damage
- The sheets should be stacked flat, NOT on edge

Limitations

The information contained in this document is current as at June 2011 and is based on data available to CHH Woodproducts at the time of going to print.

It is important that you call 0800 326 759 to confirm that you have the most up to date information available or refer to www.chhwoodproducts.co.nz to download current specification literature.

CHH Woodproducts has used 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.

6.0 INSTALLATION

6.1 FRAMING

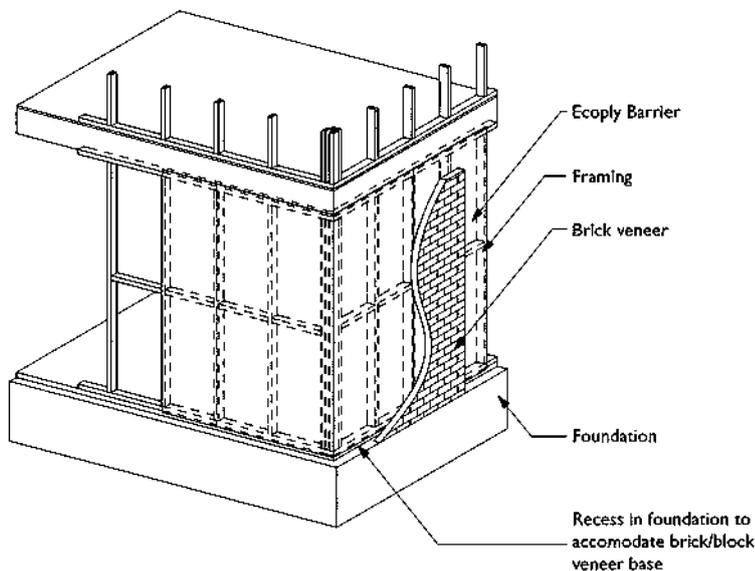
Use kiln dried framing e.g. Laserframe® in accordance with timber framing manufacturer's specification and treated in accordance with NZS 3602.

All timber framing sizes and set outs must comply with NZS 3604 (or be specifically designed to NZS 3603:1993 "Timber Structures Standard" and with stud and nog centres and timber widths required by this specification.

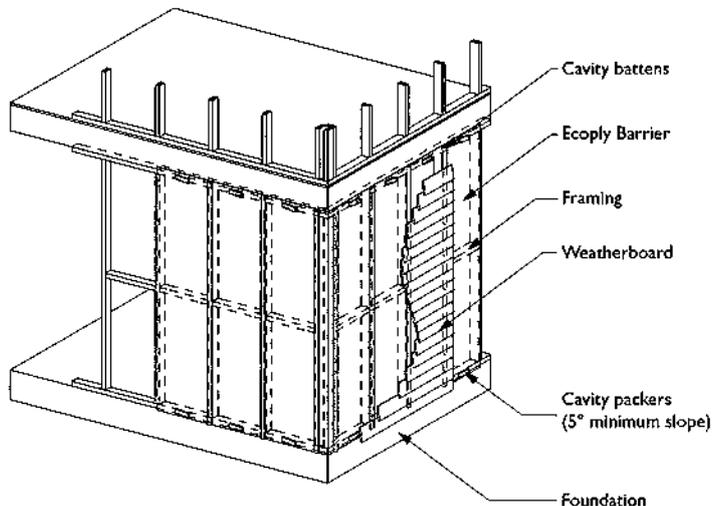
All Ecoply® Barrier sheet edges must be fully supported by framing.

- Studs must not exceed 600 mm centres
- Nogs must be provided at 1200 mm centres maximum
- The minimum framing width for fixing Ecoply Barrier is 45 mm at sheet joints
- Framing must be kept as dry as possible at all times

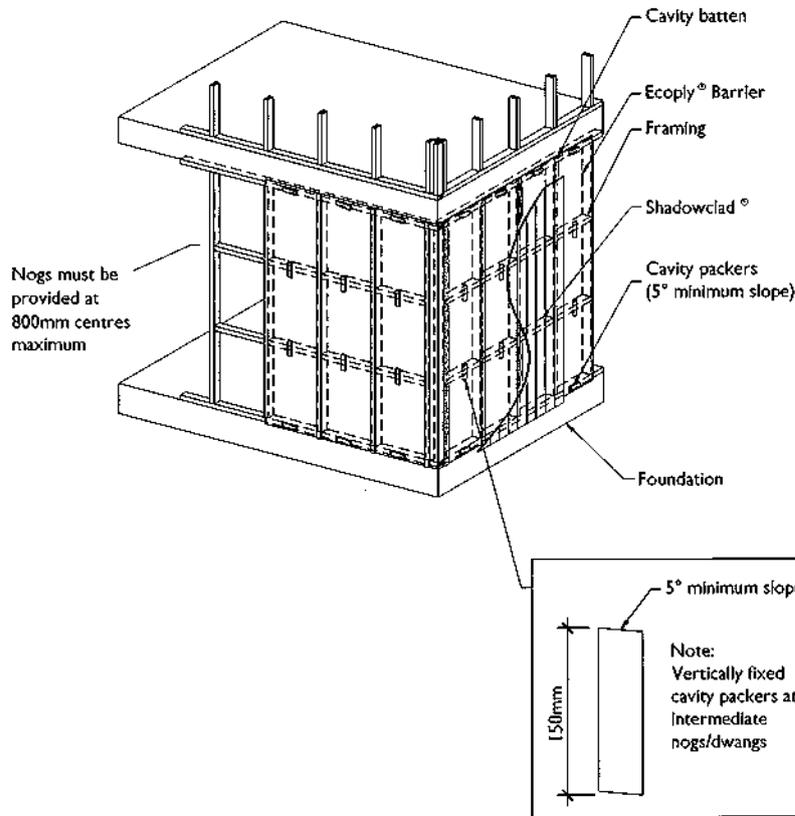
BAR001 Ecoply® Barrier with brick



BAR002 Ecoply® Barrier with weatherboard



BAR003: Ecoply® Barrier with Shadowclad®



6.2 FASTENERS

- Unless otherwise specified nail length should penetrate at least 10 nail diameters into the framing or be three times the sheet thickness, whichever is greater
- Fasteners must be at least 3 fastener diameters or 7 mm from the edge of the sheet
- Unless otherwise specified use a minimum of hot dipped galvanised fasteners or better
- Where using stainless steel nails, nails must be annular grooved
- Cladding fasteners must be increased by a minimum of 7 mm to achieve the required fastener pull out loadings

TABLE 2: FASTENER SIZE

Fixing Type	Minimum Nail Length
Hand Driven	40 x 2.5 mm clouts (flat head), hot dipped galvanised or better
Power Driven	Paslode Impulse 50 x 2.8 mm hot dipped galvanised or better, ring round head drive

Where Ecoply® Barrier is used as structural bracing refer to the specifications detailed in Section 3.0: Structural Bracing in the Ecoply Specification and Installation Guide.

6.3 FASTENER DURABILITY

Ecoply Barrier is designed for use in sheltered conditions such as cavity construction and not as an external cladding. Fasteners shall be a minimum of hot dip galvanised for all zones excluding sea

spray zones where stainless steel fasteners are required. Where stainless steel is required, annular groove nails must be used.

6.4 SHEET LAYOUT

- All sheet edges must be supported by the framing
- Fastener pattern unless otherwise specified:
 - 150 mm centres at sheet edges
 - 300 mm centres within sheet body
- Sheets must overhang the bottom plate by a minimum of 25 mm over timber and concrete foundations

Cut Sheets

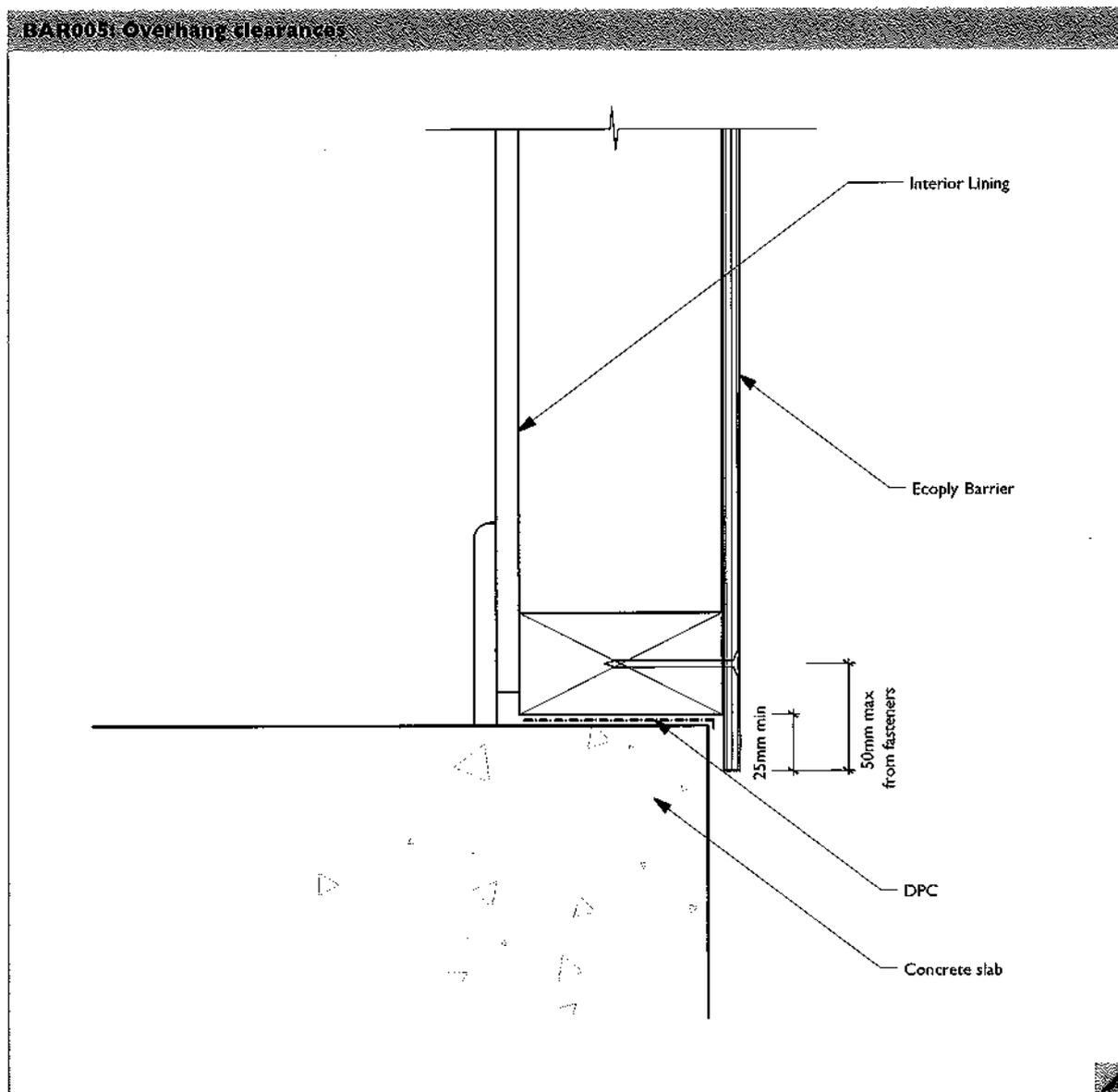
Ecoply® Barrier is envelope preservative treated. If a sheet end is cut place the cut end to the top. Always have a sealed sheet end at the bottom to avoid potential moisture ingress into the panel.

All other cuts and penetrations must be covered by a suitable flexible flashing tape and installed as per Ecoply Barrier literature.

When installed as per the above requirements, cut edges and penetrations are not required to be resealed with a brush on preservative treatment however if desired CHH Woodproducts recommends the use of Holdfast Metalex End Seal.

6.5 GROUND CLEARANCES

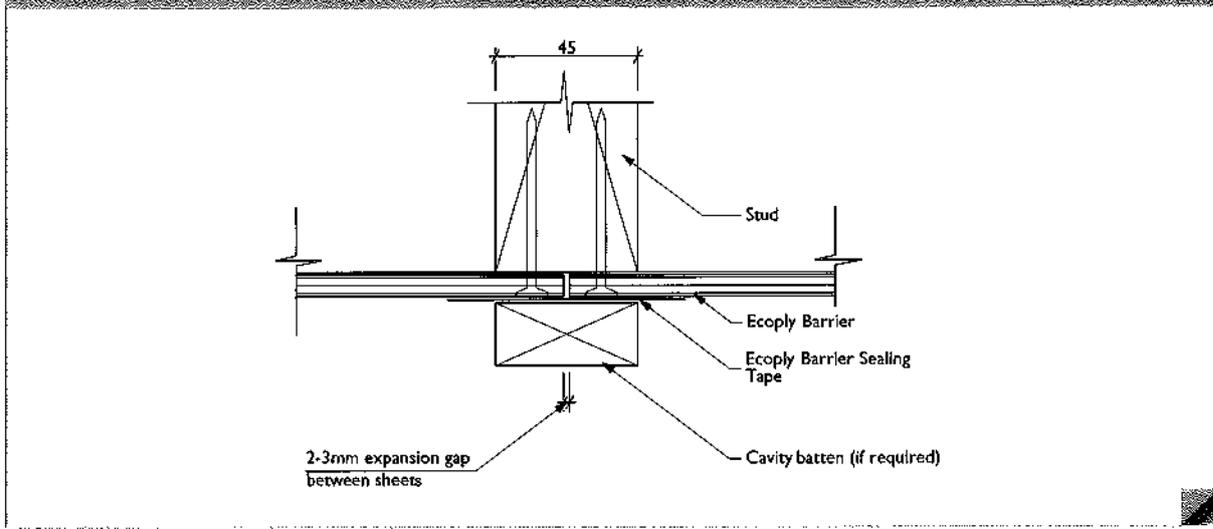
- Ground clearance from the bottom of Ecoply Barrier to ground:
 - 100 mm minimum to decks and permanently paved ground
 - 175 mm minimum to unprotected ground
- Ecoply Barrier must not be in contact with non draining water; damp or soil



6.6 VERTICAL SHEET JOINTS

- Sheets must be sealed with a suitable flexible flashing tape over vertical sheet joints to prevent moisture ingress into framing behind the sheets
- Seal vertical joints by running Ecoply® Barrier Sealing tape over the joints
- Installation of cavity battens where applicable prior to cladding installation provides further protection from moisture ingress between sheet edges
- Ensure sheet edges are free of dust prior to tape fixing to ensure adhesion between the sheet surface and tape
- Sheets and Ecoply Barrier Sealing tape must not be exposed to external weathering for more than 6 months prior to installation of the exterior cladding system

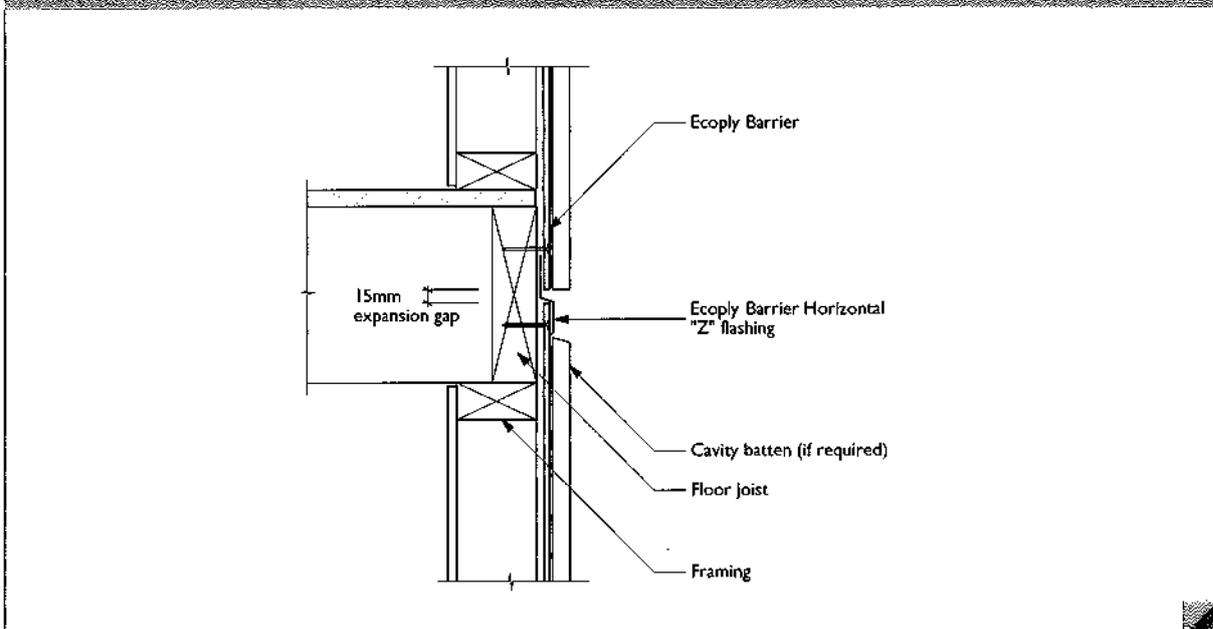
BAR006: Vertical sheet joints



6.7 HORIZONTAL SHEET JOINTS

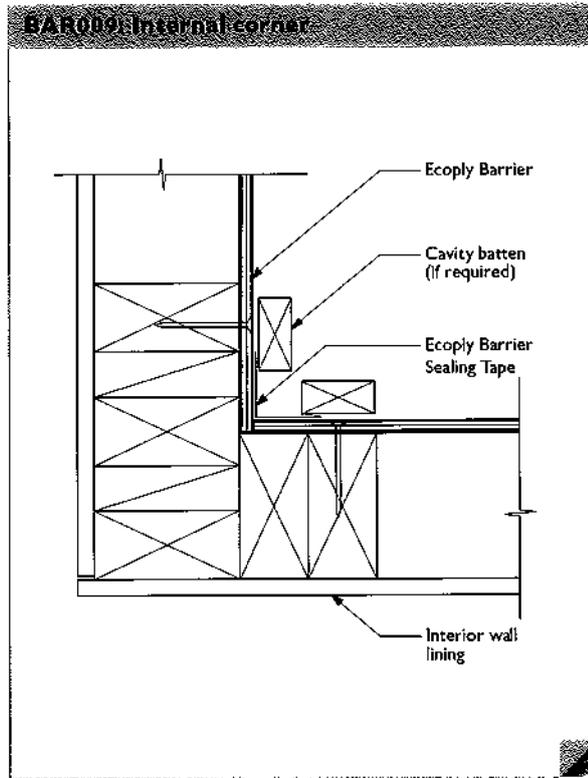
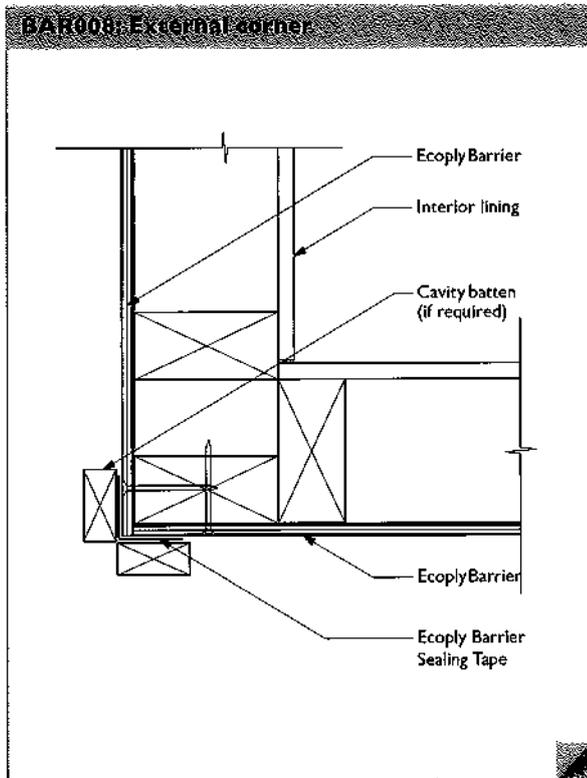
- Use Ecoply Barrier PVC horizontal 'Z' flashing (Product code RDZF7) for horizontal sheet joints
- The Ecoply Barrier PVC horizontal 'Z' flashing is manufactured by E2 Flashing Solutions. Contact E2 Flashing Solutions on (03) 358 5775 or visit www.e2flashingolutions.co.nz for further information

BAR007: Horizontal joint



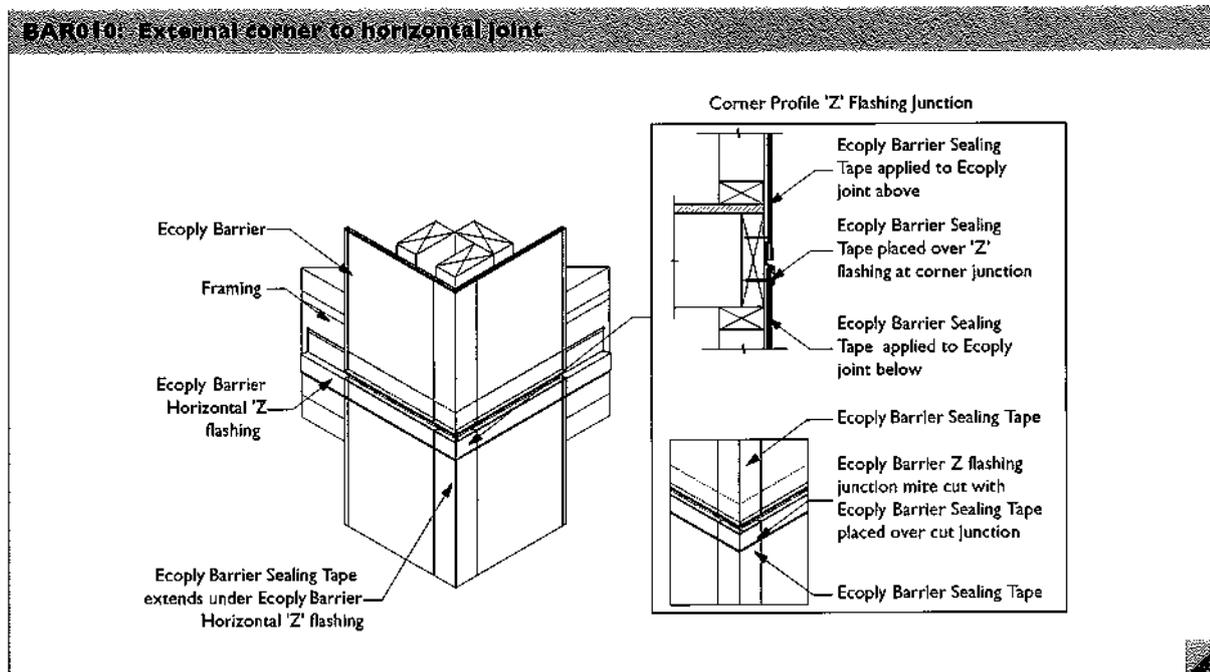
6.8 INTERNAL & EXTERNAL CORNERS

- Corners must be sealed with Ecoply® Barrier Sealing tape



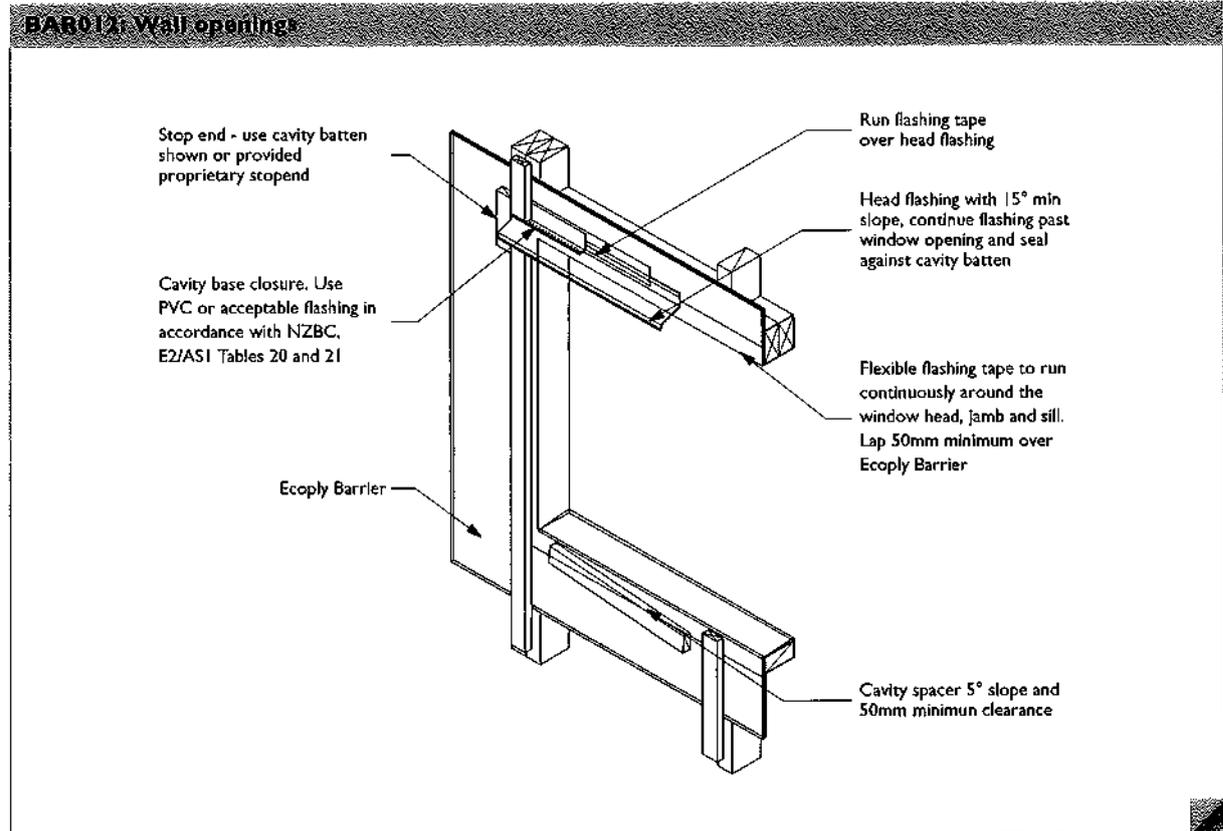
6.9 CORNER JUNCTIONS TO HORIZONTAL JOINTS

- Corners must be sealed with Ecoply Barrier Sealing tape
- At horizontal joints sealing tape must extend under horizontal 'Z' flashing
- For internal corner junctions follow BAR010 specifications as detailed for external corner junctions



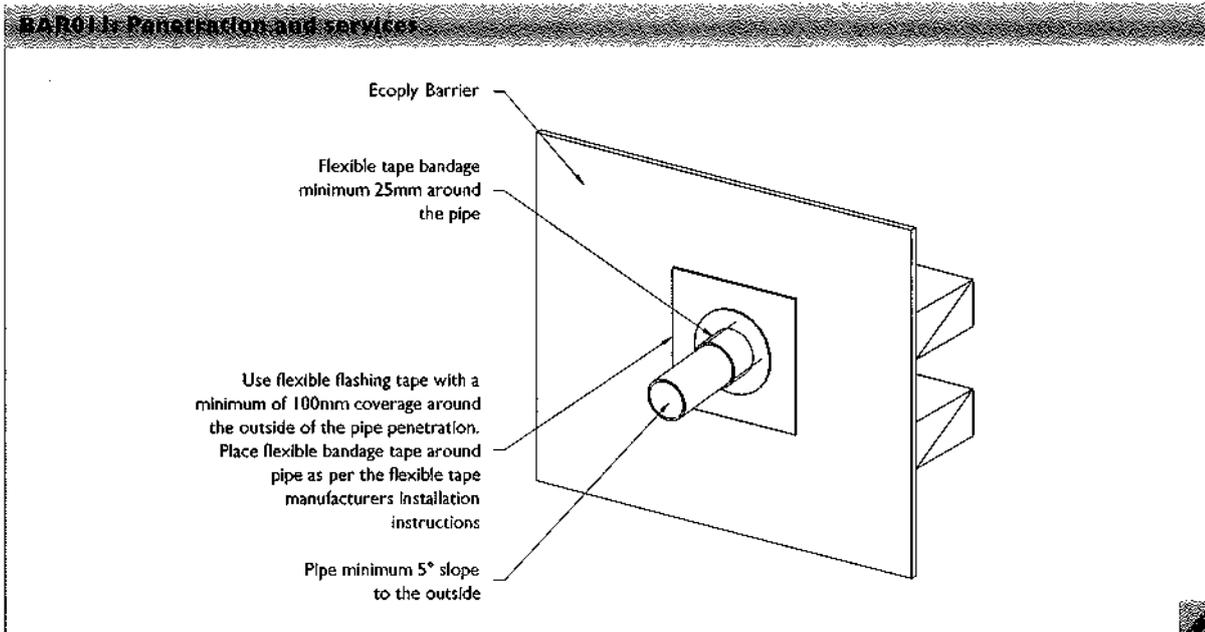
6.10 WINDOW PENETRATIONS

- Timber framing around window opening must be covered with a 150 mm wide flexible flashing tape
- The entire opening around the window frame must be covered with a flexible flashing tape
- The tape is sealed over the Ecoply® Barrier sheet
- Ecoply Barrier must be free of dust and dry before applying flexible flashing tapes
- The use of primer sprays before fixing tapes may be specified by flexible flashing tape manufacturers



6.11 SERVICE PENETRATIONS

- Service penetrations must be sealed using a flexible flashing tape
- A minimum cover of 100 mm over the sheet surrounding the penetration is required
- Use a flexible flashing tape bandage around the pipe (25 mm minimum width)
- Always refer to the flexible flashing manufacturer for further installation advice
- For sheet penetrations where Ecoply Barrier is used as structural bracing refer to Section 3.0: Structural Bracing of the Ecoply Specification and Installation Guide



Note: Refer to Figure 60 E2/ASI for further information.

6.12. STRUCTURAL BRACING

Where Ecoply® Barrier is used as structural bracing refer to the specifications detailed in Section 3.0: Structural Bracing in the Ecoply Specification and Installation Guide.

Detailing of flexible flashing tapes for Ecoply Barrier used as structural bracing are as per the specifications outlined in this guide.

TABLE 3: SUMMARY P21 RATINGS FOR 2.4 M HIGH ECOPLY® BARRIER WALL ELEMENT

Specification No.	Minimum Wall Length	Lining Requirements	BU/m Wind	BU/m Earthquake
EPI	0.6 m	7 mm Ecoply®/Ecoply® Barrier one side	125	130
EP2	0.6 m	7 mm Ecoply®/Ecoply® Barrier each side	140	150
EPG	0.4 m	7 mm Ecoply®/Ecoply® Barrier one side and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m	10 mm GIB® Standard plasterboard other side	150	150
EPGs	0.4 m	7 mm Ecoply®/Ecoply® Barrier one side* and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m	10 mm GIB® Standard plasterboard other side	150	120

* Plywood side of element can be a maximum of 300 mm below top plate

Note: Bracing technical information has been specifically tested using Ecoply branded structural plywood. This information cannot be used with any other plywood brands no matter how similar they may appear

6.13. CLADDING SYSTEM INSTALLATION

- Cladding should be installed within 6 months of Ecoply Barrier installation
- Claddings must comply and be installed in line with NZ Building Code and cladding supplier specifications
- Cladding maintenance advice should be sought from the cladding manufacturer
- Cladding fastener lengths must be increased by a minimum of 7 mm to ensure the required fastener pull out loadings are achieved

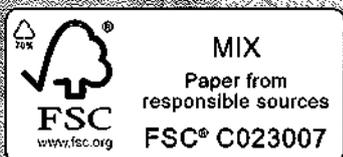
ecoply[®] Barrier

Proven. Durable. Strong.

Barrier



As part of our ongoing commitment to the environment, we have produced this brochure on FSC paper 100%.



Carter Holt Harvey
Woodproducts New Zealand

Private Bag 92-106
Auckland
New Zealand
Tel: 09 220 0000 ext 4000
Fax: 09 220 0000
Email: info@chh.co.nz

www.chhwoodproducts.co.nz

June 2011

Ecoply® Bracing Specification – EP1

June 2012

Single sided structural plywood brace

Specification No.	Minimum Wall Length	Lining Requirements	EU/m Wind	EU/m Earthquake
EP1	0.6 m	7mm Ecoply®, or Ecoply Barrier one side	125	130

Framing

Wall framing must comply with:

- NZBC B1 - Structure: AS1 Clause 3 Timber (NZS3604:2011)
- NZBC B2 - Durability: AS1 Clause 3.2 Timber (NZS3602)

Framing dimensions and height are as determined by the NZS3604:2011 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®, is recommended.

Bottom Plate Fixing

Use GIB Handibrac® hold-down connections at each end of the bracing element. Refer to 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 3604:2011.

Lining

One layer 7mm Ecoply structural plywood 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. A 2-3mm expansion gap should be left between sheets.

Fastening the Ecoply

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

Where fasteners are in contact with CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised

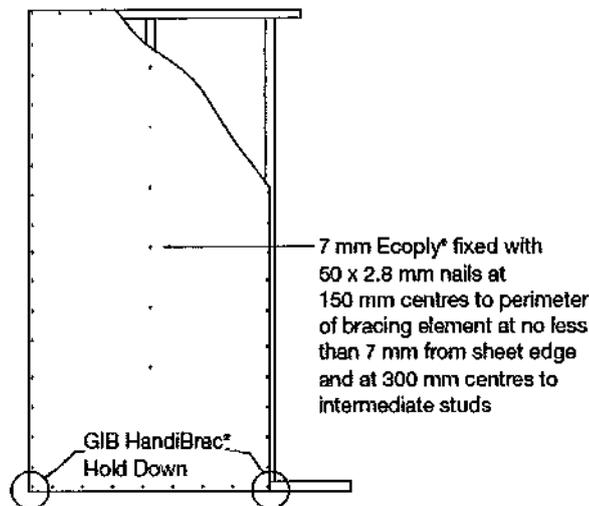
In certain circumstances stainless steel fasteners may be required. Refer to section 4 of NZS 3604:2011 for these circumstances.

Refer to Table 8 in the Ecoply Specification and Installation Guide for further fastener selection advice.

Stainless steel fasteners must be annular grooved

Fastening Centres

Fasteners are placed at 150 mm centres around the perimeter of each sheet and 300 mm centres to intermediate studs.

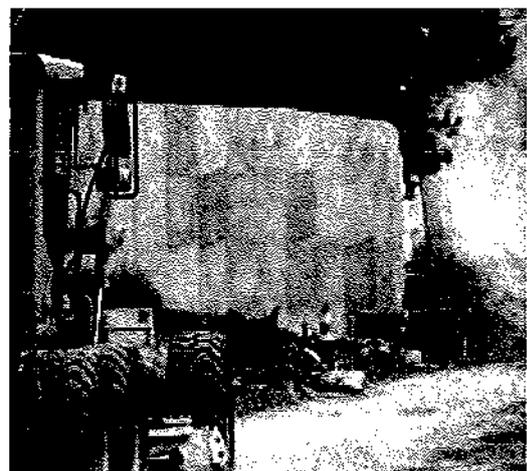
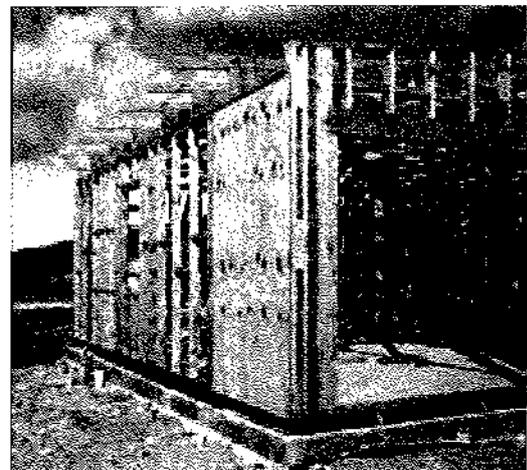


Ecoply® Bracing Systems are designed to meet the requirements of the NZBC and have been tested and analysed using the P21 method referenced in NZS3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SG8 timber framing manufactured by Carter Holt Harvey Limited trading as Carter Holt Harvey Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.



Specification & Installation Guide

December 2011



Contents

1.0 Ecoply Product Range	2
1.1 The Ecoply Brand	2
1.2 Product Description & Range	2-3
1.3 Surface Grades	4
1.4 Preservative Treatment	5
1.5 Section Properties	6
1.6 Product Identification	7
1.7 Code Compliance	8
1.8 General Design Considerations	8-9
1.9 Sustainability	10
1.10 Health & Safety	10
1.11 Storage & Handling	10
1.12 Limitations	10
2.0 General Installation Guide	11
2.1 Framing	11
2.2 Sheet Fasteners and Fixing	11-13
2.3 Adhesives	13
3.0 Structural Bracing & Ceiling Diaphragms	14
3.1 Design to Comply with the New Zealand Building Code	14-16
3.2 Ecoply Bracing Specifications Summary	17
3.3 Ecoply Bracing Specification - EP1	18
3.4 Ecoply Bracing Specification - EP2	19
3.5 Ecoply Bracing Specification - EPG	20-21
3.6 Ecoply Bracing Specification - EPGs	22-23
3.7 GIB HandiBrac	24
3.8 Structural Ceiling Diaphragm	24
4.0 Internal Linings, Soffits & Appearance Plywood	25
4.1 Product Range	25
4.2 Internal Linings & Soffits - Design Considerations	26
4.3 Internal Linings & Soffits - Installation	27
4.4 Fasteners and Fixing	27
4.5 Internal Linings & Soffits - Finishing	27
5.0 Roofs and Decks	28
5.1 Joist Diaphragm Systems	28
5.2 Roof Tile Systems	29
5.3 Roofs and Decks - Product Selection Guide	29
5.4 Typical Specifications for Ecoply® Roofs and Decks	30
5.5 Roofing - Design Considerations	31-32
5.6 Roofing - Installation	33-34
6.0 Flooring	35
6.1 Flooring - Usage	35
6.2 Flooring - Installation	35-36
6.3 Flooring - Finishing	36
6.4 Frequently Asked Questions	37-38
7.0 References, Symbols or Information	39

Ecoply® is New Zealand's leading brand of structural plywood and is manufactured by Carter Holt Harvey® Woodproducts under a third party audited quality control programme to monitor compliance with AS/NZS 2269. As such these products carry Engineered Wood Products Association of Australasia (EWPAA) Joint Accreditation System - Australia and New Zealand (EWPAA/JAS-ANZ) certification.

For information relating to Shadowclad® and plywood used as an exterior cladding, refer to the Shadowclad Specification & Installation Guide.

1.1 THE ECOPLY® BRAND

The Ecoply brand represents a range of appearance and structurally rated plywood products which provide economy, durability, strength and design flexibility in a wide range of uses and applications.

1.2 PRODUCT DESCRIPTION AND RANGE

Ecoply structural plywood is a layered panel made from radiata pine wood veneers.

The veneers are bonded together with synthetic phenolic (PF) resin set and cured under heat and pressure in controlled conditions to form a strong and durable Type A bond. Adjacent layers (veneers) are at right angles to each other to deliver two way strength and stability. The strength of Ecoply plywood is optimised for maximum performance parallel to the face grain with cross plies providing enhanced stability across the grain.

The Ecoply plywood range can be specified for its:

- Surface grade (e.g. CD) - where the first letter describes the face veneer appearance and the second letter describes the back veneer of the Ecoply sheet. Surface grades are fully defined in AS/NZS 2269 and summarised in Table 2
- Stress grade - utilises the symbol F and a suffix e.g. F8 as a code to apply a full suite of strength and stiffness properties to plywood products of that stress grade. F8 is the standard stress grade for Ecoply products with the exception of Ecoply 19 mm Longspan Flooring and 15 mm Ecoply Roofing which are F11¹ (See Tables 1, 4 and 5). Other Ecoply products are also available in F11 upon request
- Thickness - ranging from 7 mm to 25 mm. (Thicknesses above 25 mm available subject to production capacity)
- Length - being 2400 mm and 2700 mm with a standard width of 1200 mm
- Preservative treatment - being untreated, H3.2 CCA or H3.1 LOSP Azole treated
- Edge finish - being square edge or for Ecoply Flooring, Roofing and Grooved Lining, routed on the long edges of the sheet with a polypropylene plastic tongue inserted into one side for a tongue-in-groove joint

¹ Where the stress grade F11 is referred to in all CHH Woodproducts plywood literature actual stress grade properties of panels are F11 parallel to the face grain and F8 perpendicular to the face grain

For general installation advice refer to section 2.0: General installation guide.

For specification and installation advice for Ecoply used in typical applications refer to the following sections.

Typical Application	Section
Structural bracing and ceiling diaphragms	3.0
Internal linings, soffit and appearance plywood	4.0
Roofs and decks	5.0
Flooring	6.0
Structural packaging	7.0

Note: Technical notes referenced in this publication can be downloaded from www.chhwoodproducts.co.nz or contact Carter Holt Harvey Woodproducts on 0800 326 759.

The information contained in this manual relates to Ecoply® products manufactured by Carter Holt Harvey Woodproducts and cannot be used with any other plywood products. Ecoply® products are similar to many other products.

Alternative plywood products can offer a range of options which may not be mentioned above and substituting them for Ecoply® products is not appropriate and could in extreme cases lead to premature failure and injury. Users should meet the requirements of the relevant

TABLE 1: ECOPLY® PRODUCT RANGE

Normal Thickness (mm)		2400		2700		2400		2700		2400		2700		2400		2700	
Sheet length (x 1200 mm width)		2400	2700	2400	2700	2400	2700	2400	2700	2400	2700	2400	2700	2400	2700	2400	2700
Ecoply® Structural Square Edge	BB					✓				✓							
	BD			✓		✓	✓	✓		✓							
	CD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DD	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ecoply® Grooved Lining	Classic					✓pt	✓pt										
	Prime					✓pt	✓pt										
Ecoply® Flooring	BD											✓pt LS					
	CD							✓pt	✓pt	✓pt	✓pt	✓pt LS	✓pt LS	✓pt	✓pt	✓pt	✓pt
Ecoply® Roofing	DD							✓pt	✓pt	✓pt	✓pt						

Available untreated only

Available either untreated or H3.2 CCA

Available either untreated or H3.1 LOSP

pt Machine grooves on both long edges with a plastic polypropylene tongue in one groove, 1200 cover

LS Ecoply 19 mm Longspan Flooring

- Full range may not always be available ex stock, check with Ecoply supplier to ensure availability
- Non standard specifications, including thicker sheets may be available to special order in significant quantities
- All products are F8 stress grades except Ecoply 15 mm Roofing and Ecoply 19 mm Longspan Flooring which are supplied as standard in F11 stress grade¹. Other Ecoply products are also available in F11 upon request

¹ Where the stress grade F11 is referred to in all CHH Woodproducts plywood literature actual stress grade properties of panels are F11 parallel to the face grain and F8 perpendicular to the face grain

1.3 SURFACE GRADES

Table 2A summarises the surface appearance grades in which Ecoply® structural plywood is available with some typical applications for each surface grade. The surface grade

specifications are fully defined in AS/NZS 2269. Table 2B details surface appearance grades for speciality Ecoply plywood and typical applications.

TABLE 2A: ECOPLY® STRUCTURAL SQUARE EDGE PRODUCTS

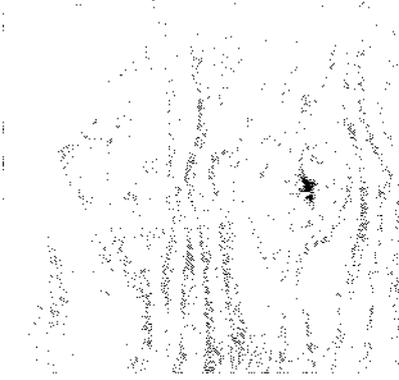
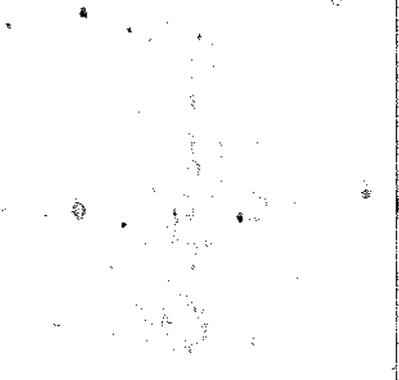
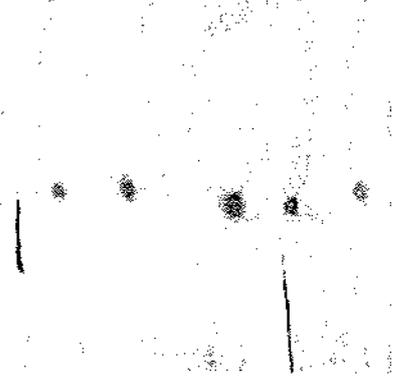
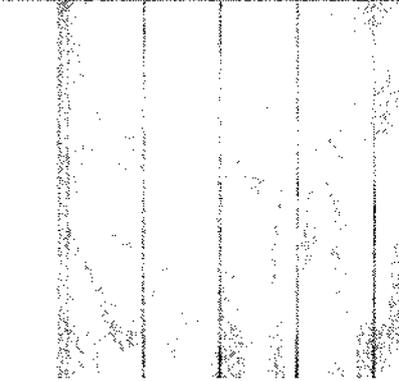
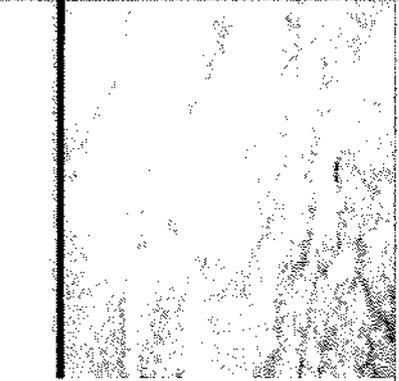
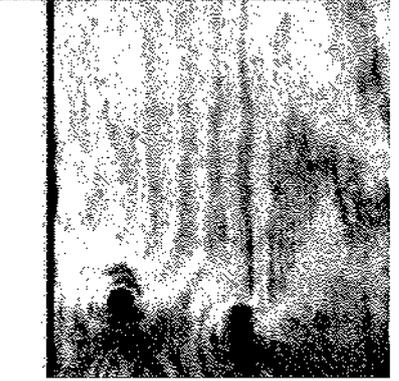
Ecoply® Structural Square Edge Products		
Face Grade B	Face Grade C	Face Grade D
 <p>Appearance grade with a solid sanded surface. Suitable for a high quality paint, clear or stain finish.</p>	 <p>Solid sanded surface with filled holes and splits, with intergrown knots. Suitable for a basic paint finish.</p>	 <p>Non appearance grade allowing open imperfections up to 75 mm across the face veneer. Splits and knots allowable</p>
<p>Possible Uses:</p> <ul style="list-style-type: none"> • Furniture/Joinery/Signs • Interior Linings • Sheathing • Engineering components where a superior visual finish is required 	<ul style="list-style-type: none"> • Structural gussets • Stressed skin panels • Bins, boxes, crates • Concrete formwork • Hoardings 	<ul style="list-style-type: none"> • Non visual bracing • Strength critical pallets • Structural components • Portal frame webs

TABLE 2B: SPECIALITY ECOPLY® PRODUCTS

Speciality Ecoply® Products		
Grade B Lining	Flooring CD	Flooring DD
 <p>Superior appearance smooth sanded face and 'V' grooves at 100 mm centres. Available in 2 face grades with tongue and groove on long edges: Classic - for clear stain and paint finishes Prime - pre-primed surface for paint finishes</p>	 <p>Solid sanded C grade surface with tongue and groove profile on long edges. Features second void free layer under the face veneer for increased protection against high point loads</p>	 <p>Unfilled D grade surface with tongue and groove profile on long edges</p>
<p>Possible Uses:</p> <ul style="list-style-type: none"> • Internal linings • Partitions & feature walls • Semi exposed soffits - (H3, I LOSP treated product only) 	<ul style="list-style-type: none"> • Substrate for flooring overlays such as linoleum, tiles and rigid coverings • Substrate for membrane roofing and decking where visible appearance is critical 	<ul style="list-style-type: none"> • Substrate for asphalt shingles • Substrate for roof systems where a smooth substrate is not required

Notes:

A higher visual grade may be substituted if required, e.g Ecoply CD can be used anywhere DD is used.

Pictures shown above are scaled down versions of typical Ecoply sheets. Grain pattern, colour may vary. If sheet appearance is critical select panels individually.

1.4 PRESERVATIVE TREATMENT

Ecoply® structural plywood is available untreated or treated in accordance with AS/NZS 1604.3. If treated, Ecoply structural plywood is most often treated with either H3.2 CCA (Copper Chrome Arsenate) or H3.1 LOSP (Azole) **clear** treatment. H3.1 LOSP is the standard preservative treatment available on BB and BD Structural Square Edge and Grooved Lining products and by special request for other Ecoply products.

H3.2 CCA and H3.1 LOSP treated plywood in accordance with AS/NZS 1604.3 is described as suitable for: "outside, above ground, subject to periodic moderate wetting and leaching."

All treated plywood is envelope treated. Where sheets are cut, exposed edges **must** be coated with a suitable brush on timber preservative such as Holdfast Metalex End Seal.

The characteristics of the treatments are shown in Table 3.

TABLE 3: PRESERVATIVE TREATMENT

	Untreated	H3.2 CCA	H3.1 LOSP (Azole)
Preservative carrier	N/A	Water	Light organic oil (white spirits)
Colour	Natural	Green	Clear (i.e. natural)
Fungicide	Heat treated dry wood	Copper	Propiconazole and Tebuconazole
Insecticide	Heat treated dry wood	Arsenate	Permethrin
Other chemicals	N/A	Chrome (to fix preservative in wood)	Butyl Oxitol (co-solvent to assist active stability)
Mouldicide	N/A	Copper (limited efficacy)	IPBC
Notes	Plywood for dry interior use, supplied ex mill at <15% moisture content	Dried after treatment to average 18% moisture content for use in service at higher moisture contents	Solvent does not affect dimensions. Solvent smell disappears over time
Availability	Readily available	Standard treatment except for Ecoply BB, BD and Grooved Lining	Treated to order for CD, DD, flooring and roofing products. Standard treatment for Ecoply BB, BD and Ecoply Grooved Lining
Applications (Refer NZ3602)	Interior dry protected	Exterior/interior damp (service performance subject to detailing & coatings)	

H3.2 CCA

Ecoply structural plywood, which is H3.2 CCA treated (waterborne preservative with a green colour), is dried following treatment so that sheets may return to the correct dimensions. The moisture content after treatment with CCA and drying will be higher than the limits placed in AS/NZS 2269 on untreated product. The target is for an average moisture content of approximately 18% to provide a panel closer to the expected equilibrium moisture content for most H3 applications.

The fillets used to separate sheets in drying may leave marks on the sheet surface. These will fade over time as the plywood weathers, and can be disguised with paint but may be visible under stain. The process of treating with CCA and subsequent drying is likely to increase the face checking of the panel. For more information on face checking refer to section 1.8 General Design Considerations - Aesthetics.

H3.1 LOSP

H3.1 LOSP treated Ecoply retains the wood colour and does not contain moisture so the plywood remains at the same dimensions and moisture content during treatment. However, the plywood when freshly treated may contain more than 60 litres of organic fluid per cubic metre. When coating H3.1 LOSP treated plywood trace amounts of 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 onto the sheet.

The H3.1 LOSP solvent smell can be quite strong and venting is recommended until most of the solvent has evaporated. Untreated plywood is recommended for internal applications where NZS 3602 allows the use of untreated plywood.

Mechanical fasteners are recommended to fix H3.1 LOSP treated Ecoply to framing. If adhesives are required, thorough venting is recommended and H3.1 LOSP tolerant adhesives should be applied according to adhesive manufacturers' instructions. See section 2.3 Adhesives.

1.5 SECTION PROPERTIES

TABLE 4A: SECTION PROPERTIES OF ECOPLY® STRUCTURAL PLYWOOD

Nominal plywood thickness ²	ID code ³	Mass	Section properties per form width					
			Parallel to the face grain			Perpendicular to the face grain		
			Parallel Moment of Inertia	Section Modulus	Shear Constant	Perpendicular Moment of Inertia	Section Modulus	Shear Constant
(mm)	(kg/m ²)	(mm ⁴)	Z (mm ³)	I/Q (mm ²)	I (mm ⁴)	Z (mm ³)	I/Q (mm ²)	
7	7-24-3	4.0	30.0	8.3	5.2	2.0	1.7	2.3
9	9-30-3	5.0	58.6	13.0	6.4	4.0	2.7	2.9
12	12-24-5	6.6	115.0	19.2	9.3	33.4	9.3	5.4
15	15-30-5	8.3	225.0	29.9	11.6	65.2	14.5	6.8
17	17-24-7	9.2	285.0	33.9	12.2	122.0	20.4	9.4
17	17-24-6	9.2	273.0	32.5	12.3	134.0	22.3	9.5
19	19-30-7	10.6	451.0	46.9	13.7	157.0	23.8	10.7
21	21-30-7	11.6	556.0	52.9	15.2	239.0	31.9	11.8
25	25-30-9	13.5	897.0	72.9	17.8	381.0	41.0	13.9

TABLE 4B: NOMINAL STRENGTHS OF SECTIONS OF ECOPLY® STRUCTURAL PLYWOOD FOR LIMIT STATES DESIGN: F8 GRADE

Nominal plywood thickness ²	ID code ³	Nominal strengths (Limit States) per mm width					
		Parallel to the face grain (F8)			Perpendicular to the face grain (F8)		
		Bending Stiffness EI	Bending Moment fZ	Rolling Shear f/Q ⁴	Bending Stiffness EI	Bending Moment fZ	Rolling Shear f/Q
(mm)	(1000 Nmm ²)	(Nmm)	(N)	(1000 Nmm ²)	(Nmm)	(N)	
12	12-24-5	1046.5	480.0	16.7	303.9	231.7	9.8
15	15-30-5	2047.5	747.5	20.9	593.3	362.5	12.3
17	17-24-7	2593.5	847.5	22.0	1110.2	510.0	17.0
17	17-24-6	2484.3	812.5	22.1	1219.4	557.5	17.1
19	19-30-7	4104.1	1172.5	24.7	1428.7	595.0	19.2
21	21-30-7	5059.6	1322.5	27.4	2174.9	797.5	21.2
25	25-30-9	8162.7	1822.5	32.0	3467.1	1025.0	25.0

TABLE 4C: NOMINAL STRENGTHS OF SECTIONS OF ECOPLY® STRUCTURAL PLYWOOD FOR LIMIT STATES DESIGN: F11 GRADE (INCLUDING LONGSPAN FLOORING)

Nominal plywood thickness ²	ID code ³	Nominal strengths (Limit States) per mm width					
		Parallel to the face grain (F11)			Perpendicular to the face grain (F8)		
		Bending Stiffness EI	Bending Moment fZ	Rolling Shear f/Q ⁴	Bending Stiffness EI	Bending Moment fZ	Rolling Shear f/Q
(mm)	(1000 Nmm ²)	(Nmm)	(N)	(1000 Nmm ²)	(Nmm)	(N)	
12	12-24-5	1207.5	595.2	18.5	303.9	231.7	9.8
15	15-30-5	2362.5	926.9	23.2	593.3	362.5	12.3
17	17-24-7	2992.5	1050.9	24.4	1110.2	510.0	17.0
17	17-24-6	2866.5	1007.5	24.6	1219.4	557.5	17.1
19	19-30-7	4735.5	1453.9	27.4	1428.7	595.0	19.3
21	21-30-7	5838.0	1639.9	30.4	2174.9	797.5	21.2
25	25-30-9	9418.5	2259.9	35.6	3467.1	1025.0	25.0

¹ Where the stress grade F11 is referred to in all CHH Woodproducts plywood literature actual stress grade properties of panels are F11 parallel to the face grain and F8 perpendicular to the face grain

² Actual thickness of Ecoply sheets manufactured to thickness tolerances stated in AS/NZS 2269

³ Identification code: panel thickness – outermost veneer thickness x 10 – number of plies

⁴ I/Q values for rolling shear are for stress at the neutral axis calculated as in NZS 3603

- Use Tables 4A & B values for all F8 stress grade Ecoply products
- Use Tables 4A & C values for all F11 stress grade Ecoply (including 19 mm Ecoply Longspan Flooring)
- The section properties in Tables 4A, B & C have been calculated in accordance with AS/NZS 2269
- For section properties for other thicknesses and Shadowclad[®] products contact CHH Woodproducts on 0800 326 759

Structural properties of Ecoply® plywood

The majority of Ecoply® plywood is F8 grade (exceptions are identified in section 1.2: Product description & range) and the characteristic values may be used in conjunction with both

NZS 3603 and AS 1720 for the design of timber components. The characteristic stress values in Table 5 have been used to provide nominal strengths in Tables 4B and 4C.

TABLE 5: STRUCTURAL PROPERTIES OF ECOPLY® PLYWOOD

Face Grade	Characteristic stress value MPa	
	F8	F11
Bending (f_{pb})	25	31.0
Tension (f_{pt})	15	18.0
Panel shear (f_{ps})	4.5	5.0
Rolling shear (f_{pr})	1.8	2.0
Compression in plane of sheet (f_{pc})	20	22.0
Compression normal to the plane of the sheet (f_{pn})	9.7	12.0
Modulus of elasticity (E)	9100	10500
Modulus of rigidity (G)	455	525

Source: AS 1720.1:2011

Wood is strongest when stressed parallel to the grain and weakest across the grain, so the lay up or arrangement of veneers in the panel determines the properties. Because of its cross banded construction, plywood possesses significant strength and stiffness both parallel and perpendicular to the direction of the face grain, but is generally strongest and stiffest along the direction of the face grain.

The section properties of structural plywood in Table 4A are calculated in accordance with AS/NZS 2269 to allow for the

reduced contribution of veneers perpendicular to the direction of stress. For engineering design to NZS 3603, the section properties are multiplied by stresses and 'k' and ϕ factors to determine resistances for limit states design.

Resistances and nominal strengths in Tables 4B and 4C assume all 'k' factors are equal to 1.0. Multiply tabled values by the strength reduction factor ϕ and 'k' factors for specific in-service conditions for design to a structural code such as NZS 3603.

1.6 PRODUCT IDENTIFICATION

In accordance with AS/NZS 2269, Ecoply structural plywood sheets have the following information marked on the back:

- Brand name: e.g. ECOPLY
- Panel construction code: e.g. 15-30-5 (Thickness (mm)-Face veneer thickness (mm x 10)-Number of veneers)
- Face grade, back grade, glue bond: e.g. CD A BOND
- Intended application: e.g. STRUCTURAL
- Australasian Standard: e.g. AS/NZS 2269
- Date and time of manufacture: e.g. 16/08/07 19:45:45
- Stress grade: e.g. F8
- Formaldehyde emission class: E₀ for A Bond Ecoply
- The Engineered Wood Products Association of Australasia (EWPA) brand and mill number: e.g. 911 (Tokoroa mill)

For example:

ECOPLY 15-30-5 CD A BOND STRUCTURAL 
AS/NZS 2269:2008 PAT 16/08/07 19:45:45 F8 E0 911

If the plywood is treated, it will also be marked in accordance with the treatment standard AS/NZS 1604.3 Specification for Preservative Treatment, Part 3: Plywood.

1.7 CODE COMPLIANCE

Ecoply® plywood manufacture is third-party audited through the product quality control programme of the Engineered Wood Products Association of Australasia (EWPAA) which is itself audited by the Joint Accreditation System of Australia and New Zealand (JAS-ANZ).

CHH Woodproducts is licensed by the EWPAA to stamp plywood with the PAA/JAS-ANZ Product Certification Mark. This certifies it has been manufactured under the third party audited Joint Product Certification programme to monitor compliance with joint Australian/New Zealand Standard AS/NZS 2269 Plywood – Structural. Plywood to this standard is referenced in NZ Building Code Acceptable Solutions and Verification Methods through:

- NZS 3602 The Use of Timber and Wood-based products for Use in Building
- NZS 3603 Timber Structures
- NZS 3604 Timber Framed Buildings
- AS/NZS 1604.3 Specification for Preservative Treatment, Part 3: Plywood
- E2/AS1 External Moisture



WARNING: Plywood which is non-certified or is manufactured to standards other than AS/NZS 2269, such as US voluntary standard PSI-95, is not referenced in the NZ Building Code. There can be significant differences between AS/NZS 2269 certified and non certified plywood around bond durability, structural ratings and veneer quality.

Structure B1

Design to NZS 3603 Timber Structures complies with the NZ Building Code in Verification Method B1/VM1 clause 6.0 Timber; Structural. Plywood is the only sheet material with properties listed in NZS 3603. Ecoply structural plywood is available in F8 stress grade with some specialty products available F11 or with specifically designed properties for specialised applications.

1.8 GENERAL DESIGN CONSIDERATIONS

Durability and exterior moisture E2

Ecoply plywood is made from softwood solid radiata pine veneer. Designers should assess the level of exposure to biological, moisture, and other hazards and apply appropriate preservative treatment and detailing to minimise exposure to these hazards.

Information in this manual outlines suggested practices for detailing building components to exclude moisture to comply with the durability requirements of the NZ Building Code.

Formaldehyde

Ecoply plywood is manufactured using phenol formaldehyde resins which are fully cured in the hot press. Cured resin is thermally and moisture stable and formaldehyde emissions for the glued plywood are similar to background levels for the wood by itself when tested to AS/NZS 2098.11 Determination of formaldehyde emissions for plywood. Accordingly every panel is branded with the lowest emission class (less than 0.5 mg/litre for E₀).

Actual formaldehyde emissions for Ecoply plywood have been tested and approved as having an actual formaldehyde emission level of less than 0.3 mg/ litre (equivalent to a Super E₀ emission level).

Moisture content and dimensional change

At the time of leaving the factory, the moisture content of untreated Ecoply plywood should generally be in the range of 8% to 15% as required by AS/NZS 2269. All wood products including plywood respond to changes in ambient humidity so the eventual moisture content of plywood varies according to how dry or how wet the environment is. After manufacture, the moisture content will move to equilibrium with the environment, and the veneers swell or shrink across the grain in response. The total expansion both along and across a 2400 x 1200 mm panel can be in the order of 1.5 mm to 3 mm as the plywood changes from a dry to a saturated state.

Ecoply that is treated with waterborne preservatives (e.g. H3.2 CCA) is expected to be used in applications that have higher humidity than interior dry use, so following treatment it is dried to a higher average moisture content of approximately 18%. This provides for a more stable panel in service than placing a dry (less than 15%) sheet in a higher moisture environment.

Detailing and construction must allow for movement if the plywood will be subject to cycles of moisture change. Seasonal and daily cycles can be significant depending on the end use.

Temperature

Wood will expand upon heating as do practically all solids. The thermal expansion of plywood is quite small and there is little effect on the structural performance or durability of plywood when used in temperatures below 54°C. The average co-efficient of thermal expansion of plywood is 4.5×10^{-6} mm/mm/°C. At temperatures above 55°C wood begins to deteriorate. Colours of coatings and finishes should be selected to reduce heat gain. For extreme conditions, further technical information is available by calling CHH Woodproducts on 0800 326 759.

The thermal resistance or insulating effectiveness of plywood panels can be calculated using NZS 4214. e.g. Plywood has a Conductivity (k) of 0.13 W/mK so a 12 mm panel has a thermal resistance $R = 0.012/0.13 = 0.09$.

Aesthetics

Ecoply® plywood products can be selected for decorative or weather protection functions as well as structural performance.

Acceptable Solution E2/AS1 External Moisture allows plywood manufactured to AS/NZS 2269, (minimum CD appearance grade, minimum 12 mm thickness and treated as required by NZS 3602) to be used for exterior cladding. For exterior cladding applications CHH Woodproducts strongly recommends Shadowclad® exterior cladding over smooth faced plywood such as Ecoply.

Shadowclad features a bandsawn face to help reduce the incidence and appearance of face checking and other appearance related issues which can occur on smooth faced plywood if not regularly maintained by the homeowner. For more information on plywood used as an exterior cladding refer to the Shadowclad Specification and Installation Guide.

Face checks on plywood exposed to weather

- Face checks (lengthwise separations of the wood fibre occurring in the face veneer) are the result of normal expansion and contraction of the wood fibre as it gains and loses moisture from the external environment
- Face checks occur naturally in all wood based products and their extent in plywood can vary depending on the length of exterior exposure, climate conditions and protection offered by the surface coating

- Face checks in plywood do not affect the structural integrity of the panel as they are confined to the surface veneer and are strictly aesthetic in nature
- As face checks occur naturally CHH Woodproducts does not consider them to be a manufacturing or product fault

Durability

The durability of Ecoply structural plywood will depend on the application. Detailing, treatment and installation details need careful consideration to satisfy the requirements of the NZ Building Code.

Normally, 50 year durability can be achieved with untreated Ecoply in dry, interior exposure. For internal environments subject to high humidity or condensation H3 treated Ecoply should be used.

Unpainted H3 treated Ecoply in exterior applications (excluding plywood used as cladding) will weather and oxidise but panels can be expected to perform structurally for 15 years. However the lack of protection will lead to appearance related issues such as surface checking, mould growth and discolouration of the sheet surface which are not considered manufacturing faults by CHH Woodproducts.

Where plywood is used as cladding (including cladding acting as bracing) refer to the Shadowclad Specification and Installation Guide.

For plywood as a rigid air barrier (including rigid air barrier acting as bracing) refer to the Ecoply Barrier Specification and Installation Guide.

Fire, spread of flame and smoke development

The following data on early fire hazard properties of uncoated Ecoply plywood are the result of tests carried out by Applied Physics Laboratory and are similar to results from extensive testing done in Australian Laboratories on uncoated radiata pine plywood.

For plywood with decorative finish coatings or intumescent coating, performances depend on spread rates of the coating. Advice and coating specifications should be sought from the coating manufacturer.

TABLE 6: EARLY FIRE HAZARD PROPERTIES OF 12 MM ECOPLY® PLYWOOD

	Ignitability Index (I _g)	Spread of Flame Index (SFI)	Heat Evolved Index (HEI)	Smoke Developed Index (SDI)
Ecoply® Structural Plywood, Untreated, Uncoated	14	7	7	3
Ecoply® Structural Plywood H3.2 CCA Treated	14	6	4	3

1.9 SUSTAINABILITY

Ecoply® is manufactured from radiata pine, a plantation grown medium density softwood. 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.

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

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

1.10 HEALTH & SAFETY

Ecoply should be handled in accordance with the Material Safety Data Sheets (MSDS) for untreated, H3.2 CCA and H3.1 LOSP treated Ecoply, which are available upon request.

Always wear safety glasses or non-fogging goggles when machining Ecoply panels.

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.

1.11 STORAGE & HANDLING

Ecoply requires care in storage and handling. The following suggestions will help keep the plywood in good condition before use and after installation:

- The storage area should be protected from sun, rain and wind that would otherwise bring about rapid changes in temperature and humidity
- Support for the sheets should be provided at both ends and middle to avoid distortion. Ensure bearers in packs above are aligned over bearers below (to avoid inducing curves in sheets)

- The stack should be kept dry and clear of ground contact, and placed so that it will not be exposed to mechanical damage
- The sheets should be stacked flat, NOT on edge
- To avoid staining, fading and surface checking, the sheets should not be exposed to the weather while awaiting installation

1.12 LIMITATIONS

The information contained in this document is current as at December 2011 and is based on data available to CHH Woodproducts at the time of going to print.

This publication replaces all previous CHH Woodproducts design information and literature relating to Ecoply Structural, Ecoply Bracing, Ecoply Flooring, Ecoply Roofing & Decking and Origin® plywood. CHH Woodproducts reserves the right to change the information contained in this document without prior notice. It is important that you call 0800 326 759 to confirm that you have the most up to date information available or refer to www.chhwoodproducts.co.nz

This publication is a guide only and is not intended to be used as a substitute for NZ Building Code requirements and associated standards.

CHH Woodproducts has used its 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.

2.0 GENERAL INSTALLATION GUIDE

The following is a general guide to be followed unless otherwise specified. For additional installation instructions for typical

applications refer to section 3.0: Typical applications.

2.1 FRAMING

Use kiln dried framing e.g. Laserframe® in accordance with timber framing manufacturers' specifications and treated in accordance with NZS 3602. All timber frame sizes and set out must comply with NZS 3604 (or be specifically designed to NZS 3603). Ecoply® may be specified for frame spacing determined by design, or using tables in section 3 for specific product applications such as bracing, internal linings, flooring and as a substrate for shingle roofs or membrane roofs and decks.

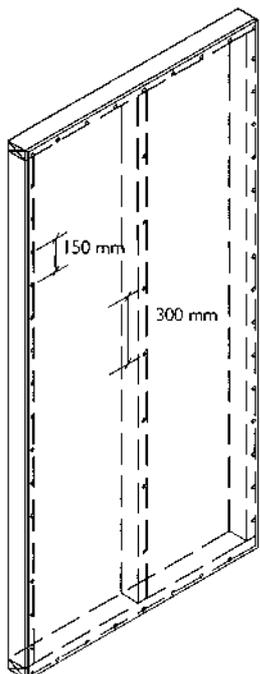
H3.1 LOSP treated framing should be vented before fixing and if construction adhesives are required (for example to screw and glue floor panels) the adhesive must be compatible with H3.1 LOSP. See section 1.4: Preservative treatment.

For plywood used as exterior cladding refer to the Shadowclad® Specification & Installation Guide.

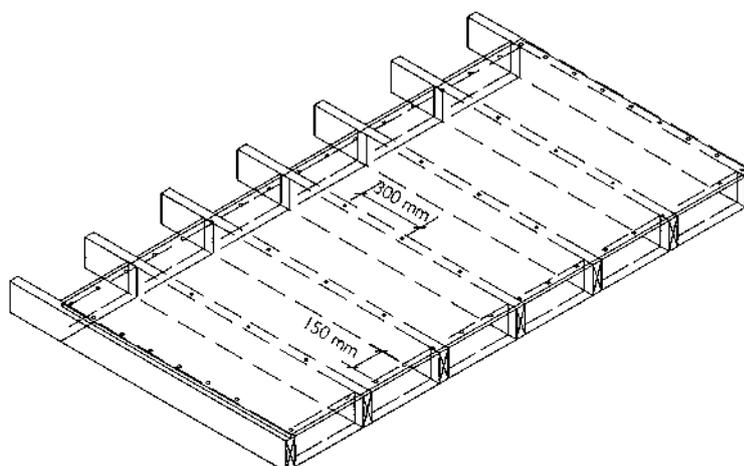
2.2 SHEET FASTENERS AND FIXING

- Where there is risk of panel size change due to changes in moisture levels, allow a 2 to 3 mm expansion gap between sheets
- Use only flathead nails or screws, with or without construction adhesives
- Fastener length should penetrate at least 10 nail diameters into the framing or be three times the sheet thickness, whichever is the greater. Longer or ring shank nails may be specified
- Fasteners must be at least 3 fastener diameters or 7 mm from the edge of the sheet. Because of its cross banded construction, fasteners can be placed close to the edge of the sheet to allow joining on narrow framing members
- For tongue and groove products such as flooring and roofing fasten 15 mm from tongue and groove edges
- Standard fixing pattern: unless otherwise specified fasten edges and ends of sheets at 150 mm centres, and within the panel at no more than 300 mm centres (see diagram below)
- Use hot dipped galvanised fasteners or corrosion resistant fasteners (i.e. stainless steel) determined by design for specific hazards
- Where using stainless steel nails, nails must be annular grooved
- Refer to Table 7 for minimum fastener sizes
- Do not over-drive power driven nails

EC001: Fastener spacings for Ecoply®



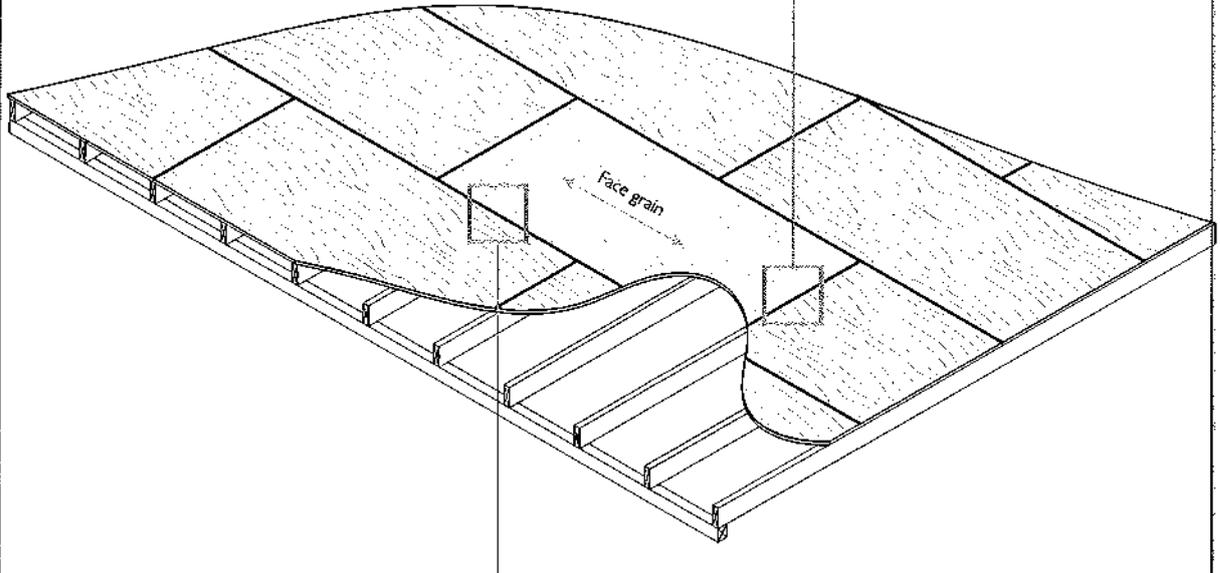
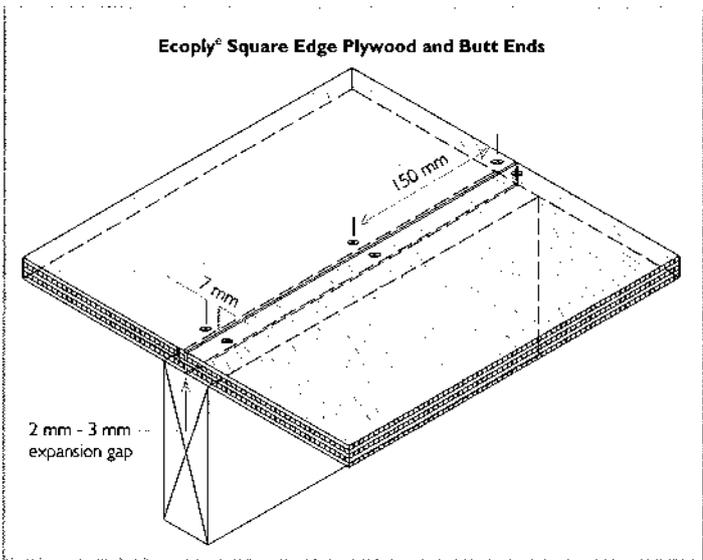
Ecoply® fastened in vertical plane



Ecoply® fastened in horizontal plane

EG002: Fastener spacings from edge

Ecoply® Square Edge Plywood and Butt Ends



Ecoply® Tongue and Groove Plywood

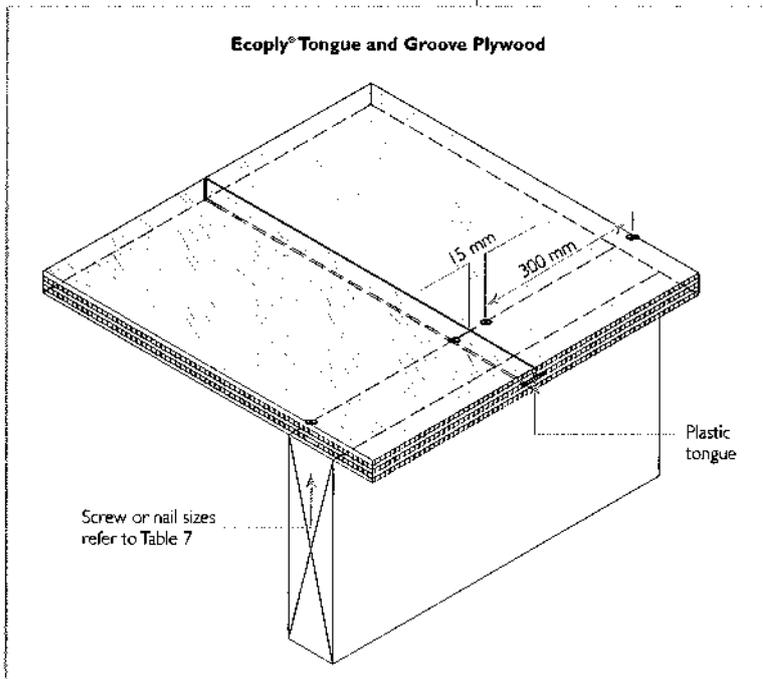


TABLE 7: FASTENERS AND CHARACTERISTIC SHEAR LOADS FOR ECOPLY

Nominal thickness (mm)	7.6mm	Load ¹	12.4/15 mm	Load ¹	19mm	Load ¹	19/20/21 mm	Load ¹	25 mm	Load ¹
Minimum nail size in timber studs	40 x 2.5 mm	570	60 x 2.8 mm	710	60 x 2.8 mm	710	60 x 2.8 mm	710	75 x 3.15 mm	883
Screw size in timber studs	No.8 x 30 mm	1230	No.8 x 40 mm	1230	No.10 x 40 mm	1650	No.10 x 45 mm	1650	No.10 x 50 mm	1650
Screw size in 1.15 mm steel studs²	10-24-35 ³	1300	10-24-40 ³	2000	10-16-45 ³	2100	10-16-45 ³	2100	10-16-45 ³	2100
Screw size in 2.80 mm steel studs²	10-24-35 ³	1200	10-16-40 ³	1200	14-20-45 ³	3000	14-20-45 ³	4000	14-20-45 ³	5000

¹ The load is the characteristic load (N) for one fastener in single shear

² Self tapping, self countersinking screw

³ Screw Numbers indicate: Gauge – Threads per inch – Length (mm)

- Steel thickness, screw sizes, characteristic loads, refer to assemblies actually tested
- Other screw sizes may be used. Screw properties vary between screw suppliers and the suitability of a particular size should be verified by the designer for performance under changing physical conditions and cyclic loading
- Non-standard nailing may be specifically designed with NZS 3603 or similar

Fasteners for H3.2 CCA treated EcoPLY[®]

Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised. In certain circumstances stainless steel fasteners may

be required. Refer to section 4 of NZS 3604 for these circumstances. Where stainless steel nails are required, annular grooved nails must be used.

2.3 ADHESIVES

Tube applied construction adhesives

Site applied construction adhesives may be used together with nails and screws for non permanent loads, reduced fastener popping, and to lower the risk of squeaking in floors. Available types include polyurethane (e.g. Holdfast[®] Gorilla Nailpower[®]) and elastomeric (e.g. Bostik[®] Wallboard Gold) based adhesives.

Elastomeric adhesives should meet the requirements of APA Performance specification AFG 01 *Adhesives for field gluing plywood to wood framing*. Other types should have appraisal from an independent authorising body such as BRANZ or equivalent authorities for the specific applications proposed. Follow manufacturers' recommendations. In addition:

- Use a bead or daubs of adhesive as per manufacturers' recommendations
- Apply pressure using fastener patterns outlined in section 2.2: Sheet fasteners and fixing
- Work from the middle of the sheet outwards to develop glue-line pressure
- Ensure adhesives are compatible with treatment in the framing timber; see section 1.4: Preservative treatment

Structural adhesive joints

Structural bonds are generally only achievable in factory controlled conditions using approved structural adhesives in accordance with approved standards for glue lamination, e.g. Resorcinol formaldehyde joints made to AS/NZS 1328 *Glued laminated structural timber*. Site gluing is not recommended for structural plywood components. Contact the EcoPLY[®] help line on 0800 326 759 for further information.

3.0 STRUCTURAL BRACING & CEILING DIAPHRAGMS

The Ecoply® 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* or specifically designed to NZS 3603 *Timber Structures Standard*.

Any Ecoply structural panel may be used for bracing as long as it is equal to or greater than 7 mm thickness, has a minimum wall length as described in Table 9, treated for the specific

application in accordance with NZS 3602 (summarised in Table 8) and fixed in accordance with Ecoply bracing specifications outlined in this publication.

Shadowclad® exterior cladding, direct-fixed to framing or installed over 20 mm cavity battens, may be used for bracing when installed in accordance with the Shadowclad Specification & Installation Guide.

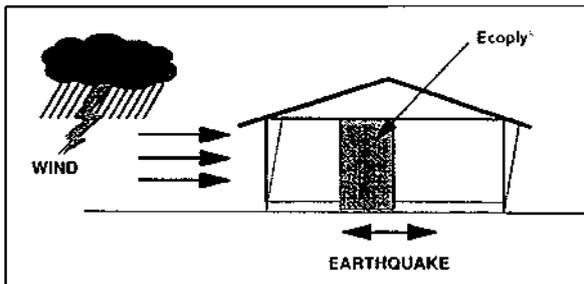
3.1 DESIGN TO COMPLY WITH THE NEW ZEALAND BUILDING CODE

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 Ecoply 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 Ezy-Brace software, downloadable from www.gib.co.nz

EP bracing systems properties can be easily loaded into the Ezy-Brace software by way of an Excel patch downloadable from www.chhwoodproducts.co.nz/ecoply-bracing together with loading instructions.

Because of changes made in the way the P21 racking test is analysed, BU's have been slightly downgraded in some instances from previous publications.

As a consequence of these changes, historical bracing systems (commonly referred to as the SP bracing series) will not meet the requirements of NZS 3604 and will not be an acceptable system from the 1st of January 2012.

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.

Durability

Ecoply 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 8 summarises the applications in which Ecoply can be used as structural bracing together with the preservative treatment and fastener material required.

TABLE 10 ECOPLY® SUSTAINABILITY FOR BRACING APPLICATIONS INCLUDING TREATMENT TYPE AND FASTENER MATERIAL

Application	Plywood Treatment	Fastener Material
Plywood bracing in interior spaces with no risk of exposure to weather or moisture penetration conducive to decay (all exposure zones¹ including sea spray): E.g. Interior linings	Ecoply Untreated	Hot dipped galvanised or better
Plywood bracing in enclosed spaces (protected from the weather) but with a risk of moisture penetration conducive to decay in exposure zones¹ B & C: E.g. Plywood bracing and/or rigid underlay (rigid air barrier), fixed to framing with/ without building paper/ wrap over, with/ without cavity battens behind cladding	Ecoply H3 treated Ecoply Barrier (rigid air barrier)	Hot dipped galvanised or better
Plywood bracing in enclosed spaces (protected from the weather) but with a risk of moisture penetration conducive to decay in exposure zone¹ D (sea spray): E.g. Plywood bracing and/or rigid underlay (rigid air barrier), fixed to framing with/without building paper/wrap over, with/without cavity battens behind cladding	Ecoply H3 treated Ecoply Barrier (rigid air barrier)	Stainless steel
Plywood bracing exposed to exterior weather conditions and dampness but not in contact with ground in exposure zones¹ B & C: E.g. Plywood used as both cladding and bracing (direct fixed to framing or over a drained ventilated cavity system)	Refer to Shadowclad® Specification and Installation Guide	
Plywood bracing exposed to exterior weather conditions and dampness but not in contact with ground in exposure zones¹ D (sea spray): E.g. Plywood used as both cladding and bracing (direct fixed to framing or over a 20 mm drained ventilated cavity system)	Refer to Shadowclad Specification and Installation Guide	
Bracing on framing exposed to ground atmosphere in exposure zones¹ B & C	Ecoply H3 treated	Hot dipped galvanised or better
Bracing on framing exposed to ground atmosphere in exposure zones¹ D	Ecoply H3 treated	Stainless steel
Bracing in wet process buildings in all exposure zones¹ (including sea spray)	Ecoply H3 treated	Stainless steel

¹ Exposure zones as per section 4 of NZS 3604

Rain wetting and construction bracing

Untreated Ecoply® will withstand normal exposure conditions during construction for up to 3 months however aesthetically the sheet appearance will deteriorate as the level of exposure increases. Rain and exposure can cause thinner plywood panels to buckle. Plywood stability is related to the number of veneers and thickness of the panel. Where panel stability is critical, consider using thicker panels.

Humidity and condensation

In uses where the moisture content may exceed 18% for prolonged periods, Ecoply must be H3 treated to resist decay or insect hazard.

Subfloor sheet bracing

H3 treated Ecoply 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 Ecoply 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 by test or from Table 9 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

Ecoply bracing panels must be fixed from top plate to bottom plate (with the exception of bracing specification of EPGs). For wall heights over 2.4 m, Ecoply and Shadowclad is available in 2.7 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 Ecoply bracing specifications (e.g. 2.4 m x 1.2 m sheet with a 0.3 m x 1.2 m part sheet above it to give a 2.7 m x 1.2 m bracing element).

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 the Shadowclad Specification and Installation 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 more information refer to section 1.8: Face checks on plywood exposed to weather. H3.2 CCA treated EcoPLY may also have a green tinge to the wood surface and may have fillet marks on the face of the sheet.

For exterior cladding applications where a high visual appearance is desired, CHH Woodproducts strongly recommends the use of Shadowclad as an exterior cladding. Shadowclad has a bandsawn face which helps reduce the incidence and appearance of face checking and is most commonly H3.1 LOSP treated (clear preservative treatment) which does not leave fillet marks on the panel face.

For further information on Shadowclad and plywood as an exterior cladding refer to the Shadowclad Specification and Installation Guide.

Soil

EcoPLY must not be allowed to come in contact with soil. 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 ECOPLY® BRACING SPECIFICATIONS SUMMARY

CHH Woodproducts has a range of bracing specifications called the EP bracing series. The EP bracing series simplifies the design and construction of bracing elements using plywood, by itself or in conjunction with GIB® Plasterboard.

- Reduced number of element types and simplified naming system
- Single sided and double sided bracing elements
- Special EPGs bracing element design for where plywood cladding comes to soffit line within 300 mm of top plate
- High performance bracing element utilising GIB® Standard plasterboard
- A single type, GIB Handibrac®, hold-down for all bracing elements
- Direct fix or cavity construction
- Simplified construction
- Specifications for each bracing element type

Historical Ecoply® bracing specifications (commonly referred to as the SP bracing series) can still be used in bracing design until the 31st of December 2011. At this time the SP bracing series will be officially withdrawn from CHH Woodproducts bracing specifications to meet the recent changes in NZS 3604:2011.

Where the cladding forms part of the structural bracing refer to Shadowclad Specification and Installation Guide for specifications.

Up until the 31st of December 2011 SP bracing series specifications can be downloaded from www.chhwoodproducts.co.nz/ecoply-bracing

TABLE 9: SUMMARY P21 RATINGS FOR 2.4 M HIGH ECOPLY® WALL ELEMENTS

Specification No.	Minimum Wall Length	Lining Requirements	WU (m Wind)	EU (m Earthquake)
EPI	0.6 m	7 mm Ecoply or Ecoply Barrier one side	125	130
EP2	0.6 m	7 mm Ecoply or Ecoply Barrier each side	140	150
EPG	0.4 m	7 mm Ecoply or Ecoply Barrier one side and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	150
EPGs	0.4 m	7 mm Ecoply or Ecoply Barrier one side* and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	120

* Plywood side of element must be a maximum of 300 mm below top plate

Note: Bracing and other technical information has been specifically tested using Ecoply and Shadowclad branded structural plywood. This information cannot be used with any other plywood brand and bracing data must be sought directly from the specific plywood manufacturer.

More information

The following pages provide a full specification of EP bracing elements. Copies of specifications can be downloaded from www.chhwoodproducts.co.nz/ecoply-bracing

NZS 3604 provides the method of calculating demand on a building. Calculation sheets are available from BRANZ or GIB® EzyBrace™ software is available as a free download from www.gib.co.nz. Information is available at www.chhwoodproducts.co.nz which can be placed in the custom elements of GIB® EzyBrace™ for ease of calculation.

Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SGB timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB Handibrac® are registered trade marks of Fletcher Building Holdings Ltd.

Ecoply® BRACING SPECIFICATION - P1

SINGLE SIDED STRUCTURAL PLYWOOD BRACE

Specification No.	Minimum Wall Length	Lining Requirements	Design Wind	Design Earthquake
EPI	0.6 m	7 mm Ecoply® or Ecoply Barrier one side	125	130

Framing

Wall framing must comply with:

- NZBC B1 - Structure: ASI Clause 3 Timber (NZS 3604:2011)
- NZBC B2 - Durability: ASI Clause 3.2 Timber (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®, 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 7 mm Ecoply plywood or Ecoply® Barrier 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. A 2-3 mm expansion gap should be left between sheets.

Fastening the Ecoply®

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails for direct fix, or 60 x 2.8 mm over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

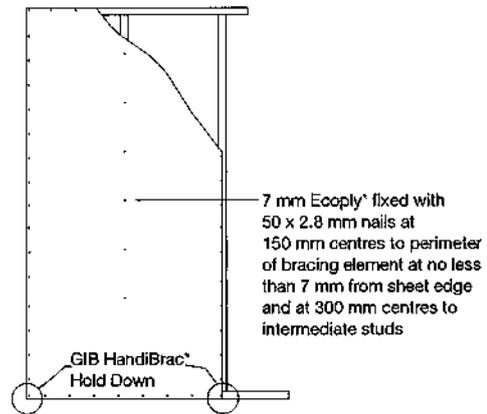
Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

In certain circumstances stainless steel fasteners may be required. Refer to table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice.

Where stainless steel nails are required, annular grooved nails must be used.

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.



Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/ASI Structure. Testing was carried out using Ecoply and Laserframe SGB timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB Handibrac® are registered trade marks of Fletcher Building Holdings Ltd.

3.4 ECOPLY® BRACING SPECIFICATION (EP2)

DOUBLE SIDED STRUCTURAL PLYWOOD BRACE

Specification No.	Minimum Wall Length	Lining Requirements	BB (mm) Wings	BB (mm) Beam/Spoke
EP2	0.6 m	7 mm Ecoply® or Ecoply Barrier each side	140	150

Framing

Wall framing must comply with:

- NZBC B1 - Structure: ASI Clause 3 Timber (NZS 3604:2011)
- NZBC B2 - Durability: ASI Clause 3.2 Timber (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®, 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

Each Side: One layer of 7 mm Ecoply plywood or Ecoply® Barrier 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. A 2-3 mm expansion gap should be left between sheets.

Fastening the Ecoply®

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails for direct fix, or 60 x 2.8 mm over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

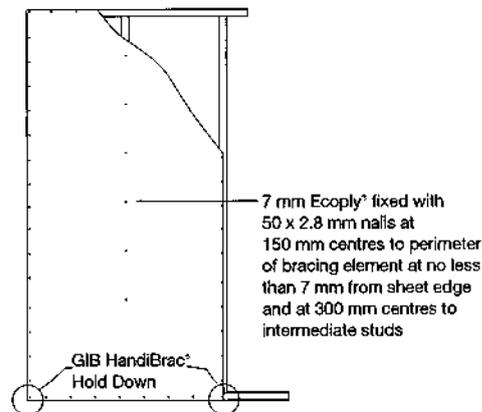
Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

In certain circumstances stainless steel fasteners may be required. Refer to table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice.

Where stainless steel nails are required, annular grooved nails must be used.

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.



Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/ASI Structure. Testing was carried out using Ecoply and Laserframe SG8 timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB Handibrac® are registered trade marks of Fletcher Building Holdings Ltd.

3.5 ECOPLY® BRACING SPECIFICATION – EPG

STRUCTURAL PLYWOOD BRACE WITH PLASTERBOARD OTHER SIDE

Specification No.	Minimum Wall Length	Finish Requirements	Brace Width	BD/75m Equivalent
EPG	0.4 m	7 mm Ecoply® or Ecoply Barrier one side and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	150

Framing

Wall framing must comply with:

- NZBC B1 - Structure: ASI Clause 3 Timber (NZS 3604:2011)
- NZBC B2 - Durability: ASI Clause 3.2 Timber (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®, 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

Side 1: One layer of 7 mm Ecoply plywood or Ecoply® Barrier exterior wall cladding 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. A 2-3 mm expansion gap should be left between sheets.

Side 2: One layer of 10 or 13 mm GIB® Standard plasterboard vertically or horizontally fixed. Sheet joints are touch fitted and fastener heads and joints stopped in accordance with the GIB® Site Guide.

Fastening the Ecoply®

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails for direct fix, or 60 x 2.8 mm over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

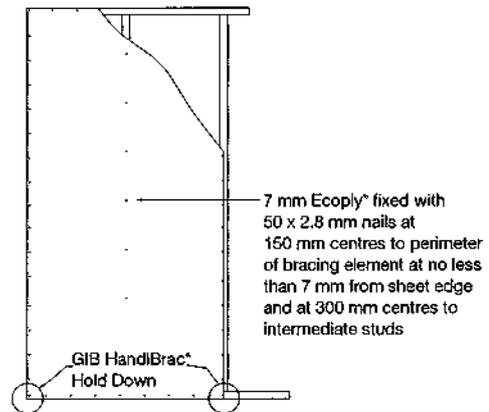
Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

In certain circumstances stainless steel fasteners may be required. Refer to table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice.

Where stainless steel nails are required, annular grooved nails must be used.

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.



Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SGB timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.

Fastening the GIB® Plasterboard

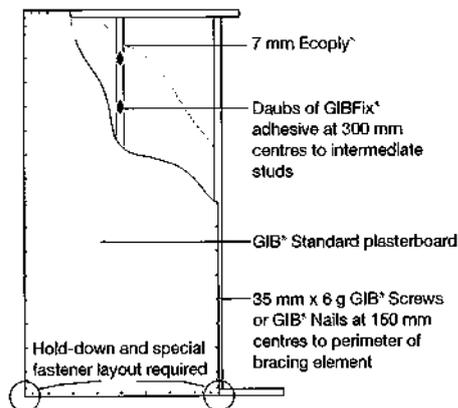
Fasteners

32 mm x 6 g GIB® Grabber® Screws or 35 mm GIB® Nails

Fastening centres

Fasten 50, 100, 150, 225 and 300 mm from each corner and 150 mm thereafter around the perimeter of the bracing element. For vertical fixing place fasteners at 300 mm centres at intermediate sheet joints. For horizontal fixing place single fasteners in the tapered edge where sheets cross studs.

Place fasteners 12 mm from paper bound edges and 18 mm from cut sheet edges. GIB® plasterboard must be treated in every respect in accordance with relevant GIB® literature.



Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SG8 timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system, GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.

3.6 ECOPLY® BRACING SPECIFICATION EPGs

A BRACING ELEMENT SPECIALLY DESIGNED FOR SHEETS TO TERMINATE AT SOFFIT HEIGHT

Specification No.	Minimum Wall Length	Fixing Requirements	BU (m Wind)	BU (m Earthquake)
EPGs	0.4 m	7 mm Ecoply® or Ecoply Barrier one side and 10 mm GIB® Standard plasterboard other side	100	115
	1.2 m		150	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 (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®, 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.

Fixing

Side 1: One layer of 7 mm Ecoply plywood or Ecoply® Barrier 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. A 2-3 mm expansion gap should be left between sheets. The Ecoply may terminate within a maximum of 300 mm below the top of the top plate, e.g. at soffit line, where solid nogging must be provided for the full length of the bracing element to provide for fixing of the Ecoply.

Side 2: One layer of 10 or 13 mm GIB® Standard plasterboard vertically or horizontally fixed. Sheet joints are touch fitted and fastener heads and joints stopped in accordance with the GIB® Site Guide.

In certain circumstances stainless steel fasteners may be required. Refer to table 8 of the Ecoply Specification and Installation Guide for these circumstances and further fastener selection advice.

Where stainless steel nails are required, annular grooved nails must be used.

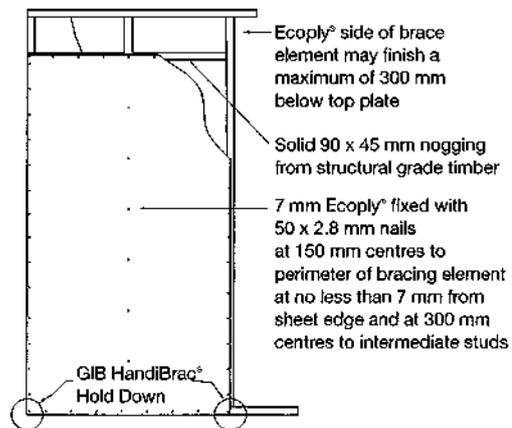
Fastening centres

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 plywood side of the brace element may be fixed over cavity battens.

The cavity battens must be a minimum of 40 x 2.0 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. A minimum of 50 mm x 2.8 mm flat head galvanised or annular grooved stainless steel nails must be used.



Fastening the Ecoply®

Fasteners

Fasten with 50 x 2.8 mm galvanised or stainless steel flat head nails for direct fix, or 60 x 2.8 mm over cavity battens. Place fasteners no less than 7 mm from sheet edges.

Fasteners for H3.2 CCA treated Ecoply

Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised.

Ecoply® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using Ecoply and Laserframe SG8 timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.

Fastening the GIB® Plasterboard

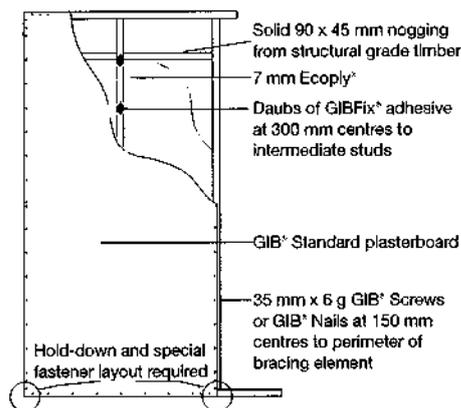
Fasteners

32 mm x 6 g GIB® Grabber® Screws or 35 mm GIB® Nails

Fastening centres

Fasten 50, 100, 150, 225 and 300 mm from each corner and 150 mm thereafter around the perimeter of the bracing element. For vertical fixing place fasteners at 300 mm centres at intermediate sheet joints. For horizontal fixing place single fasteners in the tapered edge where sheets cross studs.

Place fasteners 12 mm from paper bound edges and 18 mm from cut sheet edges. GIB® plasterboard must be treated in every respect in accordance with relevant GIB® literature.



EcoPLY® Bracing Systems are designed to meet the requirements of the New Zealand Building Code and have been tested and analysed using the P21 method referenced in NZS 3604:2011 listed as an acceptable solution B1/AS1 Structure. Testing was carried out using EcoPLY and Laserframe SG8 timber framing manufactured by

Carter Holt Harvey Limited trading as CHH Woodproducts New Zealand, and GIB® products manufactured by Winstone Wallboards Ltd. Substituting materials may compromise performance of the system. GIB® and GIB HandiBrac® are registered trade marks of Fletcher Building Holdings Ltd.

1.7 GIB HANDIBRAC® RECOMMENDED INSTALLATION METHOD

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

- The GIB HandiBrac® registered design provides for quick and easy installation
- The 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 perimeter joist or bearer</p>	
<p>Position GIB HandiBrac® at the stud/plate junction</p>		<p>Position GIB HandiBrac® in the centre of the floor joist or full depth solid block</p>	
<p>Hold-down (astromer) requirements</p> <p>A mechanical fastening with a minimum characteristic uplift capacity of 15kN or screw bolt supplied with the bracket</p>		<p>12 x 150 mm galvanised coach screw or screw bolt supplied with the bracket</p>	

Reproduced with the permission of Winstone Wallboards Ltd

3.8 STRUCTURAL CEILING DIAPHRAGMS

Diaphragms are used to transfer lateral loads to braced walls and allow for greater spacing between bracing lines. Diaphragms do not have a BU rating themselves.

Plywood diaphragms are an acceptable solution as described in section 13 NZS 3604 13.5.2 and allows for plywood not less than 6 mm thick and a minimum of three ply for:

- Diaphragms not steeper than 25 degrees to the horizontal and not exceeding 10 metres long under light or heavy roofs and;
- Diaphragms not steeper than 45 degrees to the horizontal and not exceeding 7.5 metres long under light or heavy roofs

Ceiling Diaphragms are constructed as follows:

- The length of diaphragm shall not exceed twice its width measured between supporting walls
- The ceiling lining must consist of plywood over the entire area of the diaphragm
- Complete sheets with a minimum size of 1800 x 900 must be used
- Framing size and spacing must comply with NZS 3604
- Fastener size should comply with Table 7 of this publication. E.g. 40 mm x 2.5 mm flat head nails for 7 mm and 9 mm Ecoply
- Fastening is at 150 mm centres around the perimeter of each sheet and at 300 mm centres to intermediate framing
- Fixings are no closer than 10 mm from sheet edges
- Perimeter ceiling framing must be connected to wall framing by a perimeter 140 mm x 35 mm ribbon plate nailed to the top of the top plate or alternative such as a 0.55 mm thick steel angle or proprietary steel channel

4.0 INTERNAL LININGS, SOFFITS AND APPEARANCE PLYWOOD

The below section relates to the use of Ecoply® appearance plywoods in internal and soffit lining applications.

Appearance plywood (Ecoply Structural Square Edge BB and BD face grades and Ecoply Grooved Lining - often referred to as "Plygroove") are specifically referenced in this section however where a high visual face grade is not required the use of lower visual grades such as Ecoply CD and DD grades may be used.

For more information on Ecoply surface grades see section 1.3: Surface grades.

Applications

- Interior wall and ceiling linings
- Feature walls and partitions
- Back lining to exposed rafters
- Commercial interiors and shop fitouts
- Soffit lining (where H3.1 LOSP treated)
- Furniture and cabinets

Advantages

- Decorative real wood panelling
- Tough and impact resistant
- Strong, providing stiffness and rigidity
- No special tools required
- Easy to work and finish
- Ability to create slight curves
- Cost effective
- Water-resistant glue bond

4.1 PRODUCT RANGE

TABLE 10: ECOPLY® APPEARANCE PRODUCT RANGE

Thickness (mm)	No. of Plies	Sheet Length (2400 mm)	Structural Square Edge		Grooved Lining
			BB	BD	Classic & Prime
9	3	2400		•	
12	5	2400	•	•	•
12	5	2700		•	•
15	5	2400		•	
17	7	2400	•	•	

All appearance plywoods are available either untreated or H3.1 LOSP treated (9 mm BD - available untreated only). Other sizes and thicknesses may be available on request. Contact CHH Woodproducts on 0800 326 759.

Structural square edge products

- BB grade features a solid sanded 'B' grade appearance on both sides. Suitable for applications where both sides of the panel will be visible and appearance is important
- BD grade features a solid sanded 'B' grade appearance face with an unsanded 'D' back. Suitable for applications where one side of the panel will be visible and appearance is important

Grooved lining products

Grooved Lining is a 12 mm thick sheet with a solid sanded 'B' grade appearance face with an unsanded 'D' back. It features 4 mm wide by 2 mm wide deep 'V' grooves running the length of the sheet at 100 mm centres and is available untreated for internal dry applications or H3.1 LOSP treated for internal damp or semi exposed exterior applications (such as soffit linings).

Grooved Lining is not recommended for use as an exposed exterior cladding due to the potential of appearance issues such as face checking. For more information on face checking see section 1.8: Face checks on plywood exposed to weather.

Grooved Lining is available in two finishes.

- Classic Grade:** Featuring a B face with natural features for a refined wood appearance suitable for clear and stain finishes.
- Prime Grade:** Features a pre primed surface allowing time and labour savings when painting.

When using Grooved Lining Prime some coating manufacturers may require an additional wet primer coating for speciality top coat systems. Always refer to the coating manufacturer's specifications prior to coating.

Note: All sheets containing a single visual side (such as Ecoply BD) have product identification markings on the sheet rear. All sheets with visual faces on both sides of the panel (such as Ecoply BB) are unmarked.

4.2 INTERNAL LININGS AND SOFFITS - DESIGN CONSIDERATIONS

Internal wall linings

- Use 2700 mm sheets where available for high stud walls
- Skirtings, dado mouldings, furniture trim, bookshelves, cornices and other trim can be used to hide mechanical fasteners
- Deep skirting and cornices can be used to extend the effective length of shorter sheets in longer applications
- Unsupported plywood sheets may twist with environmental changes or when coated, particularly if the coating is applied to one side only. Where on going sheet flatness is critical, plywood sheets must be supported by framing
- Ecoply® appearance plywood may be used for structural bracing. Refer to section 3.0: Structural bracing and ceiling diaphragms

Internal ceilings and soffits

- For internal ceilings and soffits (semi exposed to weather) which are visible from underneath use Ecoply Grooved Lining, B face grade Structural Square Edge or Shadowclad® installed with the face down
- For internal/moisture free applications use untreated plywood

Exterior soffits

- Use a minimum 12 mm thickness
- Use H3.1 LOSP treated product. Do not use water based preservative treatments

- Allow a 2-3 mm expansion gap between square edge sheets
- Use a good quality paint or stain to protect the plywood from intermittent wetting and wind blown moisture

Appearance plywood in exposed exterior applications

- Appearance plywood is primarily designed for internal applications (untreated) but H3 treated product can be used for sheltered exterior applications such as soffit linings
- Appearance plywood is not recommended for use in exposed exterior applications such as cladding. For cladding CHH Woodproducts recommends the use of Shadowclad exterior cladding
- If used in exposed exterior applications appearance products will meet the durability requirements of the NZ Building Code, however naturally occurring appearance issues (such as face checking and mould growth) may occur and are not considered a manufacturing fault by CHH Woodproducts. For more information refer to section 1.8: Face checks on plywood exposed to weather

Forming curves

- Ecoply can be curved for applications such as ceilings and feature walls. Table 11 provides guidance for the minimum recommended radii

TABLE 11: BENDING RADII FOR ECOPLY® PRODUCTS

Recommended minimum bending radii for Ecoply products				
Nominal thickness (mm)	9	12	15	17
Along face (m)	2.3	3.6	4.6	6.0
Across face (m)	1.3	2.4	3.0	4.4

4.3 INTERNAL LININGS AND SOFFITS - INSTALLATION

Pre Installation Inspection

- Prior to installation, inspect panels for visual defects. Responsibility lies with the installer to ensure individual panels meet the aesthetic requirements of the project. CHH Woodproducts will not be responsible for installation or removal costs where aesthetically unacceptable panels have been installed
- For best results install panels in as close to the final environmental conditions as possible
- Store panels in a dry, cool area

Sheet layout

- Maximum framing centres are shown in Table 12
- For all square edge sheets products must be supported at sheet edges
- For all sheet product with a tongue and groove edge, unless specified, tongue and groove edges do not need support - all other edges do
- Closer spacings are recommended in high impact areas e.g. bars, industrial or crowded spaces

TABLE 12: MAXIMUM FRAME SPACINGS FOR ECOPLY® PLYWOOD

Application		Maximum frame centre (mm)			
		Ecoply nominal thickness (mm)			
		9	12	15	17
Walls	1. Fixed vertically, max stud spacing without nogs or dwangs	400	600	600	600
	2. Fixed horizontally, maximum stud facing	600	600	1200	1200
Internal Ceilings or Soffits	3. Face grain across framing, under or over frame	-	900	1200	1200

- Avoid single spans between framing supports

4.4 FASTENERS & FIXING

Ecoply® appearance plywood can be installed using a variety of fastening and fixing methods depending on the degree of fastener concealment desired.

General fixing techniques include:

- Nailing (including panel pins), screw and gluing
- Use of scotia/ dado & skirtings to hide joints and fixings
- Battens and rafters to hide joints
- Creating design features of mechanical fasteners (such as use of rose head fasteners)
- Negative detailing between panel edges

Fixings for non bracing walls & ceilings

Nails: Use 40 mm panel pins at 150 mm centres at sheet edges and 300 mm centres on intermediate supports. Daubs of a polyurethane based adhesive such as Holdfast Gorilla Grip or Fix All 220 Sealant at 300 mm centres is recommended on all framing members.

Where back nailing over rafters use galvanised flat head nails 40 x 2.5 mm.

Screws: Use No.8 x 40 mm screws and adhesive as per nail specifications.

Adhesives Only (not suitable for ceiling applications)

Panels may be fixed with a bead of polyurethane based adhesive on all frame supports. Sheets must be supported by applying pressure during the adhesive curing process in accordance with the adhesive manufacturer specifications or with mechanical fasteners such as nails, panel pins or screws at 300 mm centres on all supporting framing.

Holdfast® Adhesive Only Wall System

Holdfast® has developed an installation method for Ecoply appearance plywood when used for internal wall linings (not suitable for use in ceiling applications).

The system uses a two stage process utilising Holdfast Fix All 220MS and Gator UHB double sided tape. The Gator tape provides initial fixing support for panels while a permanent bond is established using the Fix All 220MS.

When installed according to Holdfast technical specifications this system can eliminate the need for mechanical fasteners and/or bracing support during the adhesive curing process.

For specifications and technical support regarding this system contact Holdfast on 0800 70 10 80 or visit www.holdfast.co.nz to download specifications.

Forming curves - installation

- Shaped top and bottom plates or nogs can be jigsaw cut from 17, 19, 21 or 25 mm thick Ecoply
- Fix covering plywood over the framework
- Attach the out edges with tack nails or damps first to develop the curve and then fix sheets from the centre out
- For load bearing curves check capability using a structural designer
- Use recommended fastener size as detailed in Table 7 at 150 mm centres on all frames. Longer fasteners, ring shank or annular grooved nails will provide improved resistance to tension. Adhesives are not normally recommended good in tension applications

4.5 INTERNAL LININGS AND SOFFITS - FINISHING

Punch nails before finishing and apply a first coat (clear, primer or sealer) before filling punched holes to minimise dryout or staining. High quality paints, stains or clear finishes are recommended for Ecoply appearance plywood. Tinted clear finishes can provide a full range of architectural options that show the warmth of wood while reducing yellowing and other ultraviolet effects. The use of high gloss finishes and paints tend to highlight naturally occurring and manufacturing characteristics of plywood such as changes in grain and beat marks from the

sanding. Matt finishes and paints are recommended to provide a natural timber finish.

Ecoply appearance plywoods are wood based and respond to changes in humidity. Avoid using inflexible coatings (such as epoxies) that may check on movement of the wood. For ceilings or similar applications it is an advantage to prefinish panels prior to installation. Always refer to the coating manufacturers' specifications for sustainability.

5.0 ROOFS AND DECKS

The section below covers the use of Ecoply® plywood used as a substrate for flexible membrane and tile systems in roofing and decking applications. They should be considered as supplementary to system specifications from roofing and decking suppliers.

Ecoply is not recommended as a substrate for exterior decks

without a properly detailed barrier material such as butyl rubber, vinyl or E.P.D.M to protect the surface from weathering.

Always refer to the roofing and decking system supplier for installation, plywood selection and surface preparation requirements for specific roofing and decking products.

5.1 FLEXIBLE MEMBRANE SYSTEMS

- Roofing and decking membranes may comprise synthetic rubber sheeting glued to the Ecoply, or torch welded bitumen membranes
- Always ensure Ecoply is dry and free of imperfections such as surface dust and blemishes as membranes coatings will telegraph any substrate imperfections
- Use Ecoply Flooring or Structural Square Edge (CD Grade)
- Where Ecoply Flooring is used consider the use of a small daub of glue in the Tongue & Groove of each sheet if potential movement of the plastic tongue joint is not acceptable
- For trafficable decks use a minimum 17 mm thickness
- Use countersunk stainless steel screws and adhesive on framing to avoid head popping. Apply adhesive between screw locations
- Use kiln dry framing or appropriate LVL framing from the Futurebuild™ range
- Tape over all joints to provide a bond break under the membrane to allow elongation with natural plywood movement
- Where treatment is required use only H3.2 CCA treated Ecoply. Do not use H3.1 LOSP treated Ecoply (solvent based carrier) which is not compatible with most membrane systems. If there is evidence of treatment salt crystals on the Ecoply surface remove by scrubbing with a small amount of water and allow the surface to dry prior to laying the membrane system
- Prepare surface with hot air or gas blow dryers to ensure wash, dew or rain water is driven off prior to laying membrane system

Plywood substrates, face checking and flexible membrane systems

All natural wood based products (including Ecoply) have the potential to develop natural surface face checks when exposed to external environmental conditions. The degree of potential face checking is dependent on a number of factors including the length of time and level of exposure to weather during construction which is outside the manufacturing control of CHH Woodproducts. For more information see section 1.8: Face checking in plywood exposed to weather.

Face checks while typically not present after manufacture, do not affect structural performance of the sheet and are acceptable under AS/ NZS 2269. They are not a manufacturing fault.

Designers and membrane suppliers must carefully consider the suitability of plywood as a substrate for the membrane system in question if the potential of telegraphing of face checks onto the membrane surface is not acceptable.

The risk of telegraphing can be reduced by protecting the plywood surface from weather and moisture during the construction process.

Where the potential of face checking in the plywood substrate is not acceptable designers should consult the membrane supplier for a more suitable membrane or an alternative substrate.

Allowing for moisture expansion of plywood under roof and floor coverings

Membrane suppliers have strongly held different views on the requirements for plywood substrates. The fixing instructions within this publication are the starting point but designers must detail joints that allow for expansion in accordance with practices recommended by the chosen membrane supplier.

CHH Woodproducts view, and the recommendation of a number of suppliers here and in North America, has been to allow for expansion and contraction at sheet edges by loosely butting tongue and grooved edges so that the tongues can absorb movement and providing a small gap (2 to 3 mm) between square sawn edges. Use a bond breaking tape over these joints to spread elongation in the membrane over a longer distance than the narrow gap in the joint itself. This tape can double as a rain seal over the sheet edges during construction.

Other membrane suppliers believe that sheets should be tightly butted and glued and screwed hard up to each other. This practice constrains movement at the small joint between sheets, but over a wider area requires significant allowance for movement around the perimeter of a roof segment. Junctions between the roof slopes and walls need careful detailing to allow for the potential movement. Movement control joints should be provided at regular intervals following the recommendation of the membrane manufacturer; especially if this method is adopted.

5.2 ROOFTILE SYSTEMS

Most fibreglass, asphalt or wooden shingle and tile systems will tolerate DD grade surface characteristics.

- Use unsanded Ecoply® Roofing (DD grade), or sanded Ecoply of the required thickness in Table 13A
- The unsanded surface provides extra grip on steeper roofs for roofing crews

- A plywood substrate can avoid the cost of battens
- Fix tiles according to tile manufacturer's specification
- Under asphalt shingles use saturated felt underlay over the Ecoply

5.3 ROOFING & DECKING - PRODUCT SELECTION GUIDE

	Structural Square Edge (DD Grade)	Flooring (GP Grade)	Roofing (DD Grade)
Product Description	CD face grade sheets are available in a range of thicknesses and sizes	Solid sanded C grade surface with tongue and groove profile on long edges	Unfilled D grade surface with tongue and groove profile on long edges
Recommended Applications	Substrate for flexible coverings requiring a smooth substrate and where avoidance of visible surface indentations is critical. Use as a substrate for flexible roof and deck membranes and thin roofing tiles		Substrate for coverings with the ability to span holes in the D face grade (up to 75 mm in diameter) such as asphaltic roof tiles and torch welded polyester reinforce membranes Do not use under flexible membrane coverings or where avoidance of visible surface indentation is critical
Face Grades		Front: C solid sanded Back: D unsanded	Front & Back: D unsanded
Product Features	Blocking required to support all edges	Refer to Table 1 for range and treatment options Second void free layer under surface veneer for increased protection against punching through the first veneer under high point loads & increased moisture resistance Blocking not required to support tongue and groove edges (unless otherwise specified)	15 mm thickness specifically designed for use under shingles and tiles that have a courser finish Unsanded surface for extra strength and grip for installers on steep roofs Blocking not required to support tongue and groove edges (unless otherwise specified)
Thicknesses Available	12, 15, 17, 19, 21, 25 mm	15, 17, 19, 21, 25 mm	15, 17 mm
Sheet Sizes Available		2400/2700 x 1200 mm	
Stress Grades Available	F8 (F11 ¹ available upon request)	F8 (F11 ¹ available upon request) 19 mm Longspan supplied F11 ¹ as standard	F8 & F11 ¹
Treatment	Untreated, H3.2 CCA and H3.1 LOSP	Untreated, H3.2 CCA, (H3.1 LOSP available upon request)	
Span Capabilities		Refer to frame spacings in Tables 13A and 13C	

¹ Where the stress grade F11 is referred to in all CHH Woodproducts plywood literature actual stress grade properties of panels are F11 parallel to the face grain and F8 perpendicular to the face grain.

5.4 FRAME SPACINGS FOR ECOPLY™ ROOFS AND DECKS

TABLE 13A: ROOFING - SHEATHING, NON TRAFFICABLE, ABOVE 2 DEGREE PITCH

Application	Roof Pitch	Steel Grade	Maximum Wind Zone	Maximum frame centres (mm) for Ecoply only with face grain across framing				
				Ecoply nominal thickness (mm)				
				19	17	17	21	25
Sheathing, non trafficable roof for all roof pitches above 2 degrees Suitable for roof mass up to 30 kg/m ² (additional to Ecoply weight or 40 kg/m ² including Ecoply)	>2°	F8	Extra High	600	600	800	800	900
			High	900	900			
		F11	Very High	800	900			
			Extra High	800	800			
>20°	F11	Very High	900	900				
		Extra High	800	800				

Suggested applications include substrates for Asphalt Single and Membrane type roofs.
The above suggested maximum framing spans are based on the following deflections criteria:

- Under a short term 1kN point load, deflection is less than Span/130
- Under a long term self weight load, deflection is less than Span/400
- Under a short term wind gust load, deflection is less than Span/150

TABLE 13B: SUB-SHEATHING

Application	Maximum frame centres (mm) (or Ecoply [®] with face grain across framing)					
	Ecoply nominal thickness (mm)					
	19	16	17	19	21	25
Under steel or self supporting cladding for support of building paper or lateral diaphragm action. Sag not critical	800	1200				

TABLE 13C: DECKING

Application	Maximum frame centres (mm) (or Ecoply [®] with face grain across framing)			
	Ecoply nominal thickness (mm)			
	17	19	21	25
1. Trafficable roof decking Limited by dynamic response of roof as floor	540	600	600	750
2. Roof decking to clause 8.5.5.1 c) of E2/AS1*	400	400	400	400

* The current requirement in E2 AS1 is extremely conservative when compared with calculations determined for other applications using VMI Clause 6 and calibrating the spans against codes of practice from North America and Australia. CHH Woodproducts recommends designers consider the alternative solution in row 1 of Table 13C for membrane decking.

Unless otherwise stated spans apply equally to square edge or tongue and groove panels.

Check Table 1 for availability of grades and lengths to match span multiples in Table 14

- Use the next lower recommended frame spacing or thicker Ecoply[®] where appearance is critical
- To suit trusses at 900 centres, 2700 long sheets are available. See Table 14

TABLE 14: FRAME SET OUTS (MM) TO MATCH 2400 MM AND 2700 MM SHEET MODULES

Length (mm)	Frame Spacing				
2400	400	480	600	800	
2700	450	540	675	900	

Limitation for the use of Table 14

CHH Woodproducts does not have access to information about designs for specific sites. Table 14 is a guide to estimate the initial selection of a span for design. Each site should be evaluated by qualified persons to ensure all loading parameters and site conditions have been considered, and appropriate changes should be made by the building designer.

5.5 ROOFING – DESIGN CONSIDERATIONS

Durability

In general, H3.2 CCA treatment of Ecoply® plywood with waterborne preservatives is recommended for roofing.

Roofing materials

Various roofing materials used over Ecoply plywood have different durability expectations, normally in excess of the 15 years required by the NZ Building Code Clause B2. Durability of the roofing is subject to the specifications, installation and maintenance requirements of the roofing manufacturer. The durability of the Ecoply can only be assured as long as the overlying roofing and detailing excludes moisture. With good building practice and maintenance, roofing materials can be repaired or replaced at regular intervals to achieve life from the Ecoply in excess of the original roofing. With this proviso the durability of Ecoply structural plywood will be in excess of 50 years if installed in accordance with instructions and limitations in this brochure and the roof system is adequately maintained.

High humidity, condensation and solar driven moisture

Where the moisture content of wood may exceed 18% for prolonged periods, Ecoply must be H3.2 CCA treated, to resist decay hazard. This includes Ecoply used under roof coverings that may be subject to condensation, or where rain moisture soaked in the roof covering can be driven into the Ecoply by the sun. Appropriate building detailing and ventilation is recommended which can reduce the need for treatment.

Roof ventilation

Poorly ventilated spaces can develop very high temperature and moisture levels. The most likely source of moisture is the condensation of vapour from warm interior air on the underside of cold roofing. Good ventilation can remove the need for treatment by removing excess moisture vapour

in warmer climates but in regions where winter nights are consistently colder, H3 treated Ecoply is recommended. However, the use of H3 treated Ecoply is not an excuse for poor ventilation design. Moisture induced decay is only one issue. If incorrectly detailed, roof spaces can be very tight and the dark colour of many roofing materials means that excessive heat can build up causing distortion in plywood or even framing members. Use the suggested details or alternatives to suit. Designers must consider roofing type, seasonal conditions, wind effects and the intended use of the building.

As a minimum, CHH Woodproducts recommends a vent area of 1/300th of the ceiling plan area (approx 3350 mm² per square metre of ceiling) equally distributed at the eaves and ridge to allow free flow under the Ecoply, up the roof slope, and out.

Roofing material suppliers should detail vent systems suited to their specific membrane or tile roofing. Proprietary ridge capping profiles or vents are available from roofing suppliers.

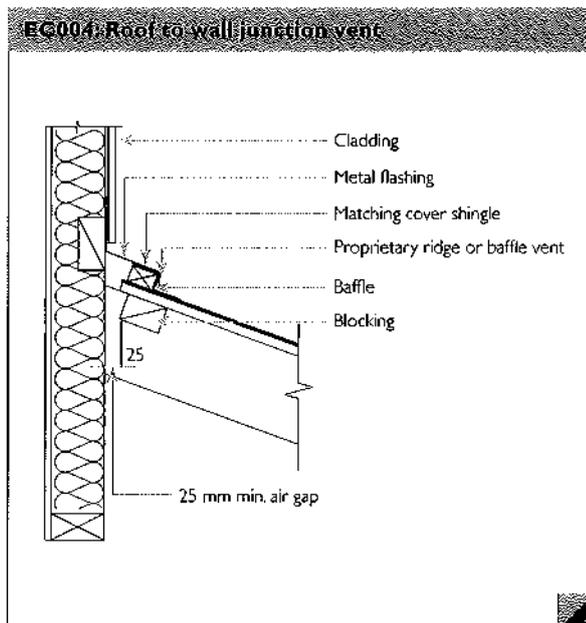
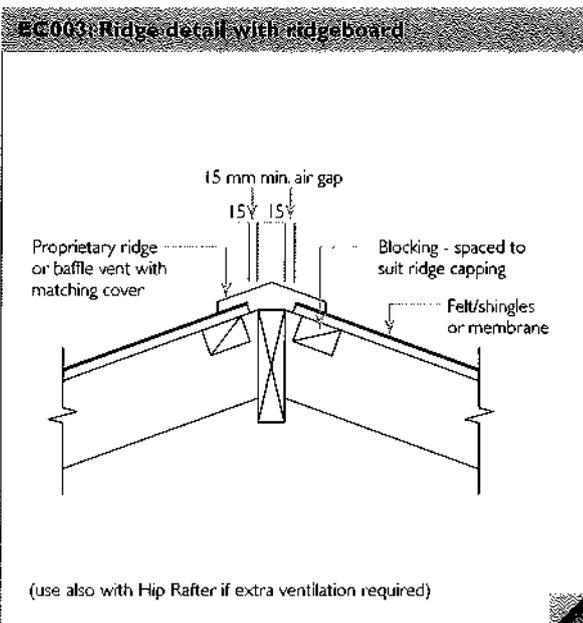
Detail gaps of 25 mm in the plywood at ridges, and at walls where a roof slopes up to an upper storey. For flat roofs, natural ventilation flows may be impeded. Use proprietary roof vents. Consider forced ventilation as appropriate.

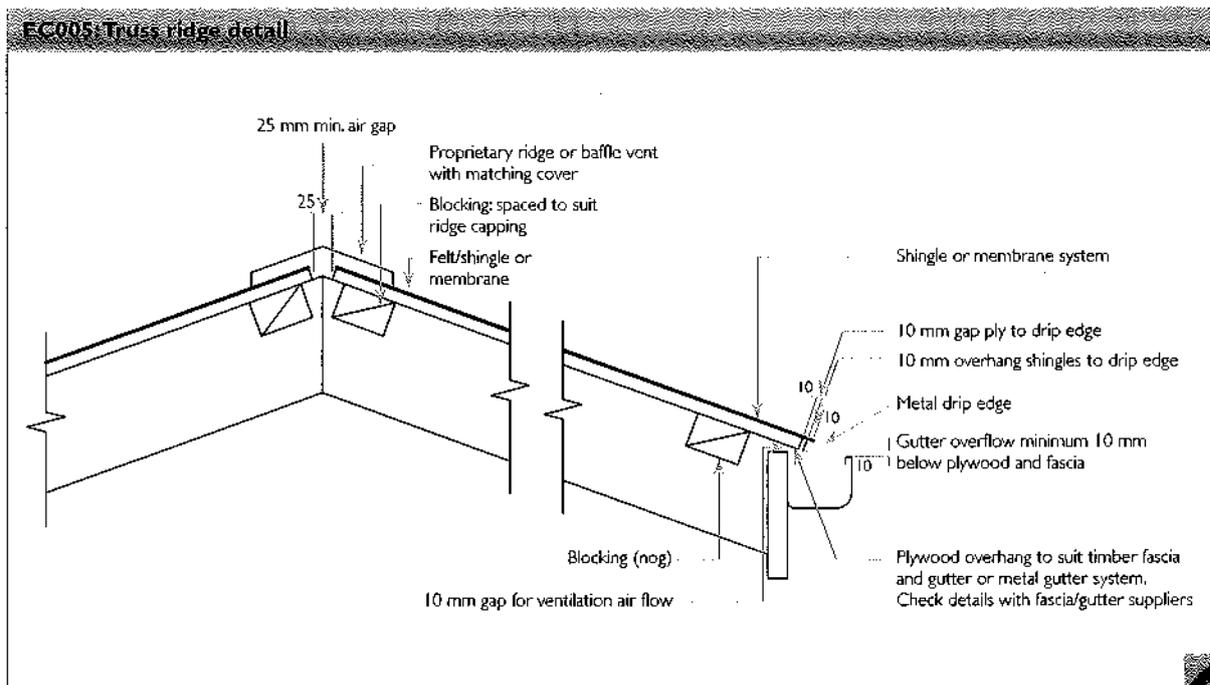
Bubbling

Plywood bubbling occurs when moisture trapped in knot holes in inner veneers expands as the temperature rises. This moisture will dissipate through the face veneer and will not affect the structural integrity of the plywood panel. As membrane coverings can prevent moisture dissipation, Ecoply Flooring and Structural Square Edge CD is recommended if the visual appearance of bubbling is not acceptable, or a high visual finish is required.

Soil

Ecoply plywood (untreated or H3 treated) must not be allowed to come in contact with soil. Surfaces, flashings and gutters should be detailed to avoid trapping detritus and moisture.





Rain wetting and construction time

Untreated Ecoply® will withstand a reasonable amount of rain wetting and exposure during construction for up to three months. In extreme weather conditions of high temperature and/or high rainfall this period may be less. Appearance issues such as discolouration and checking of the sheet surface can be expected if Ecoply is exposed. For roofs uncovered for longer periods use H3 treated Ecoply to lower the risk of decay. Return Ecoply to below 18% moisture content before installing moisture sensitive materials, coverings, coatings or adhesives. Where a high visual finish is desired (such as membrane roofing and decking) protect Ecoply from exterior moisture during construction. For detailed information see section 5.1 Flexible Membrane Systems.

Gutter details

Where Ecoply structural plywood sub-sheathing supports roofing at gutters, a metal drip edge must be provided with appropriate gaps to shed water. Gutters should have a front edge overflow or ends lower than the back to shed water overflow away from framing and sub-sheathing Ecoply. H3 treatment is recommended for Ecoply sheets that protrude into gutters, with regular maintenance to avoid leaf mould (soil) development. Do not expose untreated Ecoply to gutter splash or moisture.

Fire

Plywood is combustible but may be used as a roof substrate for all purpose groups subject to the provisions of Department of Building and Housing Acceptable Solution C/AS1: clause 7.1 and 7.9. For purpose groups SC and SD a 19 mm Ecoply panel complies with the requirement of Clause 7.

Fastener spacing for wind suction

Wind pressure applies withdrawal loads to nails holding plywood to purlins and trusses. For the frame spacing in Table 13A designers may use the following guidelines for frame spacing up to 900 mm throughout New Zealand for normal urban wind conditions.

The main body of the roof

2.8 mm nails spaced at 150 mm centres on all cross framing. Minimum nail length 60 x 2.8 mm.

Roof edges

All Ecoply structural plywood used at higher suction zones at the roof edges, gutters, eaves and gable ends must be supported on framing, and fixed at 100 mm centres with minimum 60 x 3.05 mm nail length. Suction zones are interpreted from AS 1170 as being within 20% building length or width of a gable end, or gutter or ridge.

Designers and builders should review site conditions to ensure adequate fixing is applied. Buildings in exposed sites and lee zones should be specifically designed using the loading standard (AS/NZS 1170) and the timber structures standard NZS 3603. In some wind conditions, the tiles themselves may be sucked from the plywood. Use a consulting engineer to assess site conditions, calculate wind pressures for the specific site, and determine the fastening and span requirements, and to check that the truss system can resist the loads being applied through the plywood.

Fixing of roofing

Fixing methods for tile, shingle and membrane systems must be designed for the expected wind and weather exposure to protect the Ecoply substrate. Some shingle systems may not be used in very high or cyclonic wind zones.

Follow the specifications of the roofing manufacturer and refer to the appropriate BRANZ Appraisals.

T&G ROOFING - INSTALLATION

Framing

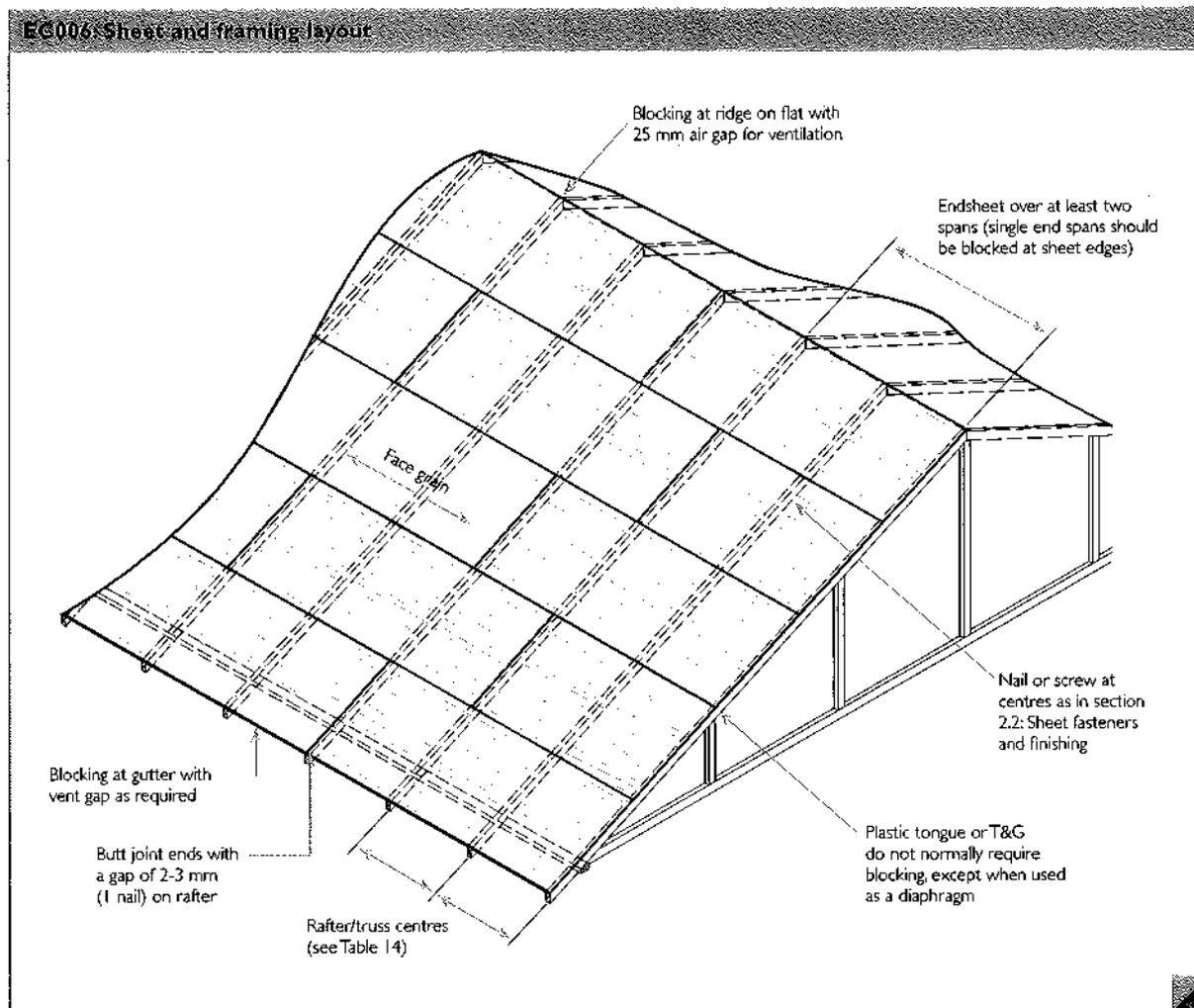
Frames should be at spacings to suit plywood thicknesses in Table 13A. Additional requirements for roof framing are:

- Ensure top edges of framing are properly aligned
- Use dry Laserframe®, hyJOIST® or hySPAN® framing to lower moisture level in roof spaces, second floor spaces, and reduce differential truss, rafter or joist deflections

Blocking (nogs, dwangs):

- Block all edges of EcoPLY® Structural Square Edge plywood
- Block all edges at the ridge and gutter lines to prevent sag at capping or gutters

- Block for high face loads or under areas accessed for maintenance
- Blocking within the body of the roof is not required under tongue and grooved edges when using EcoPLY Flooring & Roofing, unless required for framing stability or the plywood is being used as a diaphragm to resist horizontal wind or earthquake loads. In this case fixings transfer shear across the joints and details should be specified on drawings
- Use blocking on the flat to provide gaps where air flow is needed for ventilation
- Specific roofing suppliers may require blocking to suit their system



Sheet layout

- Ensure EcoPLY sheets are dry before installation
- Place face grain at right angles to supports
- Sheets must be continuous over at least two spans (three framing members)
- Lay the sheets in a staggered pattern
- Allow sufficient clearance inside confining structure such as concrete or brick walls adjacent to the roof. Use extra allowances with large areas
- Allow clearance for ventilation as required

Fixing of sheets

Ecoply® may be fixed to different types of framing with nails, screws or a combination of fasteners and construction adhesives.

Fasteners should be corrosion resistant to a level appropriate to the end use life expectancy (15 or 50 years) and expected exposure to moisture. Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners must be a minimum of hot dip galvanised. In certain circumstances stainless steel fasteners may be required. Refer to section 4 of NZS 3604 for these circumstances. Where stainless steel nails are required, annular grooved nails must be used.

The integrity of a plywood based roof system is directly related to how well the panels are fixed to the framing. Ecoply must be fixed to resist wind suction loads, and to maintain surface qualities of the overlying roof covering. Minimum fastener specifications are in Table 7 and section 2.2: Sheet fasteners and fixing.

- Always refer to the roofing system supplier for system requirements
- For roofing, check the additional requirements according to wind exposure
- For high wind zones (over 44 m/s), very exposed sites, cyclonic conditions or roofs above 10 metres height, carry out specific structural design to the relevant standards
- Screw fixing must be used for membrane roofing, and is preferred for all systems because of increased holding power and avoidance of head popping

Fixing to timber frames

- Ring shank nails or annular grooved nails or screws are recommended for additional holding power
- Use flathead nails. Do not use jolt or bullet head nails
- Stainless steel nails must be annular grooved
- Ensure fastener is compatible with the roofing cover (consult roofing system supplier)
- Staples may be used provided that the withdrawal load is equivalent to the hand driven galvanised flathead nail. A suggested minimum is a 50 mm long staple with 12 mm crown and legs 1.8 mm diameter. Space staples 20% closer than nails. Refer manufacturer for corrosion resistance and durability

Fixing to steel frames

- Fix directly to roll formed steel (up to 2 mm thick) with self-drilling, self-tapping screws. If plywood gets damp and expands, screws in thicker steel may break. Keep Ecoply dry or use larger screws or;
- Bolt or screw battens to the steel and apply Ecoply as above for timber. Ensure that battens have adequate thickness for the minimum nail or screw length

6.0 FLOORING

The following section covers the use of EcoPLY® Flooring plywood used as a flooring substrate with flexible and rigid

overlays. EcoPLY Flooring is suitable as a substrate for overlays such as carpet, linoleum, tiles and membrane products.

6.1 FLOORING - RANGE

- EcoPLY Flooring contains a second void free layer under the surface veneer for increased protection against moisture bubbles and punch through of the first veneer under high point loads than normal EcoPLY Structural Square Edge plywood
- The tongue and groove on long sheet edges does not require support blocking under the joint (unless otherwise specified)
- Supplied in F8 stress grade (F11 available upon request). EcoPLY 19 mm Longspan Flooring supplied as standard in F11 stress grade
- Supplied as standard with a sanded C grade surface with D grade back
- Sanded B grade surface is available in 19 mm thickness (untreated only) for clear finish applications. Designers must expect the surface to dent or mark more easily than hardwood flooring systems as EcoPLY is manufactured from relatively soft radiata pine.
- Available untreated or H3.2 CCA treated, (H3.1 LOSP treated available upon request)
- Refer to Table 1 for range and treatment options

6.2 FLOORING - INSTALLATION

TABLE 15: FLOORING FRAME SPACINGS

Application	Maximum frame centres (mm) (for EcoPLY Flooring with face grain across framing)				
	EcoPLY Flooring nominal thickness (mm)				
	15	17	19	21	25
1. Domestic flooring 2kPa - 1.8kN	480	540	600 F11 Longspan	600	750
2. Institutional and public assembly up to 4kPa - 2.7kN		300	480	540	750
3. Institutional and crowd assembly up to 5kPa - 3.6kN			400	450	600
4. Corridors, industrial up to 5kPa - 4.5kN			300	400	540
5. Domestic garage floor** 2.5kPa - 9kN					300

** Provide blocking to all edges of the sheet.

- Use the next lower recommended frame spacing or thicker EcoPLY flooring where appearance is critical
- To suit frames at 900 centres, 2700 long sheets are available. See Table 14

¹ Where the stress grade F11 is referred to in all CHH Woodproducts plywood literature actual stress grade properties of panels are F11 parallel to the face grain and F8 perpendicular to the face grain

Floor loads

For domestic garage floors blocking is required under all edges to control wheel loads on the tongue. Testing with 113 mm diameter load head (0.01 m²) confirms commercial floor capabilities.

Refer to Table 14 to match frame set outs with 2400 mm and 2700 mm sheet modules.

Framing

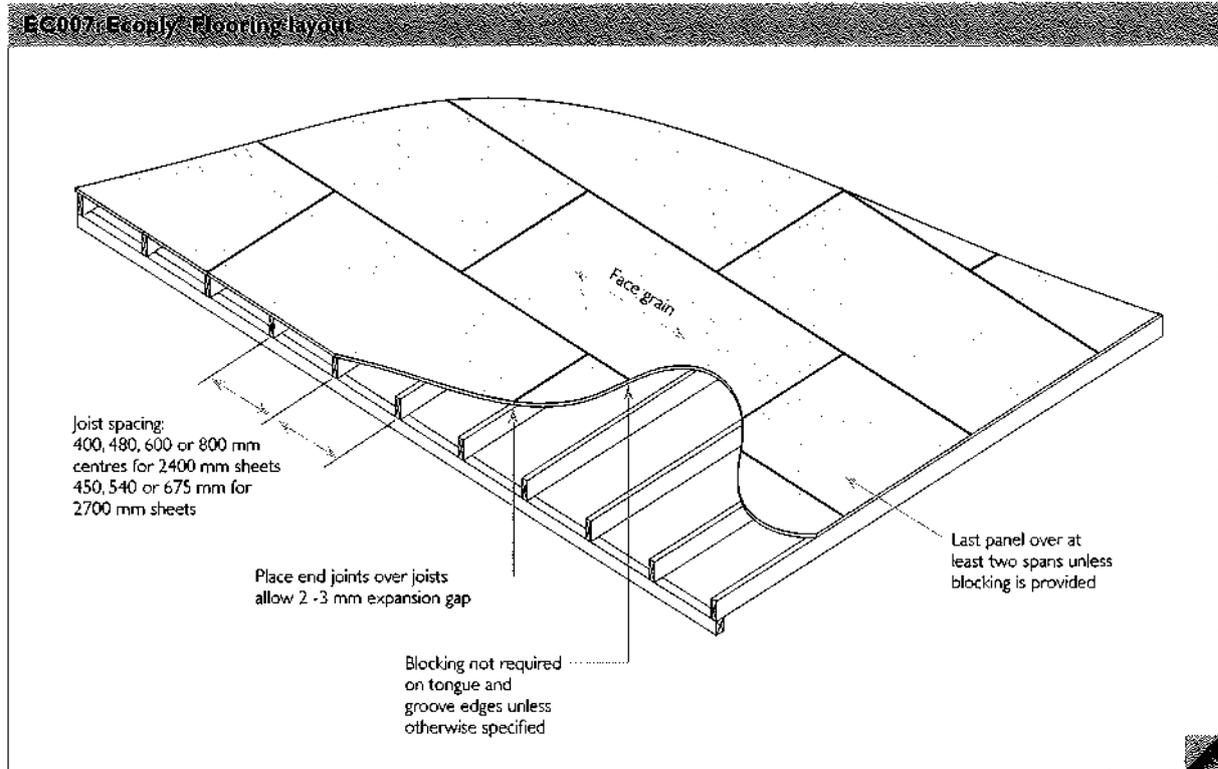
- Joist spacings should be at spacings to suit plywood thicknesses in Table 15
- Use dry Laserframe®, hyJOIST® or hySPAN® framing to achieve a moisture content of 18% or less

Blocking

- Blocking within the body of the floor is not required under tongue and groove edges unless otherwise specified (such as in domestic garage floors)

Sheet layout

- Ensure Ecoply® sheets are dry before installation
- Place face grain at right angles to supports
- Sheets must be continuous over at least two spans (three framing members)
- For panels at floor edges where a continuous two span coverage is not possible, sheet edges must be supported by blocking
- Lay sheets in a staggered pattern
- Allow clearance for ventilation as required



Fastener selection and treatment

Fasteners should be corrosion resistant to a level appropriate to the end use, life expectancy (15 or 50 years) and expected exposure to moisture.

Where fasteners are in contact with H3.2 CCA treated timber or plywood, fasteners shall be a minimum of hot dip galvanised. In certain circumstances stainless steel fasteners may be required. Refer to section 4 of NZS 3604 for these circumstances. Where stainless steel nails are required, annular grooved nails must be used.

Fasteners and fixing of sheets

- Ecoply Flooring may be fixed with nails or screws or a combination of mechanical fasteners and construction adhesives
- For fastener specifications (including lay out and sizes) refer to section 2.2: Sheet fasteners and fixing
- For construction adhesive specifications refer to section 2.3: Adhesives
- Ring shank or annular grooved nails, or screws are recommended for additional holding power
- To reduce the risk of fastener popping or floor squeak the use of construction adhesives is advised.
- Do not use jolt or bullet head nails

6.3 FLOORS - FINISHING

- Overlays and coatings should be applied following the manufacturer's specifications
- Avoid heavy sanding that may remove the critically important structural face veneer
- Adhesives must be compatible with CCA (Copper Chrome Arsenic) treatment in H3 treated sheets. Compatibility can often be improved by lightly washing, scrubbing and drying the plywood surface prior to fixing
- Where clear or stained finishes are desired, designers should select sheets and protect the floor as much as possible from the weather and construction activities
- Ecoply is made from relatively soft radiata pine and as such will dent or mark more easily than hardwood flooring systems. This is to be expected and designers must consider the long term appearance requirements of the project. Ecoply Flooring is a good substrate for harder wearing flooring overlays, and is not primarily intended for clear finishing, especially if it is exposed to moisture during construction
- For improved surface finish floors should be protected from weather during construction as soon as possible